National Institute for Health and Care Excellence

Consultation

Renal and ureteric stones: assessment and management

Surgical treatments

NICE guideline

Intervention evidence review

July 2018

Consultation

This evidence review was developed by the National Guideline Centre

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1 Surgical treatment

1.1 Review question: What are the most clinically and cost effective surgical treatment options for people with renal or ureteric stones?

1.2 Introduction

Surgical management of renal and ureteric stones includes shockwave lithotripsy, ureteroscopy and percutaneous nephrolithotomy. A decision about which surgical procedure is appropriate depends on the size / type /site of the stone, patient factors, and the local facilities and expertise available. Most centres have access to shock wave lithotripsy (SWL) but this may be on a sessional basis using a mobile machine rather than having permanent equipment on site so potentially compromising the optimum timing and outcome of SWL treatment. Recommendations are needed to guide health practitioners on which surgical procedure is the most clinically and cost effective for the different cohorts of patients with renal or ureteric stones.

1.3 PICO table

For full details, see the review protocol in appendix A.

Table 1: PICO characteristics of review question

Population	People (adults, children and young people) with symptomatic and asymptomatic renal or ureteric stones
Interventions	• Shock wave lithotripsy (SWL) • Ureteroscopy (URS) or retrograde intrarenal surgery (RIRS) • Percutaneous nephrolithotomy (PCNL)
Comparisons	Compared to: • Each other (even within the same intervention) • Non-surgical treatment/conservative treatment
Outcomes	Critical outcomes: • Stone free state (stone free, insignificant residual fragment) • Recurrence • Use of healthcare services (length of stay, readmission, retreatment or ancillary procedure) • Kidney function • Quality of life (any validated scale) • Major adverse events (infective complications [sepsis, obstructive pyelonephritis], ureteric injury [ureteral damage, ureteral perforation, ureteral stricture], mortality) • Minor adverse events (infective complications [UTI, fever, infection], ureteric injury [extravasation, submucosal dissection], haemorrhage [any bleeding, transfusion]) • Failed technology (failed access, inaccessible stone, stone not seen/reached) Important outcomes: • Pain (visual analogue scale)
Study design	Randomised controlled trials (RCTs), systematic reviews of RCTs. If no RCT evidence is available, search for non-randomised studies for children

Key confounders	• Age • Stone site • Stone size

1.4 Clinical evidence

1.4.1 Included studies

Sixty-three RCTs were included in the review;[4, 10, 11, 22, 32, 35, 39, 50, 51, 53, 66, 68, 71, 72, 80, 88, 91, 94, 98, 99, 105, 112, 113, 115, 128, 129, 131, 132, 140, 141, 143, 148, 150, 152, 157, 164, 169, 173, 174, 178, 179, 183, 184, 186-189, 193, 196, 197, 203, 205, 208, 219, 222, 224-227, 237, 241, 244-246]. Twenty-seven studies[50, 88, 91, 94, 98, 99, 128, 131, 132, 141, 148, 152, 158, 164, 169, 173, 174, 179, 187, 189, 196, 197, 203, 219, 227, 244, 245] compared SWL versus URS, 7 studies[11, 35, 51, 128, 129, 226, 241] compared SWL versus PCNL, 15 studies[22, 32, 53, 71, 80, 115, 128, 140, 143, 178, 183, 184, 222, 225, 237] compared URS versus PCNL, and 4 studies[120, 196, 241, 246] compared surgical (URS, SWL or PCNL) versus non-surgical/conservative treatment. Fourteen studies[4, 10, 39, 66, 68, 72, 105, 113, 150, 186, 188, 193, 205, 224] looked at within surgery comparisons, including tubeless versus conventional PCNL, mini versus standard PCNL and supine versus prone PCNL.

As per the protocol, for strata where there was no RCT evidence for the children and young people population, the search was widened to include cohort studies. Three studies relevant to the protocol were identified.[20, 194, 242]

These are summarised in Table 2 below. Evidence from these studies is summarised in the clinical evidence summary below (Table 3).

See also the study selection flow chart in appendix C, study evidence tables in appendix D, forest plots in appendix E and GRADE tables in appendix H.

1.4.2 Excluded studies

See the excluded studies list in appendix I.

1.4.3 Heterogeneity

For the comparison of SWL versus URS in ureteric stones <10mm in adults, there was substantial heterogeneity between the studies when they were meta-analysed for the outcomes of stone-free state, retreatment rate and ancillary procedures. For the comparison of SWL versus URS in ureteric stones 10-20mm, there was heterogeneity between the studies for the outcomes of stone-free state, length of hospital stay, pain, major adverse events and minor adverse events. For the comparison of URS versus PCNL in ureteric stones 10-20mm, there was heterogeneity between the studies for the outcomes of stone-free state, ancillary procedures, length of stay and minor adverse events. For the comparison of SWL versus URS in renal stones <10mm, there was heterogeneity between the studies for the outcome of retreatment rate. For the comparison of surgery versus non-surgical treatment in renal stones <10mm, there was substantial heterogeneity between the studies for the outcome of stone-free state. For the comparison of SWL versus URS in renal stones 10-20mm, there was heterogeneity between the studies for the outcomes of stone-free state, ancillary procedures, length of hospital stay and pain. For the comparison of SWL versus PCNL in renal stones 10-20mm, there was heterogeneity between the studies for the outcome of stone-free state. For the comparison of URS versus PCNL in renal stones 10-20mm, there was substantial heterogeneity between the studies for the outcome of length of stay and pain. For the comparison of URS versus PCNL in renal stones >20mm, there was substantial heterogeneity between the studies for the outcome of stone-free state, length of stay and pain. For the comparison of tubeless versus conventional PCNL in renal stones >20mm, there was heterogeneity between the studies for the outcome of length of stay. For the comparison of supine versus prone PCNL in renal stones >20mm, there was

heterogeneity between the studies for the outcome of length of stay. Where pre-specified subgroup analyses (see Appendix A:) were either unable to be performed, or did not explain the heterogeneity, a random effects meta-analysis was applied to these outcomes, and the evidence was downgraded for inconsistency in GRADE.

1.4.4 Summary of clinical studies included in the evidence review

1.4.4.1 Between surgery comparisons

Table 2: Summary of studies included in the evidence review

Study	Intervention and comparison	Population	Outcomes	Comments
SWL versus URS				
De Dominicis 2005[50]	Intervention (n=14): SWL performed under general anaesthesia in the prone position using 1900-3500 shocks at 330-694KJ Comparison (n=17): URS (ureteroscopy plus intracorporeal lithotripsy) performed under general anaesthesia in the lithotomy position	n=31 Children with radio-opaque calculi in the lower ureter Mean stone size (range): SWL group 6.9 (5-9); URS group 7.6 (6-10) Mean age (range): SWL group 6.9 (2.5-17); URS group 8.1 (2-14) Male to female ratio 0.48:1 Italy	Stone free state (6-8 months): defined as the radiographic evidence of fragmentation or complete disappearance of the stone Retreatment (6-8 months) Ancillary procedures (6-8 months) Length of hospital stay (hours): not suitable for meta-analysis	Stone free state is reported after one treatment before retreatments or ancillary procedures
Hendrikx 1999[88]	Intervention (n=69): SWL Comparison (n=87): URS (ureteroscopy) with semirigid ureterorenoscopes, performed in combination with pulsed-dye laser or electrohydraulic lithotripsy	n=156 People with extended-mid or lower ureteral stones ≥5mm or <5mm Age >18 years Male to female ratio 125:31 The Netherlands	Stone free state (12 weeks): stone fragments <5mm Retreatment (time-point not reported) Ancillary procedures (time-point not reported) Length of hospital stay (days) Major adverse events (time-point not reported): perforation/ureteral damage Minor adverse events (bleeding)	Extracted in the <10mm strata, but note that 16% of stones were >11mm

Study	Intervention and comparison	Population	Outcomes	Comments
			(time-point not reported) Failed technology (time-point not reported): stone not seen/reached	
Imran 2017[91]	Intervention (n=16): SWL. No further details Comparison (n=14): URS performed using 8.9 FR ureteroscope	n=30 People with proximal ureteral stones sized 10mm or larger Mean stone size (SD): SWL group 16 (3.9); URS group 20.5 (3.2) Mean age (SD): SWL group 34.1 (9.1); URS group 33 (9.5) Male to female ratio 16:14 Pakistan	Stone-free state (4 weeks): not defined Retreatment (4 weeks) Ancillary procedures (4 weeks) Length of hospital stay (hours) Minor adverse events (4 weeks) Pain: postoperative pain on visual scale	Extracted in 10-20mm strata, but not that some stones were >20mm
Islam 2012[94]	Intervention (n=68): SWL in the prone position. Level of shockwave energy was progressively stepped up Comparison (n=68): URS (ureteroscopic pneumatic lithotripsy) using semirigid ureteroscope and Lithoclast	n=136 People with lower ureteric stones <25mm, not passed spontaneously within 3 weeks Mean stone size (SD): SWL group 12.8 (3.7); URS group 12.82 (3.5) Age >18 Male to female ratio 2.4:1 Pakistan	Stone free state (3 months): not defined Retreatment (time-point not reported) Ancillary procedure (time-point not reported) Major adverse events (time-point not reported): ureteric perforation Minor adverse events (time-point not reported): infection, UTI	
Javanmard 2015[99]	Intervention (n=25): SWL using a maximum of 3000 shocks at 80 shocks per minute	n=46 People with renal pelvic stones 10-20mm and BMI>30	Stone free state (3 months): defined as no residual fragments ≥3mm as determined by abdominal CT	

Study	Intervention and comparison	Population	Outcomes	Comments
	Comparison (n=21): RIRS/ URS (flexible ureterorenoscopy) performed in lithotomy position	Mean stone size (SD): SWL group 16.3 (2.4); URS group 17.1 (1.9) Age, mean (SD): SWL group 36.1 (13.1); URS/RIRS group 33.2 (11.4) Male to female ratio 28:18 Iran	Retreatment (3 months) Minor adverse events (3 months): fever	
Javanmard 2016[98]	Intervention (n=60): SWL using Dornier HM3 Lithotripter, in the supine position. The therapeutic power started at 15kV and increased o 20kV, using a maximum of 3000 shocks at 60-90 shocks per minute Comparison (n=60): RIRS performed in lithotomy position	n=120 People with renal stones 6-20mm Mean stone size (SD): SWL group 16.4 (3.3); RIRS group 16.8 (2.1) Age, mean (SD): SWL group 31.3 (6.5), RIRS group 32.4 (7.8) Male to female ratio 1.7:1 Mean number of procedures (SD): SWL group 1.6 (0.3); RIRS group 1.2 (0.2) Iran	Stone free state (3 months): defined as no residual fragments ≥3mm as determined by abdominal CT Retreatment (time-point not reported) Length of hospital stay (hours) Minor adverse events (time-point not reported): fever Pain (VAS) (time-point not reported)	Stone free state is reported following retreatments
Kumar 2015A[131]	Intervention (n=94): SWL as an outpatient procedure using the Dornier Compact Delta, with a maximum of 3000 shock waves per session at 100 impulses a minute. Maximum of 4 sessions. Comparison (n=96): URS performed using semirigid ureteroscope and holmium laser	n=190 People with a single upper ureteral radiopaque calculus <20mm (grouped into ≤10mm and 10-20mm) Mean stone size (SD): ≤10mm subgroup – SWL group 7.9 (1.1), URS group 7.7 (1.3); 10-20mm subgroup – SWL group 15.2 (1.3), URS group 15.3 (1.2) Age >15 years	Stone free state (3 months): defined as radiological absence of stone, asymptomatic patients with stone fragment less than 3mm and sterile urine culture at 3 months or earlier Retreatment (time-point not reported) Ancillary procedures (time-point not reported)	Stone free state is recorded after initial treatment only, and does not include after ancillary procedures

Study	Intervention and comparison	Population	Outcomes	Comments
		Male to female ratio 1:1 India	Minor adverse events (time-point not reported): UTI	
Kumar 2015B[132]	Intervention (n=97): SWL as an outpatient procedure using the Dornier Compact Delta, with a maximum of 3000 shock waves per session at 100 impulses a minute. Maximum of 4 sessions. Comparison (n=98): RIRS performed using a flexible ureteroscope and holmium laser	n=195 People with a single lower caliceal radiopaque calculus ≤20mm (grouped into ≤10mm and 10-20mm) Mean stone size (SD): ≤10mm subgroup – SWL group 7.9 (1.1), URS group 7.7 (1.3); 10-20mm subgroup – SWL group 15.2 (1.3), URS group 15.2 (1.2) Age >15 years Male to female ratio 1:1 India	Stone free state (3 months): defined as radiological absence of stone, asymptomatic patients with stone fragment less than 3mm and sterile urine culture at 3 months or earlier Retreatment (time-point not reported) Ancillary procedures (time-point not reported) Major adverse events (time-point not reported): ureteral perforation Minor adverse events (time-point not reported): UTI, ureteral extravasation	
Kumar 2015C[128]	Intervention (n=52): SWL as an outpatient procedure using the Alpha Compact electromagnetic lithotripter (Dornier), with a maximum of 2500 shocks per session at 90 pulses per minute. Maximum of 4 sessions Intervention 2 (n=53): RIRS using flexible ureteroscope and holmium laser for intracoporeal lithotripsy	n=105 People with single lower calyceal radiolucent renal stone 10-20mm Mean stone size (SD): SWL group 13.2 (1.2), RIRS group 13.1 (1.1) Age >15 years Male to female ratio 0.9:1 India	Stone free state (3 months): defined as residual calculus less than 4mm Retreatment (time-point not reported) Ancillary procedure (time-point not reported) Minor adverse events(time-point not reported): UTI	
Lee 2006[141]	Intervention (n=22): SWL with 3000 shock wave pulses	n=42	Stone free state (after 1 treatment): defined as	

Study	Intervention and comparison	Population	Outcomes	Comments
	Comparison (n=20): URS (ureteroscopic lithotripsy) performed in standard fashion and using a lithoclast, electrohydraulic or ultrasound lithotripter	People with solitary radiopaque upper ureteral stones ≥15mm Mean stone size (SD): SWL group 17.9 (3.9); URS group 18.5 (2.9) Age >18 years Male to female ratio 5:1 Mean number of SWL sessions (SD): 1.7 (0.9) China	radiographic evidence of complete disappearance of the stone of the presence of insignificant residual stone (3mm or less) Retreatment (time-point not reported) Ancillary procedure (time-point not reported) Length of hospital stay (days) Pain (post-operative): VAS score Major adverse events (time-point not reported): ureteral stricture, ureteral perforation Minor adverse events(time-point not reported): UTI, fever, wound infection	
Lopes Neto 2012[148]	Intervention (n=14): SWL performed with the Dornier Compact Delta S under intravenous sedation Comparison (n=16): semirigid URS (ureterolithotripsy) with pneumatic lithotripsy	n=48 People with upper ureteral stones ≥10mm Mean stone size (SD): SWL group 13.8 (2.5); URS group 14.4 (4.1) Age, mean (SD): SWL group 46 (13.5); URS group 49.6 (15.5) Male to female ratio 1.5:1 Brazil	Stone free state (4 weeks): defined as complete stone clearance or residual fragments 3mm or less on KUB and/or CT Retreatment (time-point not reported) Ancillary procedures (time-point not reported) Length of hospital stay (hours)	

Study	Intervention and comparison	Population	Outcomes	Comments
			Pain (VAS scale) (time-point not reported) Major adverse events (time-point not reported): sepsis Minor adverse events (time-point not reported): UTI Failed technology (time-point not reported)	
Manzoor 2013[152]	Intervention (n=192): SWL performed in supine position using 3000 shock waves at a rate of 60-90 per minute. Patients were well hydrated and advised an analgesic and alpha-1 D adrenergic inhibitor on discharge Comparison (n=): URS (ureterorenoscopic manipulation) in the modified lithotomy position using semirigid ureteroscope and intracorpeal lithotripsy with Lithoclast	n=398 People with solitary upper ureteric stone of 10-15mm Mean stone size (SD): SWL group 10.84 (4.25); URS group 11.32 (3.74) Age >16 years Male to female ratio 2.7:1 Pakistan	Stone free state (1 week): not defined, assessed using x-ray KUB Retreatment (1 week) Ancillary procedure (1 week) Minor adverse events (1 week): UTI, fever	
Mehrabi 2016[158]	Intervention (n=32): shock wave lithotripsy (SWL) performed in supine position starting at 12KW and increasing to 3500 shock waves Comparison (n=27): URS (ureteroscope and laser) performed in lithotomy position, using semirigid ureteroscope and holmium laser	n=59 People with radiopaque upper ureter stones between 5-15mm Mean stone size (SD): SWL group 11.85 (3.7); URS group10.44 (2.8) Age, mean (SD): SWL group 43.7 (15.5), URS group 45.3 (14.5)	Stone free state (2 weeks): defined as clearance of stones or residual stones less than 4mm, confirmed by KUB with ultrasonography Minor adverse events (2 weeks): UTI, fever	Unclear if stone free state reported is before or after any repeat or ancillary procedures

Study	Intervention and comparison	Population	Outcomes	Comments
		Male to female ratio 1.03:1 Iran		
Mokhless 2014[164]	Intervention (n=30): shock wave lithotripsy (SWL) using Modularis Variostar Lithotripter in the supine position. The number of shocks per session was 2000 at 60-90 shocks per minute, and the power escalated until it was between 14-17kv Comparison (n=30): retrograde intrarenal surgery (RIRS) performed in the lithotomy position, using a semirigid ureteroscope and holmium laser	n=60 Children with renal stones 10-20mm diameter with no previous stone treatment Mean stone size not reported Age, mean (SD): 2.4 years (1.3) Male to female ratio 2:1 Egypt	Stone free state (after 1 session): defined as completely stone free (no significant [more than 3mm] or insignificant [less than 3mm] residual fragments), assessed by plain abdominal x-ray and renal ultrasound Residual stones (after 1 session): defined as significant residual stone (greater than 3mm) Residual stones (after 1 session): defined as insignificant residual stone (less than 3 mm) Retreatment (time-point not reported) Length of hospital stay (hours)	
Ozturk 2013[169]	Intervention (n=52): shock wave lithotripsy (SWL) with electrohydraulic extracorporeal lithotripter, 2500-3500 shocks were given at 14 to 17kv Comparison 2 (n=48): retrograde intrarenal surgery (RIRS) no further details	n=100 People with ureteral stones between 10-20mm Mean stone size (SD): SWL group 13.2 (2.04); RIRS group 13.2 (2.01) Age >18 years Male to female ratio 1.3:1	Stone free state (3 months): defined as stone free or clinically insignificant sized stones (<4 mm) Major adverse events (3 months): ureteral laceration Minor adverse events (3 months): fever	Stone free state recorded after one RIRS procedure and up to three sessions of SWL

Study	Intervention and comparison	Population	Outcomes	Comments
		Mean number of SWL sessions (SD): 2.31 (0.73) Turkey		
Pearle 2001[174]	Intervention (n=32): shock wave lithotripsy (SWL) performed in the prone position using an unmodified lithotriptor Comparison (n=32): ureteroscopy (URS) using a semirigid ureteroscope	n=64 People with a solitary radiopaque distal ureteral calculus ≤15mm Mean stone size (SD): SWL group 7.4 (2.3); URS group 6.4 (2.7) Mean age (SD): SWL group 41.2 (14.9); URS group 41.2 (12.8) Male to female ratio: 3.9:1 United States	Stone free state (up to 3 months): not defined, assessed by plain radiograph Rehospitalisation (time-point not reported) Minor adverse events (fever) (time-point not reported)	
Pearle 2008[173]	Intervention (n=32): shock wave lithotripsy (SWL) performed using one of 9 machines in the recognised standards. Power settings and number of shock waves was left to the discretion of the treating physician Comparison (n=35): ureteroscopic management (URS) using a variety of ureteroscopes. Use of ureteral access sheath, intact retrieval vs intracorpeal lithrotripsy and stent placement was left to investigator discretion	n=67 People with isolated lower pole stone ≤10mm Mean stone size not reported Age, mean (SD): SWL group 52.5 (12.3), URS group 49.3 (14.2) Male to female ratio 1.16:1 Multicentre trial in 19 institutions in the United States and Canada	Stone free state (3 months): defined as stone free or stone free + fragments of less than 4mm on CT or plain X-ray Retreatment (time-point not reported) Ancillary procedures (time-point not reported) Readmission to hospital (time-point not reported) Minor adverse events (time-point not reported): ureteral perforation Failed technology (time-point not reported)	
Rabani 2012[179]	Intervention (n=30): shockwave lithotripsy (SWL) performed	n=62	Stone free state (1 month): defined as	Extracted in 10-20mm strata as

Study	Intervention and comparison	Population	Outcomes	Comments
	under i.v. sedation with shockwave voltage between 13-18kV and maximum number limited to 4500 shockwaves Comparison (n=32): ureteroscopy (URS) with a semi rigid ureteroscope. Transureteral lithotripsy was performed in successfully accessible cases and a double-J stent was inserted in non-accessible cases	People with upper ureteral stones larger than 1mm Mean stone size, mm (range): 17.64 (12-26) Mean age, years (range): 39.5 (19-64) Male to female ratio 1.8:1 Iran	stone free on KUB and ultrasound Retreatment Length of hospital stay (hours)	mean stone size falls within 10-20mm. Note that some stones were more than 20mm. Stone free state is reported after retreatments
Salem 2009[187]	Intervention (n=100): shockwave lithotripsy (SWL) performed under i.v. sedation with shockwave voltage between 13-18kV and maximum number limited to 3000 shockwaves Comparison (n=100): ureteroscopy (URS) performed under spinal or general anaesthesia using a semirigid ureteroscope and intracorpeal lithotripsy and forceps	n=200 People with upper ureteral, solitary unilateral radiopaque calculi 5-20mm (grouped into ≥10mm and <10mm) Mean stone size (range): <10mm subgroup – SWL group 6.2 (5-9), URS group 6.8 (6-9); ≥10mm subgroup – SWL group 12.5 (11-20), URS group 12.2 (12-20) Age >20 years Male to female ratio 2.08:1 Egypt	Stone free state (2 weeks): defined as stone free without any residual fragments by KUB and US Retreatment (2 weeks) Ancillary procedure (2 weeks) Readmission Minor adverse events: fever, extravasation (time-point not reported)	Adverse event data is not reported in terms of group sizes, so data has been extracted in the <10mm strata based on the number of participants in each stone size group Stone free status is reported before retreatment/ ancillary procedures
Sarica 2017[189]	Intervention (n=34): shockwave lithotripsy (SWL) with electromagnetic lithotriptor under analgesia Comparison (n=31): ureterorenoscopy (URS) with semirigid urteroscope under general anaesthesia	n=65 Patients with acute colic pain due to a single obstructing opaque upper ureteral stone 5-10mm Age, mean (SD): 40.50 (1.73)	Stone free state (4 weeks): defined as completely stone free or residual fragments <4mm Retreatment (4 weeks)	

Study	Intervention and comparison	Population	Outcomes	Comments
		Male to female ratio 2.6:1 Turkey	Ancillary procedures (4 weeks) Pain (4 weeks): VAS score Quality of life (4 weeks): EQ-5D	
Sener 2014[197]	Intervention (n=70): shock wave lithotripsy (SWL) using electrohydraulic extracorporeal lithotripter , 2500-3000 shocks given at 14-17kV Comparison (n=70): ureterorenoscopy. (URS) using flexible ureterorenoscope and holmium laser	n=140 People with single lower pole stones <10mm Mean stone size, mm (SD): SWL group 8.2 (1.2); URS group 7.8 (1.3) Age, mean (SD): SWL group 42.9 (5.6); URS group 45.4 (6.4) Male to female ratio 1.1:1 Mean number of SWL sessions (SD): 1.48 (0.65) Turkey	Stone free state (3 months): fragmentation <3mm, method of confirmation not reported Ancillary procedures (time-point not reported) Minor adverse events (time-point not reported): fever, UTI	Stone free state is reported after ancillary procedures
Sener 2015[196]	Intervention (n=50): shockwave lithotripsy (SWL) using an electrohydraulic extracorporeal lithotripter, with 2500-3000 shocks at 14-17kV, and a maximum of 3 sessions Comparison (n=50): ureteroscopy (URS) using flexible ureterorenoscope and holmium laser	n=100 People with single lower pole stones <10mm Mean stone size, mm (SD): SWL group 7.9 (1.1); URS group 8.2 (1.2); observation 7.9 (0.7) Age, mean (SD): SWL group 34.5 (11.04); URS group 36.84 (11.7); observation group 32.52 (12.29) Male to female ratio 2.06:1	Stone free state (3 months): fragmentation <3mm Retreatment (time-point not reported) Ancillary procedures (time-point not reported) Major adverse events (time-point not reported): ureteral laceration Minor adverse events (time-point not reported): fever, UTI	

Study	Intervention and comparison	Population	Outcomes	Comments
		Mean number of SWL sessions (SD): 2.7 (0.4) Turkey		
Singh 2014[203]	Intervention (n=35): shockwave lithotripsy (SWL) under iv sedation. A total of 3500-4500 shocks per session (energy level 1-4, frequency 60-120 Hz), with a maximum of 3 sessions Comparison (n=35): retrograde intrarenal surgery (RIRS) using a flexible ureterorenoscope and holmium laser lithotripsy under spinal and epidural anaesthesia	n=70 People with symptomatic isolated inferior calyceal radiopaque stone between 10-20mm Mean stone size, mm (SD): SWL group 16.45 (2.28); URS group 15.05 (3.56) Age, mean (SD): SWL group 34.5 (4.35); RIRS group 37.65 (11.8) Male to female ratio 1.5:1 India	Stone free state (1 month): defined as completely stone free or presence of clinically insignificant residual fragment (<3mm) Retreatment (time-point not reported): defined as second session of same treatment modality Ancillary procedure (time-point not reported): defined as using a different modality of treatment to make the patient stone free Length of hospital stay (days) Pain (postoperative day 1): VAS score Major adverse events (time-point not reported): sepsis, ureteric perforation	Stone free state is reported after retreatments
Verze 2010[219]	Intervention (n=137): shockwave lithotripsy (SWL) performed in the prone position and using electromagnetic lithotripter Comparison (n=136): ureteroscopy (URS) using a semirigid ureteroscope and lithoclast lithotripter and/or extracted via baskets or forceps	n=273 Patients with solitary lower ureteric stones with a stone size of 5-15mm (grouped into ≤10mm and ≥10mm and overall) Mean stone size, mm (range): SWL group 10 (5-15); URS group 10 (6-15)	Stone free state (3 months): defined as the absence of residual lithiasis at the plain radiography Retreatment (3 months): multiple treatments with the primary treatment type	Adverse events data are not reported in terms of the grouped sizes, so extracted as overall, and put into 10-20mm strata due to mean stone size (10mm)

Study	Intervention and comparison	Population	Outcomes	Comments
		Age, mean (range): SWL group 50.5 (18-80); URS group 49.4 (21-81) Male to female ratio 1.02:1 Italy	Ancillary procedures (3 months): treatment with procedure other than primary treatment type Major adverse events (time-point not reported): obstructive pyelonephritis, ureteric perforation Minor adverse events (time-point not reported): haemorrhage, fever	Stone free state was reported after ancillary and retreatment procedures
Wazir 2015[227]	Intervention (n=112): extracorporeal shockwave lithotripsy (SWL) using electromagnetic lithotripter. Shockwave energy was progressively increased until satisfactory fragmentation Comparison (n=112): ureteroscopy (URS) with intracorporeal lithotripsy using semirigid ureteroscope and pneumatic lithotripter	n=224 People with lower ureteric stones between 6-12mm Mean stone size (SD): 9.18 (1.6) (% of stones 6-10mm: SWL group 75.9; URS group 78.6) Age, mean (SD): SWL group 46 (14.6); URS group 48.7 (16.2) Male to female ratio 2.2:1 Pakistan	Stone free state (2 weeks): defined as no stone in x-ray KUB or the US showed no stone or fragments <4mm	
Zeng 2002[244]	Intervention (n=210): shockwave lithotripsy (SWL) in the major postero-oblique position, using 8.3-15kV voltage and stroke times of 1500-3000 for each episode of treatment Comparison (n=180): ureteroscopic lithotripsy (URS) in the lithotomy position, using a ureteroscope and pneumatic lithotripter	n=390 People with lower ureteric calculi Stone size (range): 5-21mm Age, median: SWL group 51; URS group 40 Male to female ratio 1.5:1 China	Stone free state (28 days): not defined Retreatment (time-point not reported) Major adverse events (time-point not reported): ureteral perforation, ureteral stricture Minor adverse events (time-point not reported): infection	Mean stone size not reported. Study has been categorised as 10-20mm strata but note that includes some <10mm stones

Study	Intervention and comparison	Population	Outcomes	Comments
Zhang 2011[245]	Intervention (n=257): shockwave lithotripsy (SWL) using Dornier Compact S lithotripter. An maximum of 3500 shock waves at 60-90 per minute Comparison (n=269): ureteroscopic holmium laser lithotripsy (URS) using semirigid ureteroscope and holmium laser lithotripsy	n=526 People with solitary radiopaque ureteral stones Mean stone size (range): 8.7 (5-25) Age >17 years Male to female ratio 2.3:1 China	Stone free state (2 weeks): defined as no residual fragments by KUB and US Retreatment (time-point not reported) Ancillary procedures (time-point not reported) Length of hospital stay (days) Major adverse events (time-point not reported): ureteral perforation Minor adverse events (time-point not reported): extravasation, fever Failed technology (time-point not reported)	Extracted in <10mm strata due to mean stone size but note that some stones were greater than10mm
SWL versus PCNL				
Albala 2001[11]	Intervention (n=68): shockwave lithotripsy (SWL) power settings and number of shocks administered was at the discretion of the investigator Comparison (n=60): percutaneous nephrolithotomy (PNCL) in a single or two stage procedure	n=128 People with symptomatic lower pole calculi ≤30mm in aggregate diameter (grouped into 1-10mm, 11-20mm and 21-30mm) Mean stone size, mm: 1-10mm subgroup – SWL group 8.05, PCNL group 8.84; 11-20mm subgroup – SWL group 14.06, PCNL group 14.97; 21-30mm subgroup – SWL group 23.18, PCNL group 26.33 Age >18 years	Stone free state (3 months): not defined Retreatment (time-point not reported) Ancillary procedure (time-point not reported) Major adverse events (time-point not reported): sepsis, perforation Minor adverse events (time-point not reported): UTI, transfusion	Adverse event and quality of life data not reported in terms of group sizes – has been extracted as overall data in the 10-20mm strata due to overall mean stone size (13.59 and 14.43mm)

Study	Intervention and comparison	Population	Outcomes	Comments
		Gender not reported United States	Quality of life (3 months): SF-36	
Carlsson 1992[35]	Intervention (n=28): shockwave lithotripsy (SWL) performed without anaesthesia at a voltage of 14-16kV Comparison (n=21): percutaneous nephrolithotomy (PCNL) performed under epidural anaesthesia in the prone position	n=49 People with kidney stones of 4-30mm in diameter Mean stone size, mm (range): SWL group 13 (5-27); PCNL group 12 (7-25) Age, mean: PCNL group 48.2, SWL group 49.0 Male to female ratio 1.88:1 Sweden	Stone free state (4 weeks): stone free (no residual fragments) Length of hospital stay (days) Major adverse events (time-point not reported): sepsis, perforation Minor adverse events (1 day): fever	Extracted in 10-20mm strata due to mean stone size. Note that some stones were more/less than 10-20mm
Deem 2011[51]	Intervention (n=12): shockwave lithotripsy (SWL) using a flexible cystoscopy. Performed under general anaesthesia using the Medispec lithotripter. Up to 2000 shocks were delivered at a rate of 60 Comparison (n=20): percutaneous nephrolithotomy (PCNL) using a flexible cystoscopy. Performed in the prone position. Stones retrieved with graspers or fragmented with a combined ultrasonic and pneumatic device. Flexible nephroscopy then performed	n=32 People with kidney stones between 10-20mm in largest dimension Mean stone size (SD): SWL group 12.16 (1.4); PCNL group 12.85 (2.0) Age >18 years Male to female ratio 1.13:1 United States	Stone free state (3 months): not defined, confirmed by CT scan Retreatment (time-point not reported)	
Kumar 2015C[128]	Intervention (n=52): shock wave lithotripsy (SWL) as an outpatient procedure using the	n=105 People with single lower calyceal	Stone free state (3 months): defined as residual calculi less than 4mm	

Study	Intervention and comparison	Population	Outcomes	Comments
	Alpha Compact electromagnetic lithotripter (Dornier), with a maximum of 2500 shocks per session at 90 pulses per minute. Maximum of 4 sessions Comparison (n=53): mini percutaneous nephrolithotomy (mini-PCNL) performed in the prone position using a miniature nephroscope and pneumatic LithoClast	radiolucent renal stone 10-20mm Mean stone size (SD): SWL group 13.2 (1.2); PCNL group 13.3 (1.3) Age >15 years Male to female ratio 0.9:1 India	Retreatment (time-point not reported) Ancillary procedure (time-point not reported) Length of hospital stay (days) Minor adverse events (time-point not reported): UTI	
Kumar 2015D[129]	Intervention (n=111): shock wave lithotripsy (SWL) using the electromagnetic lithotripter at 90 pulses per minute for a maximum of 2500 shockwaves per session, with a maximum of 4 sessions Comparison (n=110): mini percutaneous nephrolithotomy (mini-PCNL) in the prone position using a miniature nephroscope and pneumatic lithotripsy	n=221 Children with a single radiopaque renal stone Mean stone size (SD): SWL group 12.9 (1.3); PCNL group 12.7 (1.2) Mean age, years (SD): SWL group 10.7 (1.3); PCNL group 10.3 (1.2) Male to female ratio 0.9:1 India	Stone free state (3 months): not defined Retreatment (time-point not reported) Ancillary procedures (time-point not reported): defined as a method of treatment other than the primary treatment to render the patient stone free Major adverse events (time-point not reported): ureteral perforation Minor adverse events (time-point not reported): extravasations, UTI	
Wankhade 2014[226]	Intervention (n=78): shockwave lithotripsy (SWL) performed on Dorniel compact alfa at a frequency of 60-80 and intensity of 3-4. There was a maximum of 3-4 sessions.	n=156 People lower caliceal calculi 11-15mm Mean stone size not reported	Stone free state (3 months): defined as no stone or <4 mm stone on USG Ancillary procedure (time-point not reported)	

Study	Intervention and comparison	Population	Outcomes	Comments
	Comparison (n=78): percutaneous nephrolithotomy (PCNL) performed under regional anaesthesia using pneumatic lithoclast and forceps	Age >15 years Gender not reported Mean number of SWL sessions (range): 3.38 (1-5) India	Major adverse events (time-point not reported): sepsis, mortality	
Yuruk 2010[241]	Intervention (n=33): shockwave lithotripsy (SWL) without anaesthesia using an electromagnetic lithotripter, starting at 14kV and increasing to 24kV. A total of 3000 shocks per session, and a maximum of 3 sessions Comparison (n=33): percutaneous nephrolithotomy (PCNL) performed in the prone position using rigid nephroscope and lithoclast lithotripter	n=66 Patients with asymptomatic lower caliceal calculi 20mm or less in greatest diameter Mean stone size not reported Age, mean (SD): SWL group 44.5 (9.4); PCNL group 44.1 (12.3) Male to female ratio 1:1 Turkey	Stone free state (3 months): not defined Retreatment (time-point not reported) Ancillary procedures (time-point not reported) Minor adverse events (time-point not reported): fever, bleeding	Extracted in 10-20mm strata but note that may include some stones <10mm
Zeng 2012[242]	Intervention (n=22): shockwave lithotripsy (SWL) performed on the Dornier Compact Delta-lithotripter. There were 300-1800 shockwaves per session at a rate of 60 shockwaves/ minute. Repeat SWL was performed after 2 weeks Comparison (n=24): mini-percutaneous nephrolithotomy in the prone position using pneumatic lithotripter and an 8F/9.8F semirigid ureteroscope	n=46 Children with renal stones 15-25mm Mean stone size (SD): SWL group 21.7 (1.7); PCNL group 21.4 (3.5) Age <3 years Male to female ratio 32:14 China	Stone free state (3 months): defined as no residual fragments detected with non-contrast CT Retreatment (3-5 days after the first MPCNL and 2 weeks after the first SWL) Length of stay (days) Minor adverse events (time-point not reported): fever,	Non-randomised SWL and MPCNL were performed in different hospitals
URS versus PCNL				

Study	Intervention and comparison	Population	Outcomes	Comments
Bas 2016[20]	Intervention (m=36): retrograde intrarenal surgery (RIRS) under general anaesthesia, in the lithotomy position, using a flexible ureterorenoscopes Comparison (n=45): micro-perc under general anesthesia using Ho: Yag laser fibre	n=81 Children with renal stones 10-20mm Mean stone size (SD): URS group 12.8 (3.03); PCNL group 13.97 (3.46) Age, mean (SD): URS group 8.39 (4.72); PCNL group 5.62 (4.5) Male to female ratio 38:43 Turkey	Stone-free state (end of procedure or 1 month): stone free or fragments <3mm Length of stay (days) Minor adverse events (time-point not reported): fever, UTI	Non-randomised
Basiri 2008[22]	Intervention (n=50): URS (retrograde ureteroscopic lithotripsy) using a semirigid ureteroscope Comparison (n=50): PCNL (percutaneous nephrolithotripsy) performed in the classic manner	n=100 People with urinary stones of the upper ureter ≥15mm Stone size: mean (SD): URS group 17.8 (2.4), PCNL group 20.3 (3.3) mm Age, mean (SD): URS group 39 (15); PCNL group 48 (13) Male to female ratio 65:35 Iran	Stone free state (3 weeks): not defined, confirmed by KUB radiography and ultrasonography Retreatment (time-point not reported) Length of hospital stay (days)	Extracted in 10-20mm strata but note that may include some stones >20mm
Bryniarski 2012[32]	Intervention (n=32): Retrograde intrarenal surgery (RIRS) Comparison (n=32): PCNL (percutaneous nephrolithotripsy)	n=64 People with a single stone in the renal pelvis of >20mm Age, mean (SD): PCNL group 51.8 (11.8), RIRS group 53.4 (12.4) Male to female ratio 31:33	Stone free state (3 weeks): residual fragments of ≥4mm, confirmed by radiography Retreatment (time-point not reported) Ancillary procedures (time-point not reported) Pain (1 day): VAS	

Study	Intervention and comparison	Population	Outcomes	Comments
		Poland	Length of hospital stay (days) Major adverse events (time-point not reported): sepsis Minor adverse events (time-point not reported): fever, blood transfusion	
Demirbas 2017[53]	Intervention (n=43): retrograde intrarenal surgery (RIRS) using a ureteral access sheath, a flexible ureterorenoscope and holmium Yag laser lithotripter Comparison (n=30): ultramini percutaneous nephrolithotomy (PCNL) using nephroscope and holmium laser lithotripter	n=73 People with renal stones sized 10-25mm Mean age, years (SD): RIRS group 48.72 (16.87); PCNL group 43.73 (14.62) Male to female ratio 1.3:1 Turkey	Stone free state (1 month): defined as absence of any stones, or stone fragments less than 3mm, confirmed by CT Length of hospital stay (days) Major adverse events (time-point not reported): Calvien grade 3 – no further details Minor adverse events (time-point not reported): Calvien grade 1-2 – no further details	Extracted in 10-20mm strata. Note that also includes some 20-25mm stones (not known how many)
Fayad 2017[71]	Intervention (n=60): retrograde intrarenal surgery (RIRS) Comparison (n=60): mini-percutaneous nephrolithotomy (mini-PCNL)	n=120 People with lower calyceal stones of ≤20mm Mean stone size, mm (SD; range): PCNL group 14.7 (3; 8–20), RIRS group 1411 (3; 8–20) Age >18 years Male to female ratio 72:48	Stone free state (12 weeks): defined as absence of residual stone or small residuals of ≤2mm on CT Minor adverse events (time-point not reported): bleeding, minor ureteric injury, fever	

Study	Intervention and comparison	Population	Outcomes	Comments
		Egypt		
Gu 2013[80]	Intervention (n=29): retrograde ureterolithotripsy (URS) performed under spinal or general anaesthetic in the lithotomy position using semi-rigid ureteroscope and a holmium: YAG laser Comparison (n=30): mini percutaneous nephrolithotomy/ percutaneous antegrade ureterolithotripsy (PCNL) performed under general anaesthetic in the lithotomy and prone position using ureterocope and holmium: YAG laser lithotripsy	n=59 People with impacted upper ureteral stones ≥15mm Mean stone size (range): URS group 16.23 (15-25); PCNL group 17.27 (15-25) Age, mean (SD): MPCNL group 42.5 (10.1), RIRS group 44.22 (13.0) Male to female ratio: URS group 1:0.64; PCNL group 1:0.81 China	Stone free state (1 month): not defined, confirmed by KUB or ultrasound Retreatment (time-point not reported) Ancillary procedures (time-point not reported) Length of hospital stay (days) Major adverse events (time-point not reported): ureteral perforation Minor adverse events (time-point not reported): transfusion, fever	Extracted in 10-20mm strata based on mean stone size, but note that there are some 20-25 mm stones
Karakoyunlu 2017[115]	Intervention (n=30): flexible ureteroscopy (URS) performed in lithotomy position, using a Holmium laser Comparison (n=30): percutaneous nephrolithotomy (PCNL)	n=60 People with kidney pelvic stones >20mm in diameter Mean stone size, mm (SD): URS group 27.17 (3.73); PCNL group 26.07 (3.26) Age >15 years Age, mean (SD): PCNL group 45.8 (14.1), RIRS group 48.4 (15.5) Male to female ratio 34:26 Turkey	Stone free state (2 weeks): defined as complete, clinically insignificant residual fragments (<4mm), confirmed by KUB and NCCT Length of hospital stay (days)	
Kumar 2015C[128]	Intervention 2 (n=53): retrograde intrarenal surgery (RIRS) using flexible ureteroscope and holmium laser	n=158 People with single lower calyceal radiolucent renal stone 10-20mm	Stone free state (3 months): not defined Retreatment (time-point not reported)	

Study	Intervention and comparison	Population	Outcomes	Comments
	for intracoporeal lithotripsy Comparison (n=53): mini percutaneous nephrolithotomy (mini-PCNL) performed in the prone position using a miniature nephroscope and pneumatic LithoClast	Age >15 years Age, mean (SD): PCNL group 33.7 (1.6), RIRS group 33.4 (1.4) Male to female ratio 0.9:1 United States	Ancillary procedures (time-point not reported) Length of hospital stay (days) Minor adverse events (time-point not reported): UTI	
Lee 2015[140]	Intervention (n=35): retrograde intrarenal surgery (RIRS) performed under general anaesthesia in the dorsal lithotomy position and using flexible ureteroscope and holmium laser Comparison (n=35): mini percutaneous nephrolithotomy (mini-PCNL) performed in the prone position and using a holmium laser	n=70 People with single or multiple renal stones >10mm Stone size, mean (SD): PCNL group 39.1 (30.7), RIRS group 28.9 (17.5) mm Age >20 years Age, mean (SD): PCNL group 59.3 (13.3), RIRS group 55.8 (11.2) Male to female ratio: PCNL group 28:7; RIRS group 28:5 Korea	Stone free state (3 months): defined as no residual stone or stones <2mm on NECT Length of hospital stay (days) Ancillary procedures (time-point not reported) Pain (1 day): VAS scale (1-10) Minor adverse events (time-point not reported): UTI, minor ureter perforation	
Li 2017[143]	Intervention (n=39): flexible ureteroscopy lithotripsy (URS) using holmium laser Comparison (n=33): percutaneous nephrolithotomy (PCNL) under general anaesthesia in the prone position and using rigid ureterscope and holmium laser	n=72 People with simple kidney stones Stone size, mean (SD; range): PCNL group 15 (5; 11–19), RIRS group 16 (4; 12–19) mm Mean age, years (SD): URS group 49.7 (10.2); PCNL group 52.3 (11.4) Male to female ratio 1.3:1	Stone free state (3 months): defined as no retained stones found or the fragments were <4mm and free from clinical symptoms under KUB, ultrasound or CT Major adverse events (time-point not reported): ureteral stricture Minor adverse events (time-point not reported): ureteral mucosa injury, bleeding/	

Study	Intervention and comparison	Population	Outcomes	Comments
		China	haematoma, infection/renal abscess	
Qi 2014[178]	Intervention (n=52): ureteroscopic lithotripsy (URS) using holmium: YAG laser or lithoclast lithotripsy Comparison (n=52): percutaneous nephrolithotomy (PCNL) using rigid nephroscope, ultrasonic and pneumatic lithotripter	n=104 People with impacted upper ureteral stones ≥15mm in size Stone size (mm), mean (SD): URS group 19.8 (4.3); PCNL group 20.3 (3.6) Age, mean (SD): URS group 42.5 (10.3); PCNL group 41.1 (12.4) Male to female ratio 1.5:1 China	Stone free state (1 month): not defined, confirmed by KUB and B ultrasonography Length of hospital stay (days) Minor adverse events (time-point not reported): fever, minor ureteral perforation	Extracted in 10-20mm strata
Saad 2015[183]	Intervention (n=21): retrograde intrarenal surgery (RIRS) in the lithotomy position under general anaesthesia, using semirigid ureteroscope and flexible ureteroscopy, and holmium: YAG laser Comparison (n=22): percutaneous nephrolithotomy (PCNL) in the prone position under general anaesthesia, using a paediatric nephroscope and pneumatic lithotripsy	n=38 (43 renal units) Children with renal calculi >20mm Mean age, years (SD): RIRS group 6.44 (4.84); PCNL group 6.93 (3.55) Male to female ratio 1.86:1 Egypt	Stone free state (1 month; by renal unit): defined as absence of any stone fragments on follow up imaging Retreatment (time-point not reported; by renal unit) Length of hospital stay (days) Minor adverse events (time-point not reported; by renal unit): fever, bleeding	
Sabnis 2013[184]	Intervention (n=35): Retrograde intrarenal surgery (RIRS) using flexible ureteroscope, laser lithotripsy and sent or catheter Comparison (n=35): micro PCNL performed under general anaesthesia in the lithotomy and	n=70 People with renal calculi of <15 mm Mean stone size, mm (SD): RIRS group 10.4 (2.5); PCNL group 11 (2.3)	Stone free state (3 months): defined as complete stone clearance Retreatment (time-point not reported) Ancillary procedures (time-point not reported)	

Study	Intervention and comparison	Population	Outcomes	Comments
	then prone position, using a holmium YAG laser	Age, mean (SD): RIRS group 43.7 (12.1), PCNL group 38.6 (14.6) Male to female ratio 1.91:1 India	Length of hospital stay (hours) Pain (6 hours): VAS, 1-10 Major adverse events (time point not reported): urosepsis Minor adverse events (time-point not reported): minor perforation, fever	
Sen 2017[194]	Intervention (n=23): retrograde intrarenal surgery (RIRS) using flexible URS and Ho: YAG laser Comparison (n=25): micro-perc under general anesthesia and in the lithotomy position, using the Ho: YAG laser	n=48 Children with paediatric stone disease Stone size, mean (SD), mm: URS group 13.7 (3.5); PCNL group 12.2 (2.8) Age, mean (SD): URS group 10.9 (3); PCNL group 4 (2.3) Gender not reported Turkey	Stone-free state (2 weeks): stone free on KUB or USG Length of stay (time-point not reported) Major adverse events (time-point not reported): sepsis Minor adverse events (time-point not reported): not specified	Non-randomised
Wang 2016[222]	Intervention (n=63): retrograde ureteroscopic management (URS) performed in the asymmetric lithotomy position under general anaesthesia using a semirigid ureteroscope and lithosclast Comparison (n=63): percutaneous nephrostomy (PCNL) performed under local anaesthesia	n=126 People with obstructing ureteral stones and clinical signs of sepsis Mean stone size, mm (SD): URS group 13.72 (1.57); PNC group 13.47 (1.80) Mean age, years (SD): URS group 57.52 (11.93); PCN group 58.21 (10.89) Male to female ratio 0.98:1	Ancillary procedures (time-point not reported) Length of hospital stay (days) Major adverse events (time-point not reported): mortality	

Study	Intervention and comparison	Population	Outcomes	Comments
		Taiwan		
Wang 2017 [225]	Intervention (n=50): URS (ureteroscopic lithotripsy) using an 8-9.8 F rigid ureteroscope and a holmium YAG laser Comparison (n=50): PCNL (mini PCNL)	n=100 People with upper ureteral stones >15mm Mean age, years (SD): URS group 42 (14); PCNL group 41 (15) Mean stone size, mm (SD): URS group 16.8 (2.1); PCNL group 19.3 (1.8) Male to female ratio 59:41 China	Stone-free state (1 month): defined as absence of stone debris on the KUB film Ancillary procedures (3 days): SWL Length of hospital stay (days) Major adverse events (time-point not reported): ureter perforation, ureteral structure Minor adverse events (time-point not reported): fever, blood transfusion, UTI	
Yang 2012 [237]	Intervention (n=91): URS (transuretheral ureteroscopy) using a holmium laser and rigid ureteroscope Comparison (n=91): PCNL (minimally invasive percutaneous nephrolithotomy)	n=182 People with ureteric stones Age, mean (SD): MPCNL group 45.2 (14.7), URS group 46.4 (15.1) Male to female ratio 1.43:1 China	Stone free state (1 month): defined as residual stones <4mm, confirmed by KUB and B ultrasonography Ancillary procedures (time-point not reported) Major adverse events (1 month): ureteral stricture Minor adverse events (1 month): fever	
Surgery versus conservative treatment				
Keeley 2001 [120]	Intervention (n=113): shock wave lithotripsy (SWL) Comparison (n=115): observation. No treatment was received unless symptoms developed	n=228 People with asymptomatic or minimally symptomatic calyceal stones of a combined diameter of ≤15mm in a single kidney	Stone free state (mean 2.2 years): not defined, confirmed by KUB	Extracted in <10mm strata as majority of participants have stones <10mm

Study	Intervention and comparison	Population	Outcomes	Comments
		Stone size: SWL group: 1-5mm 37%, 6-10mm 46%, 11-15mm 17%; observation group: 1-5mm 29%, 6-10mm 59%, 11-15mm 12% Age, mean (SD): SWL group 53.7 (10.8), observation group 53.2 (12.8) Male to female ratio 4.8:1 UK		
Sener 2015[196]	Intervention (n=50): shockwave lithotripsy (SWL) using an electrohydraulic extracorporeal lithotripter, with 2500-3000 shocks at 14-17kV, and a maximum of 3 sessions Comparison (n=50): ureteroscopy (URS) using flexible ureterorenoscope and holmium laser Comparison 2 (n=50): observation	n=150 People with single lower pole stones <10mm Mean stone size (SD): SWL group 7.9 (1.1); URS group 8.2 (1.2); observation 7.9 (0.7) Age, mean (SD): SWL group 34.5 (11.04); URS group 36.84 (11.7); observation group 32.52 (12.29) Male to female ratio 2.06:1 Turkey	Stone free state (3 months): defined as fragmentation <3mm Ancillary procedures (time-point not reported)	
Yuruk 2010[241]	Intervention (n=33): shockwave lithotripsy (SWL) without anaesthesia using an electromagnetic lithotripter, starting at 14kV and increasing to 24kV. A total of 3000 shocks per session, and a maximum of 3 sessions Intervention 2 (n=33): percutaneous nephrolithotomy (PCNL) performed in	n=99 Patients with asymptomatic lower caliceal calculi 20mm or less in greatest diameter Age, mean (SD): SWL group 44.5 (9.4); PCNL group 44.1 (12.3); observation group 44 (12.2) Male to female ratio 1.1:1	Stone free state (3 months): not defined Ancillary procedures (time-point not reported)	Extracted in 10-20mm strata but note that may include some stones <10mm

Study	Intervention and comparison	Population	Outcomes	Comments
	the prone position using rigid nephroscope and lithoclast lithotripter Comparison (n=33): observation Symptoms were defined as disease progression. Patients were referred for SWL, PCNL or URS after prompt medical treatment	Turkey		
Zhang 2009[246]	Intervention 1 (n=97): nifedipine (30 mg, orally, three times a day for four weeks) Intervention 2 (n=102): tamsulosin (0.4 mg/d for four weeks) Comparison (n=104): shockwave lithotripsy (SWL), a single session All patients received conventional treatment with 2500 ml hydration daily and levofloxacin (0.1 g orally, twice a day) for the first 7 days	n=314 People with lower ureteral stones Mean stone size, mm (SD): intervention 1, 6.8 (1.6); intervention 2, 6.9 (1.6); comparison, 6.9 (1.6) Mean age, years (SD): intervention 1, 36.3 (9.7); intervention 2, 34.6 (11.4); SWL group, 36.6 (11.1) Male to female ratio 2.1:1 China	Stone free state (4 weeks): defined as complete absence of any stone based on plain abdominal x-ray or fragments less than 3mm	

1.4.4.2 Within surgery comparisons

Table 3: Summary of studies included in the evidence review

Study	Intervention and comparison	Population	Outcomes	Comments
PCNL: Tubeless versus standard				
Aghamir 2012[4]	Intervention (n=13): tubeless PCNL. Ureteral stent and working sheath were removed at the end of the procedures Comparison (n=10): standard PCNL. Ureteral stent remained and a	n=23 Children <14 years old with a renal stone larger than 25 mm or renal stone with lesser diameter and SWL failure Mean stone size, mm (SD): tubeless group	Stone free state (1 month): defined as no stone fragment over 4mm, confirmed by sonography Retreatment (1 month)	

Study	Intervention and comparison	Population	Outcomes	Comments
	nephrostomy tube was placed PCNL was performed in the prone position using a sheath and nephroscope. A pneumatic lithotripter and grasper was used.	29.23 (4.85); standard group 31.40 (5.19) Mean age, years (SD): tubeless group10.32 (2.68); standard group 11.10 (1.72) Male to female ratio 2.3:1 Iran	Length of hospital stay (hours) Minor adverse events (1 month): fever	
Chang 2011[39]	Intervention (n=68): tubeless PCNL Comparison (n=63): standard PCNL using a double J catheter and nephrostomy tube PCNL was performed in the prone position using a sheath and pneumatic lithoclast	n=131 People with impacted ureteropelvic junction stone or single renal pelvic stone >20mm and <40mm Mean stone size, mm (SD): tubeless group 24.74 (2.69); standard group 24.86 (2.78) Mean age, years (SD): tubeless group 59.22 (12.44); standard group 58.70 (10.85) Male to female ratio 3.37:1 Taiwan	Stone free state (mean follow up 18-18.92 months): defined as complete removal or radiographic absence of calculi by KUB Retreatment (mean follow up 18-18.92 months) Ancillary procedures (mean follow up 18-18.92 months) Length of hospital stay (days) Pain (2 days): VAS Major adverse events (mean follow up 18-18.92 months): Calvien grade 3a – no further details Minor adverse events (mean follow up 18-18.92 months): Calvien grade 1-2 – no further details	
Jun-Ou 2010[105]	Intervention (n=43): tubeless supracostal PCNL Comparison (n=52): supracostal PCNL	n=95 People with stones Mean stone size, mm (SD): tubeless group	Stone free state (1 day): defined as completely stone free or residual fragments <4mm,	Extracted in renal strata as majority of stones were renal (including

Study	Intervention and comparison	Population	Outcomes	Comments
	with routine nephrostomy tube placement	38.3 (14.5) (range 18-80); standard group 41.1 (15.7) (range 23-95) Mean age, years (SD): tubeless group 51.49 (12.77); standard group 50.63 (12.18) Male to female ratio 1.57:1 Staghorn 30.5%, calyceal stone 22.1%, calyceal + pelvic stone 40%, upper ureteral stone 5.3%, upper ureteral + calyceal stone 2.1% Thailand	confirmed by plain film KUB Length of hospital stay (days)	staghorn and pelvic) (93%) but note that also includes some ureteral stones
Lu 2013[150]	Intervention (n=16): tubeless minimally invasive PCNL Comparison (n=16): standard minimally invasive PCNL	n=32 People who have stones in the renal pelvis of <40 mm in size Mean stone size, mm (SD): tubeless group 31.1 (6.2) (range 20-40 mm); standard group 32.9 (5.4) (range 20-40 mm) Mean age, years (SD): tubeless group 43.81 (18.89); standard group 46.25 (22.37) Male to female ratio 0.68:1 China	Stone free state (2 weeks): not defined, confirmed by KUB and ultrasound Minor adverse events (time-point not reported): extravasation, fever	
Samad 2012[188]	Intervention (n=30): tubeless mini-PCNL Comparison (n=30): standard mini-PCNL with nephrostomy tube	n=54 (60 renal units) Children undergoing PCNL Mean stone size, mm (SD): tubeless group 20.4 (9.3); standard group 28.6 (16.7)	Stone free state (1 week): not defined Ancillary procedures (time-point not reported) Length of hospital stay (days)	Extracted in >20mm strata based on mean stone size, but note that it is likely that some stones were less than 20 mm

Study	Intervention and comparison	Population	Outcomes	Comments
		Mean age, years (SD): tubeless group 6.3 (3.6); standard group 7.2)3.2) Male to female ratio 1.35:1 Pakistan	Minor adverse events (time-point not reported): UTI, fever	
Sebaey 2016[193]	Intervention (n=40): tubeless mini-PCNL Comparison (n=40): standard mini-PCNL. At the end of the procedure a 14-F nephrostomy tube was inserted	n=80 People with a solitary radio-opaque renal stone, and candidates for PCNL Mean stone size, mm (SD): tubeless group 18.2 (3.6); standard group 19.1 (3.7) Mean age, years (SD): tubeless group 40.6 (11.9); standard group 46.1 (18.4) Male to female ratio 2.6:1 Egypt	Stone free state (time point not reported): definition not reported, confirmed by abdominal radiograph Length of hospital stay (days)	
PCNL: minimally invasive a.k.a. mini versus standard				
Feng 2001[72]	Intervention (n=10): mini-PCNL. The tract dilation was up to 22F and a 19F rigid nephroscope was used Comparison (n=10): standard PCNL. At the end of the procedure a nephrostomy tube was placed	n=20 People referred for a percutaneous renal procedure with a stone of ≥15 mm, stones in the presence of obstruction, or ureteropelvic junction obstruction 96.3% renal stones Mean age, years (SD not reported): mini group 56; standard group 53 Gender not reported	Stone free state (time-point not reported): defined as free of stones or clinically insignificant stones (<5mm), confirmed by radiograph Retreatment (time-point not reported) Length of hospital stay (days) Pain (1 day): VAS Minor adverse events (time-point not reported):	Extracted in >20mm strata but note that may include some 15-20 mm stones

Study	Intervention and comparison	Population	Outcomes	Comments
		United States	bleeding requiring transfusion	
Karakan 2017[113]	Intervention (n=47): ultra-mini PCNL in the lithotomy, then prone position using a semirigid ureteroscope and holmium YAG laser Comparison (n=50): standard PCNL in the lithotomy, then prone position using a rigid endoscope and holmium YAG laser	n=123 People with a stone size equal to or smaller than 25mm Mean stone size, mm (SD): umPCNL group 20.3 (3.0); standard PCNL group 20.9 (3.6) Mean age, years (range): umPCNL group 43.3 (19-69); standard PCNL group 46.5 (26-84) Male to female ratio 1.55:1 Turkey	Stone free state (1 month): defined as stone free or clinically insignificant fragments (<3mm), confirmed using non-contrast CT Ancillary procedures (time-point not reported) Length of hospital stay (days): not suitable for meta-analysis Minor adverse events (time-point not reported): blood transfusion, fever, UTI	
Sakr 2017[186]	Intervention (n=75): minimally invasive PCNL in the flank free modified supine position. The tract was dilated to 16.5F and a 12-F sized miniature nephroscope was used Comparison (n=75): standard PCNL in the flank free modified supine position. The tract was dilated up to 30F and a 26-F nephroscope was used	n=150 People with 20-30 mm renal stones Mean stone size, mm (SD): miPCNL group 27 (2); standard PCNL group 26 (6) Mean age, years (SD): miPCNL group 43.8 (9.5); standard PCNL group 40.2 (8.3) Male to female ratio 1.6:1 Egypt	Stone free state (1 month) Retreatment (time-point not reported) Ancillary procedures (time-point not reported) Pain (1 day): VAS score Major adverse events (time-point not reported): perforation of renal pelvis Minor adverse events (time-point not reported): bleeding necessitating transfusion, fever	
PCNL: supine versus prone position				
Al-Dessoukey 2014[10]	Intervention (n=101): PCNL in the oblique	n=203	Stone free state (1 day): defined as no stone ≥4mm,	Extracted in renal strata as majority of

Study	Intervention and comparison	Population	Outcomes	Comments
	supine lithotomy position Comparison (n=102): PCNL in the prone position	People with upper urinary tract stones (single or multiple renal stones >25 mm or upper ureteral stones >10 mm) Stone site: upper ureter 3.9%, pelvic 38.9%, lower calyceal 11.3%, pelvic and middle/upper/lower calyceal 52.2%, staghorn 1.9% Mean stone size, mm (SD): supine group 36.8 (14.2); prone group 39.3 (12.6) Male to female ratio 2:1 Egypt	confirmed by KUB, US and chest x-ray Length of hospital stay (hours) Major adverse events (time-point not reported): colonic injury Minor adverse events (time-point not reported): blood transfusion, fever	stones were pelvic or pelvic + caliceal Note that stone site adds up to over 100% - not explained in paper
Falahatkar 2011[66]	Intervention (n=18): PCNL in the supine position without flank elevation Comparison (n=15): PCNL in the prone position	n=33 People with renal stones ≥20 mm, stone size ≥15 mm in lower calyx and stones resistant to ESWL ≥10 mm Mean stone size, mm (SD not reported): supine group 31.2; prone group 27.3 Mean age, years (SD not reported): supine group 49.9; prone group 47.06 Male to female ratio 3.13:1 Iran	Stone free state (2 weeks): residual stones less than 5mm, confirmed on plain radiography Major adverse events (time-point not reported): mortality Minor adverse events (time-point not reported): fever, transfusion	Extracted in renal stone >20mm strata due to mean stone size
Falahatkar 2008[68]	Intervention (n=40): PCNL in the supine position without flank elevation, placed at the bed edge without a rolled towel under the flank or change in leg position	n=80 People with single or multiple renal stones >20mm Mean stone size, mm (SD not reported):	Stone free state (1 day): defined as stone <5mm, confirmed by KUB x-ray and sonography	

Study	Intervention and comparison	Population	Outcomes	Comments
	Comparison (n=40): PCNL in the prone position	supine group 40.6; prone group 40.3 Mean age, years (SD not reported): supine group 45.35; prone group 43.02 Male to female ratio 1.05:1 Iran	Major adverse events (time-point not reported): mortality Minor adverse events (time-point not reported): extravasation, transfusion, fever	
Sio 2008[205]	Intervention (n=39): percutaneous nephrolithotomy (PCNL) in the supine position using nephroscope and ultrasonic lithotripsy Comparison (n=36): percutaneous nephrolithotomy (PCNL) in the prone position using nephroscope and ultrasonic lithotripsy	n=75 People with single or multiple renal stones (pelvic-calyceal) treatable with a single percutaneous access Mean stone size, mm (range): supine group 34 (25–51); prone group 33 (27–45) Mean age, years (range): supine group 38 (25–72); prone group 41 (28–69) Male to female ratio 0.79:1 Italy	Stone free state (1 month): defined as no stone >2 mm Visualized Ancillary procedures (time-point not reported)	
Wang 2013[224]	Intervention (n=60): percutaneous nephrolithotomy (PCNL) in the modified supine position Comparison(n=62): percutaneous nephrolithotomy (PCNL) in the prone position	n=122 People with renal and ureteral calculi, >20mm or >15 mm respectively Renal stones 83.6%; ureteral stones 16.4% Mean stone size not reported Mean age, years (range): supine group 44 (30-69); prone group 42 (22-70) Male to female ratio 1.03:1	Stone free state (1 month): defined as no residual stones of diameter >4 mm Recurrence (time-point not reported) Ancillary procedures (time-point not reported) Retreatment (time-point not reported) Minor adverse events (time-point not reported): fever, clinically	Over 80% of participants had renal stones so data extracted in renal stone strata and >20 mm strata

Study	Intervention and comparison	Population	Outcomes	Comments
		China	insignificant bleeding	

See appendix D for full evidence tables.

1.4.5 In Quality assessment of clinical studies included in the evidence review

1.4.5.1 Between surgery comparisons

1.4.5.1.1 Adult, ureteric, <10mm

Table 3: Clinical evidence summary: SWL versus URS

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with URS	Risk difference with SWL (95% CI)
Stone free state	1152 (8 studies) 2 weeks - 3 months	⊕⊖⊖⊖ VERY LOW1,4 due to risk of bias, inconsistency	RR 0.9 (0.81 to 0.99)	929 per 1000	93 fewer per 1000 (from 9 fewer to 186 fewer)
Retreatment	1094 (6 studies) 2 weeks - 3 months or time-point not reported	⊕⊕⊖⊖ LOW1,3 due to risk of bias, inconsistency	RR 5.01 (1.39 to 18.04)	29 per 1000	116 more per 1000 (from 11 more to 494 more)
Ancillary procedures	959 (5 studies) 2-4 weeks or time-point not reported	⊕⊖⊖⊖ VERY LOW1,2,5 due to risk of bias, inconsistency, imprecision	RR 2.29 (0.71 to 7.40)	41 per 1000	53 more per 1000 (from 12 fewer to 262 more)
Readmission to hospital	64 (1 study) time-point not reported	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	RR 0.50 (0.10 to 2.54)	125 per 1000	62 fewer per 1000 (from 112 fewer to 192 more)
Length of hospital stay (days)	156 (1 study)	⊕⊖⊖⊖ VERY LOW1,2,6 due to risk of bias,		The mean length of hospital stay in the	The mean length of hospital stay in the SWL group was

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with URS	Risk difference with SWL (95% CI)
		imprecision, indirectness		URS/RIRS group was 4.4 days	2.20 lower (3.09 to 1.31 lower)
Pain Scale from: 0 to 10. Better indicated by lower score	65 (1 study) 4 weeks	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision		The mean pain in the URS/RIRS group was 4.1	The mean pain in the SWL group was 1.6 higher (0.28 to 2.92 higher)
Quality of life - EQ-5D mean index Scale from: 0 to 1. Better indicated by higher score	65 (1 study) 4 weeks	⊕⊕⊕⊖ MODERATE1 due to risk of bias		The mean quality of life - eq-5d mean index in the URS/RIRS group was 0.87	The mean quality of life - eq-5d mean index in the SWL group was 0.1 lower (0.15 to 0.05 lower)
Quality of life - EQ-5D VAS value Scale from: 0 to 100. Better indicated by higher score	65 (1 study) 4 weeks	⊕⊕⊕⊖ MODERATE1 due to risk of bias		The mean quality of life - eq-5d vas value in the URS/RIRS group was 84.67	The mean quality of life - eq-5d vas value in the SWL group was 11.5 lower (15.95 to 7.05 lower)
Minor adverse events	1048 (5 studies) time-point not reported	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	RR 0.67 (0.29 to 1.52)	20 per 1000	7 fewer per 1000 (from 14 fewer to 10 more)
Major adverse events	682 (2 studies) time-point not reported	⊕⊕⊖⊖ LOW1,6 due to risk of bias, indirectness	Peto OR 0.15 (0.05 to 0.47)	57 per 1000	48 fewer per 1000 (from 29 fewer to 54 fewer)
Failed technology	682 (2 studies) time-point not reported	⊕⊖⊖⊖ VERY LOW1,2,6 due to risk of bias, imprecision, indirectness	Peto OR 0.27 (0.06 to 1.21)	23 per 1000	17 fewer per 1000 (from 22 fewer to 5 more)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with URS	Risk difference with SWL (95% CI)
1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias and downgraded by 2 increments if the majority of the evidence was at very high risk of bias 2 Downgraded by 1 increment if the confidence interval crossed 1 MID or by 2 increments if the confidence interval crossed both MIDs. 3 Downgraded by 1 or 2 increments because heterogeneity, I2= 62%, p= > 0.1, unexplained by subgroup analysis 4 Downgraded by 1 or 2 increments because heterogeneity, I2= 85%, p= > 0.1, unexplained by subgroup analysis 5 Downgraded by 1 or 2 increments because heterogeneity, I2= 72%, p= > 0.1, unexplained by subgroup analysis 6 Downgraded by 1 or 2 increments because the majority of the evidence included an indirect population (downgrade by one increment) or a very indirect population (downgrade by two increments) or the majority of the evidence had indirect outcomes					

Table 4: Clinical evidence summary: surgery (URS, SWL or PCNL) versus non-surgical treatment

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Conservative treatment	Risk difference with Surgery (95% CI)
Stone free state	303 (1 study) 4 weeks	⨁⨁⊖⊖ LOW1,2 due to risk of bias, imprecision	RR 1.23 (1.10 to 1.39)	709 per 1000	163 more per 1000 (from 71 more to 277 more)
1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias and downgraded by 2 increments if the majority of the evidence was at very high risk of bias 2 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs					

1.4.5.1.2 *Adult, ureteric, 10-20mm*

Table 5: Clinical evidence summary: SWL versus URS

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with URS	Risk difference with SWL (95% CI)
Stone free state	1777 (13 studies) 1 session - 3 months	⊕⊖⊖⊖ VERY LOW1,2,3 due to risk of bias, imprecision, inconsistency	RR 0.85 (0.79 to 0.92)	852 per 1000	128 fewer per 1000 (from 68 fewer to 179 fewer)
Retreatment	1394 (10 studies) 1 week to 3 months or time-point not reported	⊕⊕⊕⊖ MODERATE1 due to risk of bias	RR 4.43 (3.39 to 5.79)	87 per 1000	298 more per 1000 (from 208 more to 417 more)
Ancillary procedures - Lower ureteric	274 (2 studies) 3 months or time-point not reported	⊕⊕⊖⊖ LOW1,2 due to risk of bias, imprecision	RR 2.12 (1.11 to 4.05)	87 per 1000	97 more per 1000 (from 10 more to 265 more)
Ancillary procedures - Upper ureteric	668 (6 studies) 1-4 weeks or time-point not reported	⊕⊕⊖⊖ LOW1,2 due to risk of bias, imprecision	RR 1.12 (0.85 to 1.48)	254 per 1000	30 more per 1000 (from 38 fewer to 122 more)
Readmission to hospital	200 (1 study) 2 weeks	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	Peto OR 7.46 (0.46 to 120.17)	0 per 1000	20 more per 1000 (from 13 fewer to 53 more)8
Length of hospital stay – Hours	164 (4 studies)	⊕⊖⊖⊖ VERY LOW1,5,10		The mean length of hospital stay - hours in the URS/RIRS	The mean length of hospital stay - hours in the SWL group was 25.84 lower

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with URS	Risk difference with SWL (95% CI)
		due to risk of bias, inconsistency, indirectness		group was 47.3 hours	(32.64 to 19.05 lower)
Pain VAS Scale from: 0 to 10. Better indicated by lower score	102 (3 studies) Post-treatment or time-point not reported	⊕⊖⊖⊖ VERY LOW1,2,4 due to risk of bias, inconsistency, imprecision		The mean pain vas in the URS/RIRS group was 2.35	The mean pain vas in the SWL group was 0.69 lower (1.82 lower to 0.44 higher)
Major adverse events	971 (6 studies) 3 months or time-point not reported	⊕⊖⊖⊖ VERY LOW1,2,7 due to risk of bias, inconsistency, imprecision	RR 0.63 (0.14 to 2.74)	43 per 1000	16 fewer per 1000 (from 37 fewer to 75 more)
Minor adverse events	1536 (10 studies) 1 week to 3 months or time-point not reported	⊕⊖⊖⊖ VERY LOW1,2,9 due to risk of bias, inconsistency, imprecision	RR 0.47 (0.21 to 1.05)	61 per 1000	32 fewer per 1000 (from 48 fewer to 3 more)
Failed technology	30 (1 study) time-point not reported	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	Peto OR 0.15 (0.00 to 7.8)	62 per 1000	53 fewer per 1000 (from 63 fewer to 281 more)

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
2 Downgraded by 1 increment if the confidence interval crossed 1 MID or by 2 increments if the confidence interval crossed both MIDs
3 Downgraded by 1 or 2 increments because heterogeneity, I2=50%, p= > 0.1, unexplained by subgroup analysis
4 Downgraded by 1 or 2 increments because heterogeneity, I2=89%, p= > 0.1, unexplained by subgroup analysis
5 Downgraded by 1 or 2 increments because heterogeneity, I2=86%, p= > 0.1, unexplained by subgroup analysis

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with URS	Risk difference with SWL (95% CI)
6 Could not be calculated as there were no events in the comparison group 7 Downgraded by 1 or 2 increments because heterogeneity, I2=60%, p= > 0.1, unexplained by subgroup analysis 8 Risk difference calculated in Review Manager 9 Downgraded by 1 or 2 increments because heterogeneity, I2=53%, p= > 0.1, unexplained by subgroup analysis 10 Downgraded by 1 or 2 increments because the majority of the evidence included an indirect population (downgrade by one increment) or a very indirect population (downgrade by two increments) or the majority of the evidence had indirect outcomes					

Table 6: Clinical evidence table: URS versus PCNL

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with PCNL	Risk difference with URS (95% CI)
Stone free state	541 (5 studies) 3-4 weeks	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, inconsistency	RR 0.89 (0.8 to 0.99)	1000 per 1000	110 fewer per 1000 (from 10 fewer to 200 fewer)
Retreatment	159 (2 studies) time-point not reported	⊕⊖⊖⊖ VERY LOW1,3 due to risk of bias, imprecision	RR 1.57 (0.66 to 3.72)	70 per 1000	40 more per 1000 (from 24 fewer to 190 more)
Ancillary procedure	444 (4 studies) 3 days or time-point not reported	LOW1,4 due to risk of bias, inconsistency	RR 4.3 (1.36 to 13.61)	49 per 1000	162 more per 1000 (from 18 more to 618 more)
Length of hospital stay (days)	470 (5 studies)	⊕⊖⊖⊖ VERY LOW1,5 due to risk of bias, inconsistency		The mean hospital stay (days) in the PCNL group	The mean hospital stay (days) in the URS/RIRS group was 3.24 lower (3.95 to 2.53 lower)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with PCNL	Risk difference with URS (95% CI)
				was 6.13	
Major adverse events	444 (4 studies) 4 weeks or time-point not reported	⊕⊕⊕⊖ MODERATE1 due to risk of bias	Peto OR 8.31 (2.04 to 33.9)	0 per 1000	36 more per 1000 (from 10 more to 63 more)6
Minor adverse events	441 (4 studies) 4 weeks or time-point not reported	⊕⊖⊖⊖ VERY LOW1,3,5,7 due to risk of bias, inconsistency, imprecision, indirectness	RR 0.95 (0.31 to 2.94)	118 per 1000	6 fewer per 1000 (from 81 fewer to 229 more)

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
2 Downgraded by 1 or 2 increments because heterogeneity, I2= 78%, p= > 0.1, unexplained by subgroup analysis
3 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
4 Downgraded by 1 or 2 increments because heterogeneity, I2= 58%, p= > 0.1, unexplained by subgroup analysis
5 Downgraded by 1 or 2 increments because heterogeneity, I2=80%, p= > 0.1, unexplained by subgroup analysis
6 Risk difference calculated in Review Manager
7 Downgraded by 1 or 2 increments because the majority of the evidence included an indirect population (downgrade by one increment) or a very indirect population (downgrade by two increments) or the majority of the evidence had indirect outcomes

1.4.5.1.3 Children, ureteric, <10mm

Table 7: Clinical evidence table: SWL versus URS

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with URS/RIRS	Risk difference with SWL (95% CI)
Stone free state	31 (1 study) 6-8 months	⊕⊖⊖⊖ VERY LOW1,2,4 due to risk of bias, imprecision, indirectness	RR 0.46 (0.25 to 0.84)	941 per 1000	508 fewer per 1000 (from 151 fewer to 706 fewer)
Retreatment	31 (1 study) 6-8 months	⊕⊕⊕⊖ MODERATE1 due to risk of bias	Peto OR 17.96 (3.66 to 88.1)	0 per 1000	571 more per 1000 (from 394 more to 833 more)3
Ancillary procedures	31 (1 study) 6-8 months	⊕⊕⊖⊖ LOW1,2 due to risk of bias, imprecision	RR 6.07 (0.8 to 46.1)	59 per 1000	299 more per 1000 (from 12 fewer to 1000 more)

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias and downgraded by 2 increments if the majority of the evidence was at very high risk of bias

2 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.

3 Risk difference calculated in Review Manager4 Downgraded by 1 increment if the outcome definition reported did not meet definition of outcome in protocol

4 Downgraded by 1 or 2 increments because the majority of the evidence included an indirect population (downgrade by one increment) or a very indirect population (downgrade by two increments) or the majority of the evidence had indirect outcomes

1.4.5.1.4 Adult, renal, <10mm

Table 8: Clinical evidence summary: SWL versus URS

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with URS/RIRS	Risk difference with SWL (95% CI)
Stone free state	404 (4 studies) 3 months	⊕⊕⊕⊖ MODERATE1 due to risk of bias	RR 0.95 (0.88 to 1.02)	882 per 1000	44 fewer per 1000 (from 106 fewer to 18 more)
Retreatment	273 (3 studies) time-point not reported	⊕⊖⊖⊖ VERY LOW1,2,3 due to risk of bias, inconsistency, imprecision	RR 5.97 (0.98 to 36.42)	57 per 1000	283 more per 1000 (from 1 fewer to 1000 more)
Ancillary procedures	413 (4 studies) time-point not reported	⊕⊕⊖⊖ LOW1,3 due to risk of bias, imprecision	RR 2.39 (1.13 to 5.04)	39 per 1000	54 more per 1000 (from 5 more to 158 more)
Readmission	67 (1 study) time-point not reported	⊕⊖⊖⊖ VERY LOW1,3 due to risk of bias, imprecision	Peto OR 0.14 (0.01 to 1.39)	86 per 1000	73 fewer per 1000 (from 85 fewer to 30 more)
Major adverse events	206 (2 studies) time-point not reported	⊕⊖⊖⊖ VERY LOW1,3 due to risk of bias, imprecision	Peto OR 0.13 (0.01 to 1.28)	30 per 1000	26 fewer per 1000 (from 30 fewer to 8 more)
Minor adverse events	413 (4 studies) time-point not reported	⊕⊕⊕⊖ MODERATE1 due to risk of bias	Peto OR 0.13 (0.04 to 0.46)	50 per 1000	43 fewer per 1000 (from 26 fewer to 48 fewer)
Failed technology	67 (1 study) time-point not reported	⊕⊖⊖⊖ VERY LOW1,3 due to risk of bias, imprecision	RR 0.22 (0.03 to 1.77)	143 per 1000	112 fewer per 1000 (from 139 fewer to 110 more)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with URS/RIRS	Risk difference with SWL (95% CI)

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
2 Downgraded by 1 or 2 increments because heterogeneity, I2= 65%, p= > 0.1, unexplained by subgroup analysis
3 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 9: Clinical evidence summary: SWL versus PCNL

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with PCNL	Risk difference with SWL (95% CI)
Stone free state	39 (1 study) 3 months	⨁⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	RR 0.64 (0.45 to 0.9)	1000 per 1000	360 fewer per 1000 (from 100 fewer to 550 fewer)
Retreatment	42 (1 study) time-point not reported	⨁⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	RR 0.91 (0.14 to 5.86)	100 per 1000	9 fewer per 1000 (from 86 fewer to 486 more)
Ancillary procedures	42 (1 study) time-point not reported	⨁⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	Peto OR 7.44 (0.73 to 75.95)	0 per 1000	136 more per 1000 (from 24 fewer to 297 more)3

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
2 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
3 Risk difference calculated in Review Manager

Table 10: Clinical evidence summary: surgery (URS, SWL or PCNL) versus non-surgical treatment

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Conservative	Risk difference with Surgery (95% CI)
Stone free state	350 (2 studies) 3 months - 2.2 years	⊕⊖⊖⊖ VERY LOW1,2,3,4 due to risk of bias, inconsistency, imprecision, indirectness	RR 8.28 (0.09 to 756.16)	91 per 1000	662 more per 1000 (from 83 fewer to 1000 more)
Ancillary procedures	150 (1 study) time-point not reported	⊕⊖⊖⊖ VERY LOW1,3 due to risk of bias, imprecision	RR 0.58 (0.21 to 1.64)	120 per 1000	50 fewer per 1000 (from 95 fewer to 77 more)

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
2 Downgraded by 1 or 2 increments because heterogeneity, I2= 95%, p= > 0.1, unexplained by subgroup analysis
3 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
4 Downgraded by 1 or 2 increments because the majority of the evidence included an indirect population (downgrade by one increment) or a very indirect population (downgrade by two increments) or the majority of the evidence had indirect outcomes

21.4.5.1.5 Adult, renal, 10-20mm

Table 11: Clinical evidence summary: SWL versus URS

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with URS	Risk difference with SWL (95% CI)
Stone free state	395 (5 studies) 1-3 months	⊕⊖⊖⊖ VERY LOW1,2,3 due to risk of bias, inconsistency, imprecision	RR 0.84 (0.74 to 0.96)	897 per 1000	144 fewer per 1000 (from 36 fewer to 233 fewer)
Retreatment	395 (5 studies) 3 months	⊕⊕⊕⊖ MODERATE1 due to risk of bias	RR 5.96 (3.77 to 9.42)	95 per 1000	471 more per 1000 (from 263 more to 800 more)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with URS	Risk difference with SWL (95% CI)
	or time-point not reported				
Ancillary procedures	229 (3 studies) time-point not reported	⨁⊖⊖⊖ VERY LOW1,3,4 due to risk of bias, inconsistency, imprecision	RR 2.02 (0.69 to 5.85)	93 per 1000	95 more per 1000 (from 29 fewer to 451 more)
Length of hospital stay - Hours	190 (2 studies)	⨁⊖⊖⊖ VERY LOW1,3,5 due to risk of bias, inconsistency, imprecision		The mean length of hospital stay - hours in the URS/RIRS group was 33.45	The mean length of hospital stay - hours in the SWL group was 27.09 lower (56.49 lower to 2.31 higher)
Pain VAS Scale from: 0 to 10. Better indicated by lower score	190 (2 studies) 1 day or not reported	⨁⊖⊖⊖ VERY LOW1,3,6 due to risk of bias, inconsistency, imprecision		The mean pain vas in the URS/RIRS group was 3.72	The mean pain vas in the SWL group was 0.05 higher (3.91 lower to 4.01 higher)
Minor adverse events	325 (4 studies) 3 months or time-point not reported	⨁⊖⊖⊖ VERY LOW1,3 due to risk of bias, imprecision	RR 1.27 (0.49 to 3.32)	49 per 1000	13 more per 1000 (from 25 fewer to 114 more)
Major adverse events	144 (2 studies) time-point not reported	⨁⊖⊖⊖ VERY LOW1,3 due to risk of bias, imprecision	RR 1 (0.15 to 6.71)	29 per 1000	0 fewer per 1000 (from 25 fewer to 166 more)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with URS	Risk difference with SWL (95% CI)

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
2 Downgraded by 1 or 2 increments because heterogeneity, I2= 52%, p= > 0.1, unexplained by subgroup analysis
3 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
4 Downgraded by 1 or 2 increments because heterogeneity, I2= 72%, p= > 0.1, unexplained by subgroup analysis
5 Downgraded by 1 or 2 increments because heterogeneity, I2= 99%, p= > 0.1, unexplained by subgroup analysis
6 Downgraded by 1 or 2 increments because heterogeneity, I2= 98%, p= > 0.1, unexplained by subgroup analysis

Table 12: Clinical evidence summary: SWL versus PCNL

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with PCNL	Risk difference with SWL (95% CI)
Stone free state	427 (6 studies) 1-3 months	⨁⊖⊖⊖ VERY LOW1,2 due to risk of bias, inconsistency	RR 0.63 (0.5 to 0.79)	960 per 1000	355 fewer per 1000 (from 202 fewer to 480 fewer)
Retreatment	239 (4 studies) 3 months or time-point not reported	⨁⨁⨁⊖ MODERATE1 due to risk of bias	RR 18.69 (7.06 to 66.89)	12 per 1000	212 more per 1000 (from 61 more to 679 more)
Ancillary procedures	363 (4 studies) 3 months or time-point not reported	⨁⨁⨁⊖ MODERATE1 due to risk of bias	RR 5.97 (2.38 to 14.95)	17 per 1000	84 more per 1000 (from 23 more to 237 more)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with PCNL	Risk difference with SWL (95% CI)
Length of hospital stay (days)	49 (1 study)	⊕⊖⊖⊖ VERY LOW1,3,6 due to risk of bias, imprecision, indirectness		The mean length of hospital stay - days in the PCNL group was 7.4 days	The mean length of hospital stay - days in the SWL group was 3.30 lower (5.45 to 1.15 lower)
Quality of life (SF-36) - Physical functioning Scale from: 0 to 100. Better indicated by high score	81 (1 study) 3 months	⊕⊖⊖⊖ VERY LOW1,3,6 due to risk of bias, imprecision, indirectness		The mean quality of life (sf-36) - physical functioning in the PCNL group was -0.4	The mean quality of life (sf-36) - physical functioning in the SWL group was 2.7 higher (6.06 lower to 11.46 higher)
Quality of life (SF-36) - Physical role Scale from: 0 to 100. Better indicated by high score	80 (1 study) 3 months	⊕⊖⊖⊖ VERY LOW1,3,6 due to risk of bias, imprecision, indirectness		The mean quality of life (sf-36) - physical role in the PCNL group was 14.9	The mean quality of life (sf-36) - physical role in the SWL group was 1.5 higher (17.73 lower to 20.73 higher)
Quality of life (SF-36) - Bodily pain Scale from: 0 to 100. Better indicated by high score	81 (1 study) 3 months	⊕⊖⊖⊖ VERY LOW1,3,6 due to risk of bias, imprecision, indirectness		The mean quality of life (sf-36) - bodily pain in the PCNL group was 26.3	The mean quality of life (sf-36) - bodily pain in the SWL group was 10.1 lower (21.47 lower to 1.27 higher)
Quality of life (SF-36) - General health Scale from: 0 to 100. Better indicated by high score	79 (1 study) 3 months	⊕⊖⊖⊖ VERY LOW1,3,6 due to risk of bias, imprecision, indirectness		The mean quality of life (sf-36) - general health in the PCNL group was 4.9	The mean quality of life (sf-36) - general health in the SWL group was 5.7 lower (13.9 lower to 2.5 higher)
Quality of life (SF-36) - Vitality Scale from: 0 to 100.	81 (1 study) 3 months	⊕⊖⊖⊖ VERY LOW1,3,6 due to risk of bias, imprecision, indirectness		The mean quality of life (sf-36) - vitality in the PCNL group was 8.7	The mean quality of life (sf-36) - vitality in the SWL group was 0.8 higher (8.57 lower to 10.17 higher)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with PCNL	Risk difference with SWL (95% CI)
Quality of life (SF-36) - Social functioning Scale from: 0 to 100. Better indicated by high score	81 (1 study) 3 months	⊕⊖⊖⊖ VERY LOW1,3,6 due to risk of bias, imprecision, indirectness		The mean quality of life (sf-36) - social functioning in the PCNL group was 5.7	The mean quality of life (sf-36) - social functioning in the SWL group was 5.2 higher (5.32 lower to 15.72 higher)
Quality of life (SF-36) - Emotional role Scale from: 0 to 100. Better indicated by high score	81 (1 study) 3 months	⊕⊖⊖⊖ VERY LOW1,3,6 due to risk of bias, imprecision, indirectness		The mean quality of life (sf-36) - emotional role in the PCNL group was 4	The mean quality of life (sf-36) - emotional role in the SWL group was 8 higher (10.87 lower to 26.87 higher)
Quality of life (SF-36) - Mental health Scale from: 0 to 100. Better indicated by high score	81 (1 study) 3 months	⊕⊖⊖⊖ VERY LOW1,3,6 due to risk of bias, imprecision, indirectness		The mean quality of life (sf-36) - mental health in the PCNL group was 3.1	The mean quality of life (sf-36) - mental health in the SWL group was 1.3 lower (9.67 lower to 7.07 higher)
Quality of life (SF-36) - Total physical Scale from: 0 to 100. Better indicated by high score	78 (1 study) 3 months	⊕⊖⊖⊖ VERY LOW1,3,6 due to risk of bias, imprecision, indirectness		The mean quality of life (sf-36) - total physical in the PCNL group was 5.1	The mean quality of life (sf-36) - total physical in the SWL group was 1.8 lower (5.55 lower to 1.95 higher)
Quality of life (SF-36) - Total mental Scale from: 0 to 100. Better indicated by high score	78 (1 study) 3 months	⊕⊖⊖⊖ VERY LOW1,3,6 due to risk of bias, imprecision, indirectness		The mean quality of life (sf-36) - total mental in the PCNL group was 1.4	The mean quality of life (sf-36) - total mental in the SWL group was 0.7 higher (3.85 lower to 5.25 higher)
Quality of life (SF-36) - Overall health Scale from: 0 to 100. Better indicated by high score	78 (1 study) 3 months	⊕⊖⊖⊖ VERY LOW1,3,6 due to risk of bias, imprecision, indirectness		The mean quality of life (sf-36) - overall health in the PCNL group was 8.2	The mean quality of life (sf-36) - overall health in the SWL group was 1.5 lower (9.51 lower to 6.51 higher)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with PCNL	Risk difference with SWL (95% CI)
Major adverse events	321 (3 studies) time-point not reported	⨁⊖⊖⊖ VERY LOW1,6 due to risk of bias, indirectness	Peto OR 0.11 (0.02 to 0.57)	70 per 1000	62 fewer per 1000 (from 29 fewer to 68 fewer)
Minor adverse events	310 (4 studies) 1 day or time-point not reported	⨁⊖⊖⊖ VERY LOW1,3,6 due to risk of bias, imprecision, indirectness	RR 0.53 (0.15 to 1.82)	42 per 1000	20 fewer per 1000 (from 36 fewer to 34 more)

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
2 Downgraded by 1 or 2 increments because heterogeneity, I2= 72%, p= > 0.1, unexplained by subgroup analysis
3 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
4 Could not be calculated as there were no events in the intervention or comparison group
5 Risk difference was calculated in Review Manager
6 Downgraded by 1 or 2 increments because the majority of the evidence included an indirect population (downgrade by one increment) or a very indirect population (downgrade by two increments) or the majority of the evidence had indirect outcomes

Table 13: Clinical evidence summary: URS versus PCNL

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with PCNL	Risk difference with URS (95% CI)
Stone free state	405 (5 studies) 1-3 months	⨁⨁⨁⊖ MODERATE1 due to risk of bias	RR 0.98 (0.9 to 1.06)	927 per 1000	19 fewer per 1000 (from 93 fewer to 56 more)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with PCNL	Risk difference with URS (95% CI)
Recurrence	72 (1 study) 1 year	⨁⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	RR 0.63 (0.15 to 2.63)	121 per 1000	45 fewer per 1000 (from 103 fewer to 197 more)
Retreatment	154 (2 studies) time-point not reported	⨁⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	RR 0.58 (0.08 to 4.36)	27 per 1000	11 fewer per 1000 (from 25 fewer to 91 more)
Ancillary procedure	154 (2 studies) time-point not reported	⨁⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	RR 1.20 (0.34 to 4.28)	51 per 1000	10 more per 1000 (from 34 fewer to 167 more)
Length of hospital stay (days)	143 (3 studies)	⨁⊖⊖⊖ VERY LOW1,3 due to risk of bias, inconsistency		The mean length of hospital stay (days) in the PCNL group was 2.25	The mean length of hospital stay (days) in the URS/RIRS group was 0.26 lower (1.65 lower to 1.12 higher)
Pain (VAS) Scale from: 1 to 10 Better indicated by lower score	70 (1 study) 6 hours postoperatively	⨁⨁⊖⊖⊖ LOW1,2 due to risk of bias, imprecision		The mean pain (vas) in the PCNL group was 4.8	The mean pain (vas) in the URS/RIRS group was 1 lower (1.64 to 0.36 lower)
Major adverse events	205 (3 studies) time-point not reported	⨁⊖⊖⊖ VERY LOW1,2, due to risk of bias, imprecision	RR 0.45 (0.15 to 1.37)	0 per 1000	23 fewer per 1000 (from 81 fewer to 36 more)[4]
Minor adverse events	405 (5 studies)	⨁⊖⊖⊖	RR 0.65 (0.35 to 1.22)	73 per 1	26 fewer per 1000 (from 47 fewer to 16 more)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with PCNL	Risk difference with URS (95% CI)
	time-point not reported	VERY LOW1,2 due to risk of bias, imprecision			

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
2 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
3 Downgraded by 1 or 2 increments because heterogeneity, I2= 81%, p= > 0.1, unexplained by subgroup analysis
4 Risk difference calculated in Review Manager

Table 14: Clinical evidence summary: surgery (URS, SWL or PCNL) versus non-surgical treatment

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Conservative	Risk difference with Surgery (95% CI)
Stone free state	94 (1 study) 3 months	⊕⊕⊕⊖ MODERATE1,4 due to risk of bias, indirectness	Peto OR 20.09 (8.6 to 46.93)	0 per 1000	758 more per 1000 (from 644 more to 872 more)
Ancillary procedures	94 (1 study) time-point not reported	⊕⊖⊖⊖ VERY LOW1,2,4 due to risk of bias, imprecision, indirectness	RR 0.22 (0.06 to 0.80)	219 per 1000	171 fewer per 1000 (from 44 fewer to 206 fewer)

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
2 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
3 Could not be calculated as there were no events in the comparison group
4 Downgraded by 1 or 2 increments because the majority of the evidence included an indirect population (downgrade by one increment) or a very indirect population (downgrade by two increments) or the majority of the evidence had indirect outcomes

1.4.5.1.6 *Adult, renal, >20mm*

Table 15: Clinical evidence summary: SWL versus PCNL

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with PCNL	Risk difference with SWL (95% CI)
Stone free state	14 (1 study) 3 months	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	RR 0.17 (0.03 to 1.05)	857 per 1000	711 fewer per 1000 (from 831 fewer to 43 more)
Retreatment	18 (1 study) time-point not reported	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	RR 1 (0.18 to 5.63)	222 per 1000	0 fewer per 1000 (from 182 fewer to 1000 more)
Ancillary procedures	18 (1 study) time-point not reported	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	Not estimable3	0 per 1000	0 fewer per 1000 (from 191 fewer to 191 more)4

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
2 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
3 Could not be calculated as there were no events in the intervention or comparison group
4 Risk difference calculated in Review Manager

Table 16: Clinical evidence summary: URS versus PCNL

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with PCNL	Risk difference with URS (95% CI)
Stone free state	192 (3 studies)	⊕⊖⊖⊖	RR 1.02 (0.84 to 1.24)	900 per 1000	18 more per 1000 (from 144 fewer to 216 more)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with PCNL	Risk difference with URS (95% CI)
	discharge - 3 months	VERY LOW1,2 due to risk of bias, inconsistency			
Retreatment	132 (2 studies) time-point not reported	⊕⊖⊖⊖ VERY LOW1,3,8 due to risk of bias, inconsistency, imprecision	RR 1.91 (0.08 to 46.71)	14 per 1000	13 more per 1000 (from 13 fewer to 640 more)
Ancillary procedure	132 (2 studies) time-point not reported	⊕⊖⊖⊖ VERY LOW1,3 due to risk of bias, imprecision	RR 0.21 (0.04 to 1.16)	103 per 1000	81 fewer per 1000 (from 99 fewer to 16 more)
Length of hospital stay (days)	192 (3 studies)	⊕⊖⊖⊖ VERY LOW1,3,4 due to risk of bias, inconsistency, imprecision		The mean length of hospital stay (days) in the PCNL group was 5.34	The mean length of hospital stay (days) in the URS/RIRS group was 0.87 lower (2.29 lower to 0.54 higher)
Pain (VAS) Scale from: 0 to 10.	132 (2 studies) 1 day	⊕⊖⊖⊖ VERY LOW1,3,7 due to risk of bias, inconsistency, imprecision		The mean pain (vas) in the PCNL group was 3.1	The mean pain (vas) in the URS/RIRS group was 0.38 lower (1.74 lower to 0.98 higher)
Major adverse events	64 (1 study) time-point not reported	⊕⊕⊖⊖ LOW1,3 due to risk of bias, imprecision	Not estimable 5	0 per 1000	0 fewer per 1000 (from 60 fewer to 60 more)6
Minor adverse events	132 (2 studies)	⊕⊖⊖⊖ VERY LOW1,3 due to risk of bias, imprecision	RR 0.65 (0.35 to 1.24)	262 per 1000	92 fewer per 1000 (from 170 fewer to 63 more)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with PCNL	Risk difference with URS (95% CI)

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
2 Downgraded by 1 or 2 increments because heterogeneity, I2= 77%, p= > 0.1, unexplained by subgroup analysis
3 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
4 Downgraded by 1 or 2 increments because heterogeneity, I2= 92%, p= > 0.1, unexplained by subgroup analysis
5 Could not be calculated as there were no events in the intervention or comparison group
6 Risk difference calculated in Review Manager
7 Downgraded by 1 or 2 increments because heterogeneity, I2= 87%, p= > 0.1, unexplained by subgroup analysis
8 Downgraded by 1 or 2 increments because heterogeneity, I2= 55%, p= > 0.1, unexplained by subgroup analysis

1.4.5.1.7 Children, renal, 10-20mm

Table 17: Clinical evidence summary: SWL versus URS

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with URS	Risk difference with SWL (95% CI)
Stone free state	60 (1 study) 3 months	⨁⨁⊖⊖ LOW1,2 due to risk of bias, imprecision	RR 0.81 (0.61 to 1.06)	967 per 1000	165 fewer per 1000 (from 338 fewer to 52 more)
Residual stones (insignificant stone)	60 (1 study) 1 session	⨁⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	Peto OR 0.14 (0 to 6.82)	33 per 1000	28 fewer per 1000 (from 33 fewer to 156 more)
Residual stones (significant stone)	60 (1 study) 1 session	⨁⨁⊖⊖ LOW1,2 due to risk of bias, imprecision	RR 3 (0.9 to 10.01)	100 per 1000	200 more per 1000 (from 10 fewer to 901 more)
Retreatment	60 (1 study)	⨁⨁⨁⊖	Peto OR 10.11 (2.48 to 41.23)	0 per 1000	300 more per 1000

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with URS	Risk difference with SWL (95% CI)
	time-point not reported	MODERATE1 due to risk of bias			(from 132 more to 468 more)3
Length of hospital stay (hours)	60 (1 study)	⊕⊕⊕⊖ MODERATE1 due to risk of bias		The mean length of hospital stay (hours) in the URS/RIRS group was 12	The mean length of hospital stay (hours) in the SWL group was 6 lower (8.95 to 3.05 lower)

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
2 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
3 Risk difference calculated in Review Manager

Table 18: Clinical evidence summary: SWL versus PCNL

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with PCNL	Risk difference with SWL (95% CI)
Stone free state	212 (1 study) 3 months	⊕⊕⊖⊖ LOW1,2 due to risk of bias, imprecision	RR 0.88 (0.8 to 0.97)	943 per 1000	113 fewer per 1000 (from 28 fewer to 189 fewer)
Retreatment	212 (1 study) time-point not reported	⊕⊕⊕⊖ MODERATE1 due to risk of bias	RR 14.67 (4.7 to 45.77)	28 per 1000	383 more per 1000 (from 104 more to 1000 more)
Ancillary procedures	212 (1 study) time-point not reported	⊕⊕⊖⊖ LOW1,2 due to risk of bias, imprecision	RR 2.5 (1.01 to 6.2)	57 per 1000	85 more per 1000 (from 1 more to 296 more)
Major adverse events	212 (1 study)	⊕⊖⊖⊖	Not estimable4	0 per 1000	0 fewer per 1000 (from 18 fewer to 18 more)3

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with PCNL	Risk difference with SWL (95% CI)
	time-point not reported	VERY LOW1,2 due to risk of bias, imprecision			
Minor adverse events	212 (1 study) time-point not reported	⊕⊕⊕⊖ MODERATE1 due to risk of bias	Peto OR 0.19 (0.05 to 0.67)	85 per 1000	68 fewer per 1000 (from 26 fewer to 80 fewer)

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
2 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
3 Risk difference calculated in Review Manager
4 Could not be calculated as there were no events in the intervention or comparison group

Table 19: Clinical evidence summary: URS versus PCNL (non-randomised studies)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with PCNL	Risk difference with URS (95% CI)
Stone free state	81 (1 study) end of procedure or 1 month	⊕⊖⊖⊖ VERY LOW1 due to risk of bias	RR 1.06 (0.91 to 1.23)	Moderate	
				867 per 1000	52 more per 1000 (from 78 fewer to 199 more)
Stone free state	48 (1 study) 2 weeks	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	RR 0.98 (0.76 to 1.27)	Moderate	
				840 per 1000	17 fewer per 1000 (from 202 fewer to 227 more)
Major adverse events	48 (1 study) time-point not reported	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	Peto OR 8.06 (0.16 to 407.6)	Moderate	
				0 per 1000	44 more per 1000 (from 67 fewer to 154 more)3

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with PCNL	Risk difference with URS (95% CI)
Minor adverse events	81 (1 study) time-point not reported	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	RR 2.5 (0.49 to 12.89)	Moderate	
				44 per 1000	66 more per 1000 (from 22 fewer to 523 more)
Minor adverse events	48 (1 study) time-point not reported	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	RR 1.45 (0.36 to 5.79)	Moderate	
				120 per 1000	54 more per 1000 (from 77 fewer to 575 more)
Length of stay (days)	81 (1 study)	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision		The mean length of stay in the control groups was 2.29	The mean length of stay in the intervention groups was 0.74 lower (1.11 to 0.37 lower)
Length of stay (days)	48 (1 study)	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision		The mean length of stay in the control groups was 2.1	The mean length of stay in the intervention groups was 0.1 higher (0.19 lower to 0.39 higher)

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
2 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.
3 Risk difference calculated in Review Manager

1*1.4.5.1.8 Children, renal, >20mm*

2 **Table 20: Clinical evidence summary: URS versus PCNL**

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with PCNL	Risk difference with URS (95% CI)
Stone free state	38 (43 renal units)	⊕⊖⊖⊖	RR 0.75 (0.56 to 1)	955 per 1000	239 fewer per 1000 (from 420 fewer to 0 more)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with PCNL	Risk difference with URS (95% CI)
	(1 study) 1 month	VERY LOW1,2,3 due to risk of bias, imprecision, indirectness			
Retreatment	38 (1 study) time-point not reported	⊕⊖⊖⊖ VERY LOW1,2,3 due to risk of bias, imprecision, indirectness	RR 2.1 (0.2 to 21.42)	46 per 1000	51 more per 1000 (from 37 fewer to 939 more)
Length of hospital stay (days)	38 (1 study)	⊕⊖⊖⊖ VERY LOW1,2,3 due to risk of bias, imprecision, indirectness		The mean length of hospital stay (days) in the PCNL group was 2.59	The mean length of hospital stay (days) in the URS/RIRS group was 1.49 lower (2.35 to 0.63 lower)
Minor adverse events	38 (1 study) time-point not reported	⊕⊖⊖⊖ VERY LOW1,2,3 due to risk of bias, imprecision, indirectness	RR 0.3 (0.07 to 1.28)	318 per 1000	223 fewer per 1000 (from 296 fewer to 89 more)

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias and downgraded by 2 increments if the majority of the evidence was at very high risk of bias

2 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

3 Downgraded by 1 or 2 increments because the majority of the evidence included an indirect population (downgrade by one increment) or a very indirect population (downgrade by two increments) or the majority of the evidence had indirect outcomes

Table 21: Clinical evidence summary: SWL versus PCNL (non-randomised studies)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with PCNL	Risk difference with SWL (95% CI)
Stone free state (3 months)	46 (1 study) 3 months	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	RR 0.87 (0.72 to 1.04)	Moderate	
				1000 per 1000	130 fewer per 1000 (from 280 fewer to 40 more)
Retreatment	46 (1 study) 3-5 days postoperatively for PCNL and 2 weeks postoperatively for SWL	⊕⊖⊖⊖ VERY LOW1 due to risk of bias	RR 4 (1.28 to 12.48)	Moderate	
				125 per 1000	375 more per 1000 (from 35 more to 1000 more)
Length of stay (days)	46 (1 study) time-point not reported	⊕⊖⊖⊖ VERY LOW1 due to risk of bias		The mean length of stay in the control groups was 14.13	The mean length of stay in the intervention groups was 7.49 lower (10 to 4.98 lower)
Minor adverse events	46 (1 study) time-point not reported	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	RR 1.09 (0.31 to 3.84)	Moderate	
				167 per 1000	15 more per 1000 (from 115 fewer to 474 more)

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
2 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.

1.4.5.2 Within surgery comparisons

1.4.5.2.1 Adult, renal, 10-20mm

Table 22: Clinical evidence summary: PCNL: Tubeless versus standard

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with standard	Risk difference with Tubeless (95% CI)
Stone free state	80 (1 study) time-point not reported	⊕⊕⊖⊖ LOW1,2 due to risk of bias, imprecision	RR 1.12 (0.95 to 1.33)	825 per 1000	99 more per 1000 (from 41 fewer to 272 more)
Length of hospital stay (days)	80 (1 study)	⊕⊕⊖⊖ LOW1,2 due to risk of bias, imprecision		The mean length of hospital stay in the standard group was 1.07	The mean length of hospital stay in the tubeless group was 0.03 higher (0.1 lower to 0.16 higher)

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
2 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

1.4.5.2.2 Adult, renal, >20mm

Table 23: Clinical evidence summary: PCNL: Tubeless versus standard

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with standard	Risk difference with Tubeless (95% CI)
Stone free state	258 (3 studies) 1 day - 19 months	⊕⊕⊕⊖ MODERATE1 due to risk of bias	RR 1.01 (0.91 to 1.12)	813 per 1000	8 more per 1000 (from 73 fewer to 98 more)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with standard	Risk difference with Tubeless (95% CI)
Retreatment	131 (1 study) mean follow up 18-18.92 months	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	RR 1.48 (0.51 to 4.29)	79 per 1000	38 more per 1000 (from 39 fewer to 260 more)
Ancillary procedure	131 (1 study) mean follow up 18-18.92 months	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	RR 0.93 (0.13 to 6.38)	32 per 1000	2 fewer per 1000 (from 28 fewer to 172 more)
Length of hospital stay (days)	226 (2 studies)	⊕⊖⊖⊖ VERY LOW1,2,3 due to risk of bias, inconsistency, imprecision		The mean length of hospital stay (days) in the standard group was 4.52	The mean length of hospital stay (days) in the intervention groups was 1.09 lower (1.62 to 0.56 lower)
Pain Scale from: 0 to 10.	131 (1 study) 2 days	⊕⊕⊕⊖ MODERATE1 due to risk of bias		The mean pain in the standard group was 6.26	The mean pain in the tubeless group was 1.29 lower (1.66 to 0.92 lower)
Minor adverse events	163 (2 studies) mean follow up 18-18.92 months or time-point not reported	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	RR 1.10 (0.54 to 2.23)	142 per 1000	14 more per 1000 (from 65 fewer to 175 more)
Major adverse events	131 (1 study) mean follow up 18-18.92 months	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	Peto OR 6.97 (0.43 to 112.84)	0 per 1000	29 more per 1000 (from 20 fewer to 76 more)4

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with standard	Risk difference with Tubeless (95% CI)

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
2 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
3 Downgraded by 1 or 2 increments because heterogeneity, I2= 64%, p= > 0.1, unexplained by subgroup analysis
4 Risk difference calculated in Review Manager

Table 24: Clinical evidence summary: PCNL: Supine versus prone position

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with prone	Risk difference with Supine (95% CI)
Stone free state	513 (5 studies) 1 day - 1 month	⨁⨁⨀⨀ LOW1,7 due to risk of bias, indirectness	RR 0.96 (0.89 to 1.03)	873 per 1000	35 fewer per 1000 (from 96 fewer to 26 more)
Recurrence	113 (1 study) time-point not reported	⨁⨀⨀⨀ VERY LOW1,3,7 due to risk of bias, imprecision, indirectness	Not estimable5	0 per 1000	0 fewer per 1000 (from 34 fewer to 34 more)2
Retreatment	122 (1 study) time-point not reported	⨁⨁⨀⨀ LOW1,7 due to risk of bias, indirectness	Peto OR 8.34 (1.63 to 42.76)	0 per 1000	100 more per 1000 (from 20 more to 181 more)2
Ancillary procedures	197 (2 studies) time-point not reported	⨁⨀⨀⨀ VERY LOW1,3,7 due to risk of bias, imprecision, indirectness	RR 1.48 (0.55 to 4.02)	60 per 1000	29 more per 1000 (from 27 fewer to 181 more)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with prone	Risk difference with Supine (95% CI)
Length of hospital stay (hours)	316 (3 studies)	⨁⊖⊖⊖ VERY LOW1,3,4,7 due to risk of bias, inconsistency, imprecision, indirectness		The mean length of hospital stay (hours) in the prone group was 77.3	The mean length of hospital stay (hours) in the supine group was 12.54 lower (32.90 lower to 7.82 higher)
Major adverse events	316 (3 studies) time-point not reported	⨁⊖⊖⊖ VERY LOW1,3,7 due to risk of bias, imprecision, indirectness	Peto OR 0.14 (0.01 to 2.18)	0 per 1000	13 fewer per 1000 (from 34 fewer to 9 more)2

Minor adverse events	438 (3 studies) time-point not reported	⊕⊕⊖⊖ LOW1,3,7 due to risk of bias, imprecision, indirectness	RR 0.81 (0.54 to 1.21)	262 per 1000	50 fewer per 1000 (from 86 fewer to 39 more)

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
2 Risk difference calculated in Review Manager
3 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
4 Downgraded by 1 or 2 increments because heterogeneity, I2= 91%, p= > 0.1, unexplained by subgroup analysis
5 Could not be calculated as there were no events in the intervention or comparison groups
6 Could not be calculated as there were no events in the comparison group
7 Downgraded by 1 or 2 increments because the majority of the evidence included an indirect population (downgrade by one increment) or a very indirect population (downgrade by two increments) or the majority of the evidence had indirect outcomes

Table 25: Clinical evidence summary: PCNL: Mini versus standard

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with standard	Risk difference with Mini PCNL (95% CI)
Stone free state	263 (3 studies) 1 month or time-point not reported	⊕⊕⊖⊖ LOW1 due to risk of bias	RR 1 (0.93 to 1.07)	880 per 1000	0 fewer per 1000 (from 62 fewer to 62 more)
Retreatment	169 (2 studies) time-point not reported	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	RR 1.5 (0.26 to 8.72)	13 per 1000	6 more per 1000 (from 10 fewer to 100 more)
Ancillary procedures	247 (2 studies) time-point	⊕⊖⊖⊖	RR 0.92 (0.37 to 2.31)	80 per 1000	6 fewer per 1000 (from 50 fewer to 105 more)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with standard	Risk difference with Mini PCNL (95% CI)
	not reported	VERY LOW1,2 due to risk of bias, imprecision			
Length of hospital stay (days)	19 (1 study) time-point not reported	⊕⊖⊖⊖ VERY LOW1,2,3 due to risk of bias, imprecision, indirectness		The mean length of hospital stay (days) in the standard group was 4.1	The mean length of hospital stay (days) in the mini PCNL group was 0.88 lower (2.04 lower to 0.28 higher)
Pain (1 day) Scale from: 0 to 10.	169 (2 studies) 1 day	⊕⊕⊖⊖ LOW1 due to risk of bias		The mean pain (1 day) in the standard group was 3.5	The mean pain (1 day) in the mini PCNL group was 0.11 lower (0.33 lower to 0.11 higher)
Major adverse events	150 (1 study) time-point not reported	⊕⊖⊖⊖ VERY LOW due to risk of bias, imprecision	RR 2 (0.19 to 21.59)	13 per 1000	13 more per 1000 (from 11 fewer to 268 more)
Minor adverse events	266 (3 studies) time-point not reported	⊕⊕⊖⊖ LOW1,2 due to risk of bias, imprecision	RR 0.61 (0.31 to 1.20)	120 per 1000	47 fewer per 1000 (from 83 fewer to 24 more)

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
2 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
3 Downgraded by 1 or 2 increments because the majority of the evidence included an indirect population (downgrade by one increment) or a very indirect population (downgrade by two increments) or the majority of the evidence had indirect outcomes

1.4.5.2.3 *Children, renal, >20mm*

Table 26: Clinical evidence summary: PCNL: Tubeless versus standard

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with standard	Risk difference with Tubeless (95% CI)
Stone free state	83 (2 studies) 1 week to 1 month	⊕⊕⊖⊖ LOW1,4 due to risk of bias, indirectness	RR 1.01 (0.87 to 1.17)	933 per 1000	9 more per 1000 (from 121 fewer to 159 more)
Retreatment	23 (1 studies) 1 month	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	Peto OR 5.87 (0.11 to 305.8)	0 per 1000	77 more per 1000 (from 127 fewer to 280 more)
Ancillary procedure	60 (1 study) time-point not reported	⊕⊖⊖⊖ VERY LOW1,2,4 due to risk of bias, imprecision, indirectness	RR 0.5 (0.1 to 2.53)	133 per 1000	67 fewer per 1000 (from 120fewer to 203 more)
Length of hospital stay - Hours	83 (2 studies)	⊕⊕⊕⊖ MODERATE1 due to risk of bias		The mean length of hospital stay - hours in the standard group was 58.15 hours	The mean length of hospital stay - hours in the tubeless group was 19.17 lower (26.47 to 11.88 lower)
Minor adverse events	23 (1 study) 1 month	⊕⊖⊖⊖ VERY LOW1,2 due to risk of bias, imprecision	RR 0.51 (0.10 to 2.51)	300 per 1000	147 fewer per 1000 (from 270 fewer to 453 more)

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
2 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
3 Could not be calculated as there were no events in the comparison group

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with standard	Risk difference with Tubeless (95% CI)
4 Downgraded by 1 or 2 increments because the majority of the evidence included an indirect population (downgrade by one increment) or a very indirect population (downgrade by two increments) or the majority of the evidence had indirect outcomes					

See appendix F for full GRADE tables.

1.5 Economic evidence

1.5.1 Included studies

No relevant health economic studies were identified.

1.5.2 Excluded studies

Five economic studies relating to this review question were identified but were excluded due to methodological limitations.[17, 38, 52, 126, 191]. These are listed in appendix I, with reasons for exclusion given.

See also the health economic study selection flow chart in appendix G.

1.5.3 Summary of studies included in the economic evidence review

Table 27: Health economic evidence profile: URS versus SWL, in adults with ureteric stones <10mm

Study	Applicability	Limitations	Other comments	Incremental cost	Incremental effects	Cost effectiveness	Uncertainty
Original NICE analysis [UK]	Partially applicable[a]	Potentially serious limitations [b]	Cost analysis comparing the total costs of treatment strategies starting with URS or SWL. Includes primary intervention costs, downstream resource use (retreatment and ancillary procedures), and adverse events. Resource use and adverse event probabilities from the clinical review and GC assumptions. Three scenarios undertaken because of heterogeneity in data; Scenario 1; Cost comparison using only resource use reported in all trials. Assuming this is the resource use required for everyone to be stone free. Scenario 2; cost comparison using only studies where; everyone was stone free at the end of follow up and that also report initial stone free success. Scenario 3; cost comparison using only studies that report more detail on the success of multiple lines of treatment. Scenarios 2 and 3 also have exploratory QALY work as part of sensitivity analyses consisting	Scenario 1: £2,368 Scenario2: £2,387 Scenario 3: £1,212	NA	NA	Exploratory QALY work showed that the QoL difference needed between a stone free and non-stone free health state to make URS cost effective was beyond plausible levels. A 2-way sensitivity analysis showed that varying SWL effectiveness and time to further treatments led to some more plausible levels but they were still unlikely to be feasible. The exploratory CUA also still had high ICERs when effectiveness of SWL was varied. Various sensitivity analyses were undertaken showing that the magnitude of cost difference between the strategies was sensitive to the probabilities associated with further treatments, the types of procedures these are, the resource use assumptions such as the proportion of patients that have a stent following a URS procedure. In no

Study	Applicability	Limitations	Other comments	Incremental cost	Incremental effects	Cost effectiveness	Uncertainty
			of threshold analysis on QALYs, and further back-calculating to find QoL difference needed between a stone free and non-stone free person to make URS cost effective, and in scenario 3 there is an exploratory cost utility analysis using assumptions.				sensitivity analysis did URS ever become cheaper than SWL.

Abbreviations: QALY: quality-adjusted life years; QoL: quality of life; URS: ureteroscopy; SWL: shock wave lithotripsy

(a) UK NHS perspective, only a cost comparison not a cost utility analysis.

(b) Short time horizon - only the period of the trials so some potential underestimation of resource use if not everyone is stone free at the end of the trials. Some scenarios have limited clinical evidence. QALY work is exploratory so cost effectiveness can only be inferred.

1.5.4 Health economic model

Three subgroups were identified from the clinical evidence review comparing surgical interventions for people with renal stones, where the committee felt there is the most uncertainty in practice regarding choice of technique, and where the more expensive procedure was more effective. The subgroups are:

- Ureteric stones in adults <10mm: ureteroscopy (URS) versus shockwave lithotripsy (SWL)
- Renal stones in adults <10mm: URS versus SWL
- Renal stones in adults 10-20mm: percutaneous nephrolithotomy (PCNL), versus URS, and SWL

Ureteric stones <10mm: URS vs SWL

Methods

A cost analysis was undertaken to compare the total cost of a strategy that began with URS versus a strategy that began with SWL, for ureteric stones <10mm (for full methods see Appendix 1). URS is a more expensive procedure than SWL. However, the clinical evidence review found that URS was associated with greater success in terms of people being stone-free and, presumably as a result, less retreatment and ancillary procedures. The main consequence of the initial procedure having lower effectiveness is a higher rate of downstream procedures (either a repeat of the initial procedure or a different procedure). This will increase the intervention cost, and therefore to appropriately compare the cost difference between interventions it is important to take this into account. In addition, other outcomes may also vary such as adverse events, and this could also impact overall costs.

Clinical review data was used for the probabilities of retreatment, ancillary procedures, readmission, and major and minor adverse events. Because of concerns about heterogeneity in the data, as well as differences in how stone free outcomes are being reported, and what it is possible to infer about the treatment pathway, multiple scenarios have been undertaken which are informed by different data and with differing assumptions:

1. Cost comparison using only resource use reported in all trials. Assuming that this is the resource use required for everyone to be stone free.
2. Cost comparison using only studies where everyone was stone free at the end of follow up *and* that also report initial stone free success.
3. Cost comparison using only studies that report more detail on the success of multiple lines of treatment.

Although all scenarios are cost comparisons in the base case, some scenarios have QALY threshold or exploratory QALY work to infer the likelihood of the most expensive intervention being cost effective. More details about each scenario are provided below.

Scenario 1 has the advantage of using all the available clinical data (7 studies), with the assumption that costing up all the resource use will lead to everyone being stone free. This assumption means that this is the resource use difference needed for equivalent outcomes. Limitations of this scenario include that there may still be some difference in outcomes beyond the follow up of the trials, as not everyone was stone free at the end of all the trials. Therefore, if more resources are needed in the SWL arm for everyone to be stone free, then resource use may be being underestimated, in which case the incremental cost might be biasing against URS. This scenario does not have any exploratory QALY work because an average length of follow up would be needed for this, and the studies had different timeframes (ranging from 2 weeks to 3 months).

Scenario 2 uses only 3 studies to inform resource use of retreatments and ancillary procedures. These are studies where everyone is stone free at the end, and also where initial stone free rates are reported. The advantage of using studies where everyone is stone free at the end is that the assumption made in scenario 1 can now be taken as fact, as these are the resources that would be needed for equivalent (100%) effectiveness of the two strategies. Additionally, using studies where initial stone free rates are reported means that we have information about the initial part of the pathway. The difference in initial effectiveness between the two interventions leads to a difference in the number of people who are initially stone free, and therefore a difference in quality of life. Using this logic to infer that the incremental initial effectiveness would be the population contributing to the QALY gain between the interventions, allowing some exploratory QALY work looking at the QALY or quality of life differences required for the most expensive intervention to be cost effective. Disadvantages of this scenario are that it is using only 3 studies to inform inputs. Sensitivity analysis varying the initial effectiveness of SWL down to 40% will also be undertaken, and alongside this the QALY exploratory work for each effectiveness level explored will allow interpretation of whether quality of life gains needed to make URS cost effective are more feasible if SWL is less effective.

Scenario 3 uses only 1 study to inform the resource use inputs on retreatments and ancillary procedures. This study has the benefit of breaking down the number of people that had different lines of treatment, in which case a person could have more than one procedure. This is more detailed than other studies. It also has the advantage of reporting effectiveness that is more reflective of UK practice, which the committee felt was a disadvantage in the clinical review for surgery, as the success of SWL did not reflect the UK experience. Not everyone was stone free at the end of the trial, so the same assumption as scenario 1 is made, whereby this is the resource use needed to get everyone stone free. Disadvantages include that inputs are based only on a single study. This study is also from 1999, so it may be that experience has improved over time for certain techniques such as URS, or technology of SWL machines could have changed. Additionally, not everyone was stone free at the end of the trial, which means that we may be underestimating the resource use associated with SWL, as that is the less effective intervention, and therefore biasing against URS. To combat this, a sensitivity analysis is undertaken adding a fourth line of treatment and assuming that this would successfully lead to everyone being stone free. Some exploratory QALY work is also undertaken in this scenario (through a hypothetical cost utility analysis). Based on some assumptions about when, in the trial, the different lines of treatment would have taken place, and what the utility is with and without a stone, meant an ICER could be calculated. Also the threshold could be identified of what the utility of a non-stone free person would need to be to make URS cost effective.

Common to all scenarios are assumptions about the number of initial sessions of SWL being a single session and retreatment being one additional session, the types of procedures that are ancillary procedures, the proportion requiring stents, and follow up resource use. Unit costs were from NHS reference costs 2016/17.

Sensitivity analyses common to all scenarios include varying initial effectiveness of SWL, varying SWL costs, varying the proportion of URS that get stents.

Results

Overall for all scenarios, there was a significant cost difference between the two strategies. In scenarios 1 and 2 there was a similar magnitude of cost difference of around £2,300. This was mainly being driven by the difference in primary intervention costs because URS is a much more expensive procedure. The cost of stents was also making URS a more expensive strategy because stents were much more likely following a URS. Although there were additional downstream resources from the initially less effective intervention of SWL, this did not offset the large difference in primary intervention costs. This was because although there are more retreatments and ancillary procedures in the SWL arm, these

procedures are cheaper than URS retreatments or ancillaries, even though they apply to more people, which led to balancing out of downstream costs in the base case. Adverse events had little impact on the overall results. The incremental cost of scenario 3 was smaller than in the other scenarios (£1,212). This is being driven by a big difference in the ancillary procedure probabilities: there are many more ancillary procedures for SWL, which reflects that the success probability of the initial procedures is further apart than in the other scenarios. This result is also being driven by the types of ancillary procedures (which were taken from the study) in each strategy, which for URS were mostly SWL which is the cheapest procedure, and for SWL some ancillaries were PCNL, which is the most expensive procedure, thereby closing the cost gap further between the two strategies. A summary of the results of each scenario can be seen in **Error! Reference source not found.**.

Table 28: Results – Scenarios 1, 2 and 3 - total costs per person

Strategy	SCENARIO 1	SCENARIO 2	SCENARIO 3
URS	£3,329	£3,252	£3,240
SWL	£961	£865	£2,028
Incremental	**£2,368**	**£2,387**	**£1,212**

Sensitivity analyses varying the effectiveness of SWL in all 3 scenarios showed that the magnitude of the incremental cost was reduced as the effectiveness of SWL decreased. This can be explained because effectiveness has a negative relationship with the consequent retreatment and ancillary procedure probabilities, therefore more downstream resource use leads to higher SWL cost and lower incremental cost (see blue section of Table 29 for an example of this from scenario 2). A threshold analysis on the cost per session of SWL also showed this would have to be very high to make the comparisons cost neutral (ranging from £1,609 to £2,708 across the scenarios).

In scenarios 1 and 2, the retreatment and ancillary probabilities were pooled because of heterogeneity in these outcomes and differences between studies in criteria for deciding what procedures would be used if primary treatment failed. Assumptions were made varying what the procedures would be for the pooled probability of downstream resource use. This showed that the magnitude of the incremental costs were sensitive to the types of procedures because their costs can vary (in scenario 1 this was as low as £1,879). Varying the proportion of those having a URS that would have stents, and also assuming 2 primary sessions for SWL also had an impact on the incremental cost (the lowest incremental cost being in scenario 3 where 0% stent use led to an incremental cost of £760). However no sensitivity analyses varied the costs enough to make the strategies cost neutral.

The exploratory QALY work (scenario 2 and 3) was informative in exploring whether URS would be a cost effective alternative. In scenario 2, the QALY work showed that the quality of life difference between a stone free and non-stone free individual would need to be 27.8 for URS to be cost effective. This is not a physically possible value even taking the difference between the best and worst possible health states on the EQ-5D. This was explored further when the effectiveness of SWL was varied. This showed that as the effectiveness of SWL decreased, this drove down the QALY gain needed for URS to be cost effective. However, using the same method of applying that gain only to those people who would be initially stone free with URS over SWL, showed that the quality of life difference needed between a stone free and non-stone free health state was still outside the possible range on the EQ-5D (1.594) (see yellow section of Table 29). One problem with this is the short timeframe of the studies that was used to derive the quality of life gain. This was an average of 2 weeks for the studies in scenario 2 which means that the QoL part of the QALY has to be very large to compensate for the small timeframe this has to come from. A 2-way sensitivity analysis varying both the effectiveness and the time to further treatments (as it was assumed the quality of life gain following initial effectiveness remained for the whole time period of the

trials), showed that for longer durations between treatments, and lower effectiveness levels of SWL, there were some quality of life differences between the health states that would be possible. Whether these would be feasible gains however is another matter (see Table 30).

Table 29: Scenario 2: SA8 results – varying initial effectiveness of SWL

				RESULTS		EXPLORATORY QALY CALCULATIONS			
	Initial effectiveness	probability of needing retreatment	probability of needing ancillary procedure	Total cost of SWL strategy per pt	Incremental cost (URS - SWL)	QALY gain needed	QoL gain needed (assuming 2 wk time horizon)	Effectiveness difference with URS (I.e. proportion that QoL gain applies to)	Difference in QoL needed between a stone free and non stone free person
Base case value	82.0%	5.8%	7.6%	£865	£2,387	0.12	3.10	11.2%	27.76
	77.8%	7.6%	10.0%	£947	£2,306	0.12	3.00	15.4%	19.49
	73.6%	9.5%	12.4%	£1,028	£2,224	0.11	2.89	19.6%	14.76
	69.4%	11.3%	14.8%	£1,110	£2,142	0.11	2.78	23.8%	11.71
	65.2%	13.1%	17.1%	£1,192	£2,060	0.10	2.68	28.0%	9.57
	61.0%	14.9%	19.5%	£1,274	£1,978	0.10	2.57	32.2%	7.99
	56.8%	16.7%	21.9%	£1,356	£1,897	0.09	2.47	36.4%	6.78
	52.6%	18.6%	24.3%	£1,437	£1,815	0.09	2.36	40.6%	5.81
	48.4%	20.4%	26.7%	£1,519	£1,733	0.09	2.25	44.8%	5.03
	44.2%	22.2%	29.1%	£1,601	£1,651	0.08	2.15	49.0%	4.38
Suggested UK practice values	40.0%	24.0%	31%	£1,683	£1,569	0.08	2.04	53.2%	3.84

Red cells in the last column indicate QoL differences that are outside the possible range on the EQ-5D.

Table 30: Scenario 2: 2-way sensitivity analysis varying time to further treatment and initial SWL effectiveness

		Time to retreatments					
Cost difference	Difference in effectiveness between primary URS and SWL that corresponds to the cost difference	*2 weeks*	*4 weeks*	*8 weeks*	*12 weeks*	*16 weeks*	*20 weeks*
£2,387	*11.2%*	27.76	13.88	6.94	4.63	3.47	2.78
£2,306	*15.4%*	19.49	9.74	4.87	3.25	2.44	1.95
£2,224	*19.6%*	14.76	7.38	3.69	2.46	1.85	1.48
£2,142	*23.8%*	11.71	5.85	2.93	1.95	1.46	1.17

		Time to retreatments					
Cost difference	**Difference in effectiveness between primary URS and SWL that corresponds to the cost difference**	***2 weeks***	***4 weeks***	***8 weeks***	***12 weeks***	***16 weeks***	***20 weeks***
£2,060	*28.0%*	9.57	4.79	2.39	1.60	1.20	0.96
£1,978	*32.2%*	7.99	4.00	2.00	1.33	1.00	0.80
£1,897	*36.4%*	6.78	3.39	1.69	1.13	0.85	0.68
£1,815	*40.6%*	5.81	2.91	1.45	0.97	0.73	0.58
£1,733	*44.8%*	5.03	2.52	1.26	0.84	0.63	0.50
£1,651	*49.0%*	4.38	2.19	1.10	0.73	0.55	0.44
£1,569	*53.2%*	3.84	1.92	0.96	0.64	0.48	0.38

Body of the table are the quality of life differences needed between a stone free and non-stone free health state.
Red cells indicate QoL differences that are outside the possible range on the EQ-5D.

In scenario 3, the exploratory cost utility analysis (based on assumptions about timing of further treatments during the 3 month trial, and quality of life of someone with and without a stone taken from the literature) showed that the ICER would be over £150,000. Varying the effectiveness of SWL showed that at an effectiveness as low as 40%, the ICER was still above £60,000. A threshold analysis on what the utility of someone without a stone would need to be to make URS cost effective at the £20,000 threshold identified that this would need to be -0.596, which is just outside worst possible state on the EQ-5D.

There are a number of limitations to the analyses: some assumptions may be underestimating the total resource use involved in clearing a stone; a single or very few studies are informing some scenarios. Additionally, a cost utility analysis was not felt possible because: of many unknowns about the health outcomes side of living with a renal stone; and because of the lack of clarity about what is happening at different points in the pathway regarding primary procedures and retreatments in order to apply utilities, as a result many assumptions would have to be made.

The exploratory QALY work also has many caveats. It is uncertain what the quality of life differences actually are, how long they apply for and the frequency of peoples pain episodes, and when further treatments are happening. So we can only estimate whether URS is likely to be cost effective. It is also important to remember that we are referring to the general ureteric <10mm stone population here, which will be a mix of people with different levels and frequency of symptoms. This is why even if QoL differences between a stone free and non-stone free person are physically possible, this does not mean these are feasible values, when considering the average population in question.

The time frame that has been used in the exploratory QALY work for scenarios 2 and 3 is the time between having failed a retreatment and having further treatment, and this is the same regardless of strategy. Note that this is not the time to the primary treatment (which would also be a factor in practice that would be considered when a clinician is considering treatment options). Waiting times are variable within the NHS for both SWL and URS. This is dependent on many local factors such as availability of equipment and staff. For SWL specifically, whether a fixed site lithotripter or mobile one is available can lead to differences in waiting times. URS waiting times are also variable because of staffing and theatre list arrangements. Anecdotally, having a fixed site lithotripter means SWL could be undertaken in a shorter space of time than waiting for a mobile machine which tends to come to each hospital on a sessional basis. If SWL has a shorter waiting time than URS for example, then multiple retreatments might be undertaken within the same timeframe of waiting for surgery, which would close the gap in effectiveness between the two interventions. Additionally, further treatment after a failed treatment would be seen as less of a priority in the NHS than primary treatment, in which case waiting time could be many weeks. The longer the waiting time, the more time that people are living with a stone having failed the less effective treatment, and the more QALYs the initially effective treatment would accrue.

There may also be differences in QoL between the two interventions that haven't been considered. For example, because of the nature of the interventions themselves: Perhaps URS has a higher initial decrement in QoL because it is invasive and involves general anaesthetic, but outweighing this might be the fact that there could be a shorter recovery time as it gets rid of the stone in one go. Alternatively, SWL may have a higher decrement in QoL because people remember the SWL treatment, it not being performed under anaesthesia, and therefore remember the uncomfortable nature of the shockwave treatment. However it is also more convenient for patients as they can arrange a time around their daily routine for the sessions. Another issue is that people are more likely to have stents inserted after a URS, and stents are uncomfortable and therefore have a quality of life impact (with side effects like pain and frequent need to urinate). This means that to have an achievable QALY gain for URS, the effectiveness difference between SWL and URS needs to be larger, in order for the QoL gain from the additional stone free individuals to counteract the QoL loss

from stents. A recommendation has been made in the guideline as part of the stents after surgery review to discourage the use of stents after surgery as there was no evidence of benefit, therefore as the recommendation is implemented then there would be fewer people experiencing the QoL impact of stents.

Other factors influencing quality of life that haven't been considered include the impact of an untreated ureteric stone. The risk of obstruction/infection is difficult to quantify as generally these are people that are excluded from trials. The population in question however is likely to be people who are having planned treatment, and therefore those that are considered emergency cases would be outside the population being discussed here. The goal from a clinical perspective is to treat a ureteric stone a soon as possible because obstruction can result in loss of renal function within 6 weeks. The risk of obstruction is not something that could be included in the analysis as it couldn't be quantified, but this was a concern the committee raised with regards to the less effective intervention of SWL which would take longer to clear a stone because of multiple treatments needed.

In essence, the above are just examples, but there may be factors on the health outcomes side that have not been captured, and therefore the exploratory QALY work needs to be interpreted with caution. The results however show that the gains being calculated as needed are beyond feasible levels which provide some reassurance that URS is unlikely to be cost effective.

Renal stones <10mm: URS vs SWL

Methods

Given that

- the ureteric <10mm analysis showed that URS is unlikely to be cost effective, even when larger effectiveness differences were assumed between the strategies,
- and also comparing across the clinical review data for the three groups, which showed the effectiveness not to be too dissimilar

It was inferred that simpler cost offset calculations would be adequate in helping to infer the likelihood of the cost effectiveness of the more expensive treatments. The cost offset calculations only incorporate the cost of the initial interventions, and retreatment and ancillary procedures. What is being tested as to whether costs offset each other is the difference in initial intervention costs traded off against the difference in downstream resource use of retreatments and ancillary procedures. As the more expensive intervention is also more effective, which in turn leads to lower downstream resource use. Therefore the purpose is to see whether the downstream resource use will offset the difference in upfront intervention costs. Note that it is not clear if this is the cost that would make everyone stone free, as this depends on the endpoint of the studies that the clinical data is a summary of. So there are limitations to the approach in terms of potential underestimation of cost, however these calculations are meant to be interpreted as informal cost calculations using the available clinical data. Also, it may not be the case that the aim is to get someone stone free, as this depends on their symptoms and size of stone for example.

Assumptions were made about the number of sessions that constitute a primary treatment and how many constitute a retreatment (together making a course of treatment - note that clinically a course of treatment is offered as the 'primary treatment' which is usually up to 3 sessions for a stone in the kidney. So the clinical terminology may not be the same as the terminology used for the purposes of the costings – see full analysis write-up in Appendix 1 for more detailed descriptions).

Additionally, various scenarios have been assumed where the type of ancillary procedure is varied to see the iimpact on costs.

The summary of the clinical review data for this group showed that the effectiveness of URS is lower for small renal stones than it was for small ureteric stones, with SWL effectiveness remaining similar. Meaning the incremental effectiveness between the two interventions is smaller for small renal stones than for small ureteric stones. This implies that there will be less benefit of URS above that of SWL compared to the ureteric group, as fewer people will be initially stone free with URS, and so there will be less people achieving an increase in QoL early on in the pathway. Also as more resource use would be required downstream in the URS arm to get everyone stone free, then this would lead to higher costs also. The result of this is likely to be an even bigger cost divide between the interventions and a smaller difference in QALYs, compared to the ureteric group.

Additionally, as the ureteric analysis was a costing analysis primarily, with the QALY work being exploratory, then the conclusion can only be an estimate of whether the intervention is feasibly cost effective, and therefore simpler costing calculations would still allow exploratory work around the feasibility of cost effectiveness. This was done using four different timeframes that the initial effectiveness difference between the interventions would apply for 1,2,3 and 4 months for illustration.

Furthermore, as another potential source of data to assist in illustrating the costs of an SWL strategy, UK audit data from the BAUS (British association of Urological Surgeons) Endourology national SWL practice and outcomes audit[31] was analysed and costs applied to identify the cost of treating people with SWL using real data.

The audit is a snapshot of current SWL practice across the UK in 2017. This involved all units undertaking SWL across the country being asked to recruit 10 consecutive new patients with renal stones attending for SWL and submit data over a 6 month period. The raw data was obtained through the committee, and analysed to crudely obtain the cost of SWL treatment by costing up the resource use involved in providing SWL including the primary treatments and downstream resource use. Note that as this audit only includes renal stones, a similar analysis could not be undertaken for the ureteric analysis. In total there were 141 patients suitable for evaluation in the dataset, with 101 patients having renal stones <=10mm, and 40 having renal stones 10-20mm.

The dataset reports information such as the status at review 3 months and 6 months following the first SWL treatment, and the subsequent management decision following the 3 and 6 month reviews. The status of the patient at review is broken down into 4 categories: ‘stone free’, ‘stone fragments <2mm in maximal diameter’, ‘stone fragments 2-4mm in maximal diameter’, and ‘stone fragments >4mm in maximal diameter’. Stone free using this dataset has been defined as patients in the ‘stone free’ and ‘stone fragments <2mm in maximal diameter’ category. The 3 month status of the patient and subsequent management decided at 3 months are the source of information on resource use, which costs were attached to. It is acknowledged that omitting the 6 month data may lead to an underestimate of the resource use of an SWL strategy if further resource use is consumed after 3 months. However, at 6 months more people were lost to follow up or the status was blank which would have led to fewer patients having outcomes that could be costed. Additionally, as the subsequent management at 3 months was included in the costings, which included those who had interventions planned, then if the 6 month outcome was that the intervention had been undertaken, then this would have already been accounted for. Therefore this was unlikely to make a large difference.

Results

With one session assumed for primary treatment and 2 for retreatment (making a total course of 3 treatments for those that have retreatments), and costing up the retreatment and ancillary procedures showed a range of cost offsets from £988 (assuming retreatment and ancillary probabilities are pooled and URS is the secondary procedure) to £1,537 (assuming the ancillary is URS for SWL group, and PCNL for URS group). This means that URS is still

the more expensive strategy overall, as the difference in initial costs of performing the procedures are not being offset by the higher downstream resource use of SWL (i.e. taking into account downstream resource use still leads to a positive value, meaning the URS cost is still higher than the SWL cost). The main difference in cost is again from the difference in primary procedure costs.

Using the same back-calculations for the exploratory QALY approach to find the quality of life difference needed between a stone free and non-stone free health state, assuming an effectiveness difference of 20%, showed that this QoL difference needed to make URS cost effective was within the possible EQ-5D range (i.e. below 1.594) when the time between treatments was over 3 months. In other words time is important because if people who failed SWL have to wait longer for further treatments, then URS needs a smaller quality of life gain to make it cost effective, because the immediate benefit of URS (as gets more people stone free) avoids a longer period of lower quality of life in the alternative strategy (SWL).

There are many limitations to these cost calculations: they omit parameters such as the use of stents, follow up, adverse events, and therefore are not a full analysis like the ureteric analysis. The exploratory QALY calculations can only demonstrate what QoL gains would be needed and are a crude way of inferring cost effectiveness. However we have the ureteric analysis as a reference point that can help with this, for example a renal stone is not likely to have as much of a quality of life impact as the stone has more room to move in the kidney, therefore there is less benefit to clearing the stone early. Therefore although there are many unknowns around the actual health outcomes, as in the ureteric analysis, there are also less risks to leaving the renal stone, and so we can infer that URS would not be cost effective for renal stones <10mm given there is still likely to be a substantial difference in costs, and also smaller benefit to be gained from clearing the stone in one go.

Renal stones tend to be offered a course of treatment of up to 4 sessions of SWL, whereas a ureteric stone would be offered up to 2. In which case more SWL sessions would close the incremental cost gap further between the two strategies, however this depends on many factors such as how successful each number of sessions is as not everyone would need 4.

This is where costing up resource use from the BAUS audit data could be helpful because analysis of this dataset showed that people had on average 1.87 sessions, and this led to a 48% effectiveness (stone free) at 3 months. Costing up the average number of sessions as well as the resource use from the subsequent management decided at 3 months led to an overall cost of around £1,300 per person. This is similar to that found from the total costs of the SWL strategy in the cost offset calculations. Although we have not analysed similar audit data for people undertaking URS, we know the cost of the strategy will be at minimum the cost of the surgery which is over £2,200, which is still higher than the £1,300 found from the analysis of SWL audit data. Therefore, with the use of real life audit data we can be more confident that the cost of an SWL strategy is still likely to be lower than that of a URS strategy.

Renal stones 10-20 mm: PCNL vs URS vs SWL

Methods

For the larger renal stones subgroup, there was data in the clinical review for all three types of surgery because there were three pairwise comparisons;:SWL vs URS, URS vs PCNL, and SWL vs PCNL. The clinical data for each intervention was based on taking the average probability as each intervention could have two sources of data from the three pairwise comparisons.

Two pairwise comparisons are made, the most expensive (PCNL) compared to the next most expensive (URS): the clinical review showed that the difference in effectiveness in terms of stone free rate is not too dissimilar between PCNL and URS. The retreatment and ancillary procedure probabilities show that URS has slightly higher probabilities but this can vary

depending on the pairwise comparison that the data was taken from. PCNL is also more than twice as expensive as a URS. The other pairwise comparison was URS versus SWL for this subgroup, the summary clinical review data showed that the effectiveness difference is larger than that of the other subgroups. This may be because the effectiveness of SWL reduces as the stone size increases. There is also a large variation in SWL retreatment and ancillary rates, depending on which pairwise comparison these are from, but as expected, SWL leads to more downstream resource use which we assume is a consequence of lower effectiveness.

Cost offset calculations are undertaken for these two pairwise comparisons, using the same methods as the small renal stones group. Primary SWL is assumed to be a single session, and retreatment is assumed to be 3 sessions (because of the larger size of the renal stone). Given the retreatment probability for SWL this gives an average of 2.2 sessions.

Comparing PCNL to SWL was not deemed necessary because there is such a large difference in the primary costs of treatments alone that it can be inferred PCNL is highly unlikely to be cost effective against SWL, even though it is considered more effective.

The BAUS snapshot data was also analysed for this group (of which there were 40 patients), using the same methods as described for the small renal stone group.

Results

When comparing PCNL versus URS, the large primary cost differences were offset very little by downstream resource use, regardless of what procedure might be assumed as an ancillary (ranging from £2,782 to £2,986). This is because both procedures are highly effective, and the resulting small downstream costs are having a negligible impact on the initial intervention cost differences. The small effectiveness difference between the interventions is unlikely to create a large enough QALY gain to justify the large additional cost of PCNL.

When comparing URS with SWL, cost offsets ranged from £836 (assuming retreatment and ancillary probabilities are pooled and URS is the secondary procedure) to £1,391 (assuming the ancillary is URS for SWL group, and PCNL for URS group). This means that the difference in primary procedure costs are not being offset by difference in downstream costs, as URS still remains a more expensive strategy. Using the same back-calculations for the exploratory QALY approach to find the quality of life difference needed between a stone free and non-stone free health state to make URS cost effective, assuming an effectiveness difference of 30%, showed that the QoL difference was within the possible EQ-5D range when the time between treatments was over 2 months (i.e. smaller than 1.594).

The limitations are the same as those for the small ureteric analysis: they omit parameters such as the use of stents, follow up, adverse events. The exploratory QALY calculations can only demonstrate what QoL gains would be needed. A large renal stone may have more of a quality of life detriment than a smaller renal stone, but perhaps not as much as a ureteric stone. There is little data to be able to quantify this theory but this was discussed with the committee. Therefore although there are many unknowns around the actual health outcomes, as in the ureteric analysis, there are also less risks to leaving the stone, and so we can infer that URS would also not be cost effective for this group given there is still likely to be a substantial difference in costs.

Costing up resource use from the BAUS audit data showed that people had on average 2.2 sessions, and this led to a 35% effectiveness (stone free) at 3 months. This is lower than the smaller renal stone group. Costing up the average number of sessions as well as the resource use from the subsequent management decided at 3 months led to an overall cost of around £1,600 per person. This is similar to that found from the total costs of the SWL strategy in the cost offset calculations. With the use of real time audit data we can be more confident that the cost of an SWL strategy as demonstrated above is still likely to be lower

than that of a URS strategy (as we know the cost of the strategy will be at minimum the cost of the surgery which is over £2,200.

Summary

Overall, the ureteric analysis demonstrated that the cost differences between URS and SWL are likely to be substantial even when testing lower levels of effectiveness of SWL, as well as testing other input parameters. Exploratory QALY work showed that the gains in quality of life needed in those individuals to be stone free from the more effective treatment was beyond feasible values. This was tested by varying the effectiveness of SWL, and timeframe that the gain was applied to, and although there may be some possible gains, the feasibility of these was still questionable. Particularly given that quality of life associated with a stone is unknown, and the quality of life gain calculated is also likely to be an overestimate because the average quality of life difference would be based on the average patient taking into account that pain is episodic and variable across a population. In essence URS is unlikely to be cost effective.

More informal costing calculations for the renal stone groups of <10mm and 10-20mm, using both the clinical review, and UK SWL audit data to illustrate further real SWL costs, showed that there are still likely to be large cost differences between URS and SWL strategies that would not be offset by downstream resource use. Quality of life impact of a ureteric stone and concerns around safety of not clearing a stone soon enough are more applicable to ureteric stones than to renal stones. In which case smaller quality of life gains are expected for a renal stone from the more effective intervention, which would make it more difficult for the benefit to justify the costs. PCNL is also much more expensive than URS and both are similarly effective, meaning it is unlikely PCNL is cost effective.

See appendix 1 for full details of the costing work.

1.5.5 Unit costs

Table 31: Intervention costs

Parameter	NHS reference cost description	Cost
SWL cost (per session)	LB36Z Extracorporeal Lithotripsy Day case schedule	£452
URS cost	<u>Elective schedule:</u> Weighted average of LB65C, LB65D and LB65E, Major Endoscopic, Kidney or Ureter Procedures, 19 years and over. (a) = £2,605 <u>Day case schedule:</u> Weighted average of LB65C, LB65D and LB65E, Major Endoscopic, Kidney or Ureter Procedures, 19 years and over. (a) = £1,739	£2,172 (b)
PCNL	Weighted average of LB75A, LB75B, Percutaneous nephrolithotomy Elective schedule (a)	£5,195

Source: NHS references costs 2016-17[6]
SWL: shockwave lithotripsy; URS: Ureteroscopy; PCNL: percutaneous nephrolithotomy.
(a) Includes all complication categories, and is weighted by activity with excess bed days incorporated.
(b) 50% elective and 50% day case cost as was decided by committee to reflect UK practice.

1.6 Resource costs

Overall, the recommendations made by the committee based on this review may have a substantial impact on resources.

Further work is being carried out to quantify the potential resource impact in this area.

The recommendations made by the committee based on this review for the adult ureteric stone <10mm strata, (see section 1.8) are likely to have a substantial impact on resources. Current practice in this group is more likely to be URS, however economic analysis showed that the cost of a treatment strategy with SWL was less costly than a strategy with URS, and also showed that URS was unlikely to be cost effective in various sensitivity analyses. As a result, SWL has been recommended. Implementation costs are likely to be incurred because this will be a change in practice. Therefore, savings are more likely to be longer term, as in the short term implementation costs will be required. There are likely to be many options for the implementation of SWL e.g. having good referral systems may mean additional machines are not needed. As currently there is believed to be less waiting time for SWL than surgery therefore existing capacity may be available. Alternatively, more investment in mobile lithotripters could be an option, or networks of fixed site lithotripters. Other resources may be affected however such as more staff being needed to undertake SWL (e.g. ultrasonographers) to meet the demand of the machines being used. Additional training to maximise effectiveness of lithotripsy may also be needed.

The committee has made a recommendation based on this review (see section 1.8) for the adult ureteric stone 10-20mm strata, that SWL should be ‘considered’. Unlike for stronger recommendations stating that interventions should be adopted, it is not possible to make a judgement about the potential resource impact to the NHS of recommendations regarding interventions that could be used, as uptake is too difficult to predict. However, the committee noted that where this recommendation is implemented, there would be additional costs incurred relating to the use of SWL, which will require implementation costs to set up as local facilities and access to SWL can vary (as preceding paragraph).

The committee has made a recommendation based on this review (see section 1.8) for the adult renal stone 10-20mm strata, that URS or SWL should be ‘considered’. Unlike for stronger recommendations stating that interventions should be adopted, it is not possible to make a judgement about the potential resource impact to the NHS of recommendations regarding interventions that could be used, as uptake is too difficult to predict. However, the committee noted that where this recommendation is implemented, there would be additional savings relating to the use of URS of SWL, which are cheaper interventions than PCNL, which is current practice.

The other adult recommendations made by the committee based on this review (see section 1.8) are not expected to have a substantial impact on resources. These include: the ‘offer URS’ recommendation for adults with ureteric stones 10-20mm, the recommendations for adults with renal stones <10mm (specifically ‘offer SWL’), the recommendations for adults with renal stones larger than 20mm including staghorn stones (specifically ‘offer PCNL’).

The children recommendations made by the committee based on this review (see section 1.8) are not expected to have a substantial impact on resources.

1.7 Evidence statements

1.7.1 Clinical evidence statements

SWL versus URS

Adults

Evidence for SWL compared to URS was found for the adult population, in ureteric stones measuring <10mm and 10-20mm; in renal stones measuring <10mm and 10-20mm; and for the paediatric population in ureteric stones measuring <10mm; and renal stones measuring 10-20mm.

SWL was compared to URS in the adult, ureteric, <10mm population. Eight studies reported the outcome stone free state (n=1127), and 6 studies reported the retreatment (n=1094). For both outcomes, the evidence suggested a clinical benefit of URS. Six studies reported the outcome ancillary procedures (n=959), and there was a clinical benefit of URS. In terms of length of stay and readmission to hospital (1 study; n=64-156), the evidence demonstrated a suggested clinical benefit of SWL, however in terms of both quality of life measures and pain one study found a suggested clinical benefit of URS (n=65). There was no clinical difference between SWL and URS in terms of both minor adverse events (4 studies; n=848) and failed technology (2 studies; n=682). Two studies reported the outcome major adverse events (n=682), and found a suggested clinical benefit of SWL. The evidence ranged from Moderate to Very Low quality due to risk of bias, imprecision, and inconsistency for the stone-free state and retreatment outcomes.

For the adult, ureteric, 10-20mm population, 13 studies reported the outcome stone free state (n=1777). The evidence showed a suggested clinical benefit of URS compared to SWL. Ten studies reported the retreatment (n=1394), and 2 studies reported ancillary procedures in the lower ureteric stone subgroup (n=274). Both found a suggested clinical benefit of URS. There was no clinical difference between SWL and URS in terms of ancillary procedures for the upper ureteric stone subgroup (6 studies; n=668), readmission to hospital (1 study; n=200), pain (3 studies; n=102) and minor adverse events (10 studies; n=1536). There was a suggested clinical benefit of SWL for the following outcomes: length of stay (4 studies; n=164); major adverse events (6 studies; n=971); minor adverse events (10 studies; n=1706); and failed technology (1 study; n=30). The evidence ranged from Low to Very Low due to risk of bias, imprecision, and inconsistency for the stone-free state, pain, and both adverse event outcomes.

For the adults, renal, <10mm population, 4 studies reported the stone-free state (n=404). No clinical difference was found between SWL and URS for this outcome. Three studies reported the retreatment (n=273) and four studies reported ancillary procedures (n=413). For both outcomes, a suggested clinical benefit of URS was found. A suggested clinical benefit of SWL was found for readmission (1 study; n=67), major adverse events (2 studies; n=206) and failed technology (1 study; n=67). No clinical difference between interventions was found for minor adverse events (4 studies; n=413). The evidence ranged from Moderate to Very Lowquality, due to risk of bias, imprecision and inconsistency.

For the adult, renal, 10-20mm population, 5 studies reported the outcome stone-free state and retreatment (n=395), and 3 studies reported ancillary procedures (n=229). For all outcomes, there was a suggested clinical benefit of URS compared to SWL. A suggested clinical benefit of SWL was found in terms of length of hospital stay (2 studies; n=190). No clinical difference was found between SWL and URS for the outcomes pain, major or minor adverse events. The quality of evidence ranged from Moderate to Very Low, due to risk of bias, imprecision, and inconsistency.

Children

In the children, ureteric, <10mm stone population, one study reported the outcomes stone-free state, retreatment and ancillary procedures (n=31). For all outcomes, a suggested clinical benefit was found for URS. The quality of evidence ranged from Moderate to Very Low, due to risk of bias, imprecision and indirectness.

In the children, renal, 10-20mm population, one study reported the outcomes stone free state, insignificant and significant residual stones, retreatment and length of stay (n=60). A suggested clinical benefit of URS was found for stone-free state, retreatment and clinically significant residual stones, whereas there was no difference between interventions in terms of the outcomes insignificant residual stones and length of stay. The quality of evidence ranged from Moderate to Very Low, due to risk of bias and imprecision.

SWL versus PCNL

Adults

In the adults, renal, <10mm stone population, 1 study compared SWL to PCNL. There was a clinical benefit of PCNL in terms of stone-free state and ancillary procedures, and no clinical difference between the interventions in terms of retreatment (n=39-42) . The quality of evidence was Very Low, due to risk of bias and imprecision.

In the adults, renal, 10-20mm stone population, 6 studies compared SWL versus PCNL. The outcome stone-free state was reported in all 6 studies (n=427) and the evidence suggested a clinical benefit of PCNL. Fours studies reported the retreatment and ancillary procedures (n=239-464). For these outcomes, a clinical benefit was found for PCNL. In one study of 49 participants, a clinical benefit of SWL was found in terms of length of stay. One study reported quality of life using the SF36 domains (n=78-81). For the domains physical functioning, physical role, vitality, mental health, total physical, total mental and overall health, no clinical difference was found between the interventions. For the domains bodily pain and general health, a suggested clinical benefit of PCNL was found. For the social functioning and emotional role domains, a suggested clinical benefit of SWL was found. Three studies reported major adverse events (n=321), and four studies reported minor adverse events (n=310). A clinical benefit of SWL was found in terms of major events; however there was no clinical difference in terms of minor adverse events. The quality of evidence ranged from Moderate to Very Low, due to risk of bias, imprecision, and inconsistency.

In the adult, renal, >20mm stone population, one study compared SWL versus PCNL (n=14-18). A suggested clinical benefit of PCNL was found in terms of stone-free state; however there was no clinical difference between interventions in terms of retreatment and ancillary procedures. The quality of the evidence was Very Low due to risk of bias, and serious or very serious imprecision.

Children

SWL was compared to PCNL in the children, renal, 10-20mm stone population in one study (n=212). For the outcomes stone-free state, retreatment and ancillary procedures, the evidence showed a suggested clinical benefit of PCNL. There was a suggested clinical benefit of SWL in terms of minor adverse events, but no clinical difference between the interventions in terms of major adverse events. The quality of evidence ranged from Moderate to Very Low due to risk of bias and imprecision.

One non-randomised study compared SWL to PCNL in the children, renal, >20mm stone population. This study showed a suggested clinical benefit of PCNL in terms of both stone-free state and retreatment, a clinical benefit of SWL in terms of length of stay, and no clinical difference in terms of minor adverse events (n=46). The quality of the evidence was Very Low due to risk of bias and imprecision.

URS versus PCNL

Adults

URS was compared to PCNL in the adult, ureteric, 10-20mm stone population. Five studies reported the stone-free state (n=541), 2 studies reported the retreatment (n=159), and 4 studies reported ancillary procedures (n=444). There was a suggested clinical benefit of PCNL in terms of stone-free state and ancillary procedures, and no clinical difference between the interventions in terms of retreatment. Five studies reported the length of hospital stay (n=470), and found a suggested clinical benefit of URS. Four studies reported major and minor adverse events (n=441-444), and found no clinical difference between URS and PCNL. The quality of evidence ranged from Moderate to Very Low due to risk of bias, imprecision, and inconsistency for the stone-free state, ancillary procedure, and minor adverse events outcomes.

In the adult, renal, 10-20mm stone population, 5 studies compared URS to PCNL. For the outcomes stone-free state, recurrence , retreatment , ancillary procedure, length of stay, major and minor adverse events, there was no clinical difference between URS and PCNL (1-5 studies; n=72-405). A suggested clinical benefit was found for URS in terms of pain (2 studies; n=143). The quality of the evidence ranged from Moderate to Very Low due to risk of bias, imprecision and inconsistency.

In the adult, renal, >20mm stone population, 3 studies reported the outcomes stone-free state, retreatment, and length of stay (n=192-216), and two studies reported the outcomes ancillary procedures, pain, and minor adverse events (n=132). One study reported major adverse events. There was no clinical difference between URS and PCNL in terms of stone-free state, retreatment, pain and major adverse events. There was a suggested clinical benefit of URS in terms of ancillary procedures, length of stay and minor adverse events. The quality of evidence ranged from Low to Very Low due to risk of bias, imprecision and inconsistency.

Children

Two non-randomised studies compared URS to PCNL in the children, renal, 10-20mm population. There was a suggested benefit of URS in terms of stone-free state and length of stay, and a benefit of PCNL in terms of minor adverse events for one of the studies (n=81). The other study showed no clinical difference between the interventions in terms of stone free state, major adverse events and length of stay, and a benefit of PCNL in terms of minor adverse events (n=48). The quality was Very Low due to risk of bias and imprecision.

One study compared URS to PCNL in the children, renal, >20mm stone population (n=43). A suggested clinical benefit of PCNL was found for the outcomes stone-free state and retreatment. However a suggested clinical benefit of URS was found in terms of length of hospital stay and minor adverse events. The quality was Very Low due to risk of bias and imprecision.

Surgery (URS, SWL or PCNL) versus non-surgical treatment

Adults

Surgery was compared to non-surgical treatment in the adult, ureteric, <10mm population. One study reported the outcome stone free state (n=303), and the evidence suggested a clinical benefit of surgery. The quality of the evidence was Low due to risk of bias and serious imprecision. No other outcomes were reported.

In the adult, renal <10mm stone population, two studies compared surgery versus non-surgical treatment. Two studies reported the outcome stone free state (n=350) and 1 study reported ancillary procedures (n=150). For both outcomes, a suggested clinical benefit of surgery was found. The quality of the evidence was Very Low due to risk of bias, very serious imprecision, and for the stone-free state outcome, inconsistency.

In the adult, renal, 10-20mm stone population, one study compared surgery versus conservative treatment. (n=94). A clinical benefit of surgery was found in terms of stone-free state and ancillary procedures. The quality of the evidence ranged from Moderate to Very Lowdue to risk of bias and imprecision.

Within surgery comparisons

Adults

Tubeless PCNL was compared to standard PCNL in the adult, renal 10-20mm stone population in 1 study (n=80). In terms of stone-free state, a suggested clinical benefit of tubeless PCNL was found, however there was no difference between the interventions in terms of length of stay. The quality of the evidence was Low due to risk of bias and imprecision.

Tubeless PCNL was compared to standard PCNL in the adult, renal, >20mm stone population in three studies. Stone-free state was reported by all three studies (n=258), and the evidence demonstrated no clinical difference between the two interventions. One study reported retreatment, ancillary procedures, pain and major adverse events (n=131). For the outcomes retreatment, ancillary procedure and major adverse events there was no clinical difference, however there was a suggested clinical benefit for tubeless PCNL in terms of pain. Two studies reported length of stay and minor adverse events (n=163-226). There was no clinical difference for major adverse events, but a clinical benefit of tubeless PCNL in terms of length of stay. The quality of evidence was Moderate to Very Lowdue to risk of bias, imprecision and inconsistency.

Supine PCNL was compared to prone PCNL in the adult, renal, >20mm stone population. Five studies reported stone-free state (n=513) and found no clinical difference between the two interventions. A clinical benefit of supine PCNL compared to prone PCNL was found for length of hospital stay (3 studies; n=316), and for major and minor adverse events (3 studies; n=316-438). There was no clinical difference between interventions in terms of recurrence, and ancillary procedures (1-2 studies; n=113-197). There was a clinical benefit of prone PCNL for retreatment (1 study; n=122). The quality of the evidence ranged from Low to Very Lowdue to risk of bias, imprecision and inconsistency.

Mini PCNL was compared to standard PCNL in the adult, renal, >20mm stone population. One small study of 19 participants reported the outcome length of stay, and found a suggested clinical benefit of mini PCNL. One study reported major adverse events and found a suggested clinical benefit of standard PCNL compared to mini PCNL (n=150). There was no clinical difference between the two interventions for the outcomes stone free state, retreatment , ancillary procedures, pain or minor adverse events (2-3 studies; n=169-263). The quality of evidence ranged from Low to Very Low due to risk of bias and imprecision.

Children

Tubeless PCNL was compared to standard PCNL in two studies in the children, renal, >20mm stone population. Both studies reported stone-free state, and length of hospital stay (n=83). The evidence showed no clinical difference between the two interventions for the stone-free state outcome, but a clinical benefit of tubeless PCNL in terms of length of stay. There was evidence from one study for the outcomes of retreatment, ancillary procedures and minor adverse events (n=23-60). A clinical benefit of tubeless PCNL was found for ancillary procedures, length of hospital stay and minor adverse events. A clinical benefit of standard PCNL was found in terms of retreatment. The quality of the evidence was Moderate to Very Low due to risk of bias and imprecision.

1.7.2 Health economic evidence statements

- One original comparative cost analysis found that URS was more costly than SWL for treating adults with ureteric stones <10mm (cost difference per patient: £2,368 in scenario

1, £2,387 in scenario 2, and £1,212 in scenario 3). This analysis was assessed as partially applicable with potentially serious limitations.

1.8 Recommendations

F1. Consider watchful waiting for asymptomatic renal stones in adults, children and young people if:

- the stone is less than 5 mm, **or**
- the stone is larger than 5 mm and the person or their parent/carer agrees to watchful waiting after an informed discussion of the possible risks and benefits.

F2. Follow the recommendations in Table 32 for treating ureteric or renal stones in adults, children and young people when medical expulsive therapy has failed or is not indicated, there is ongoing pain or the stone is not likely to pass spontaneously.

Table 32: Surgical treatment of ureteric and renal stones in children, young people and adults when medical expulsive therapy has failed or is not indicated, there is ongoing pain or the stone is not likely to pass spontaneously:

Stone type and size	Treatment for adults (16 years and over)	Treatment for children and young people (under 16 years)
Ureteric stone less than 10 mm	Offer SWL Consider URS if: there are contraindications for SWL, or the stone is not targetable with SWL, or a previous course of SWL has failed	Consider URS or SWL
Ureteric stone 10 to 20 mm	Offer URS Consider SWL if local facilities allow up to 2 SWL sessions within 4 weeks of the decision to treat Consider PCNL for impacted proximal stones when URS has failed	Consider URS or SWL
Renal stone less than 10 mm	Offer SWL Consider URS if: there are contraindications for SWL, or a previous course of SWL has failed, or because of anatomical reasons, SWL is not indicated	Consider URS or SWL Consider PCNL if; URS or SWL have failed, or for anatomical reasons it is the more favourable option

Stone type and size	Treatment for adults (16 years and over)	Treatment for children and young people (under 16 years)
	Consider PCNL if SWL and URS have failed to treat the current stone or are not an option	
Renal stone 10 to 20 mm	Consider URS or SWL Consider PCNL if URS or SWL have failed	Consider URS or SWL or PCNL1
Renal stone larger than 20 mm, including staghorn stones	Offer PCNL2 Consider URS if PCNL is not an option	Consider URS or SWL or PCNL1
SWL, shockwave lithotripsy; URS, ureteroscopy; PCNL, percutaneous nephrolithotomy		
1 Use clinical judgement when considering mini or standard PCNL 2 Use clinical judgement when considering tubeless, mini or standard PCNL, and supine or prone positions		

1.9 Rationale and impact

1.9.1 Why the committee made the recommendations

1.9.1.1 The committee noted that in current practice, watchful waiting may be used for people with asymptomatic renal stones, as these stones are not likely to have a quality of life impact and may pass spontaneously without intervention. This is particularly the case for stones less than 5 mm, but may also apply to larger stones. The committee noted that larger stones are more likely to have risks associated with watchful waiting such as the stone's location may move and cause obstruction. They agreed that watchful waiting should be considered for those with asymptomatic renal stones less than 5 mm, and for stones larger than 5 mm as long as the possible risks and benefits have been discussed with the patient.

Adults, ureteric stones, smaller than 10 mm

Some evidence showed a small benefit of URS over SWL for the stone free outcome, repeat treatments needed and quality of life, but there was a shorter hospital stay, less pain and fewer major adverse events with SWL. Economic analysis showed that SWL offered a better balance of benefits and costs than URS, even when the possible need for repeat treatment was taken into account. The cost differences were substantial and sensitivity analysis showed economic benefit for SWL even with lower SWL success. The committee therefore agreed to offer the less-invasive procedure of SWL to treat small ureteric stones (less than 10 mm) in adults. However, they acknowledged that prompt treatment of these stones is needed because of the risk of obstruction and kidney damage URS may be considered as an alternative treatment if, for example, there are contraindications to SWL, the stone is not targetable, or a course of SWL has previously failed (as patients tend to form the same type of stones).

Adults, ureteric stones, 10 to 20 mm

Evidence showed a benefit of URS over SWL for stone removal and repeat treatments needed, but there was a shorter hospital stay, less pain, and fewer major adverse events with SWL.

Prompt treatment of ureteric stones is needed because of the risk of obstruction and kidney damage. There is more of a risk for ureteric stones than with renal stones, because there is less room for the stone to move in the ureter compared with the kidney. The risk is even more of a concern for larger stones.

The committee acknowledged that in terms of costs, SWL may offer better value, however the committee were very concerned about the risks in using SWL for ureteric stones. SWL may be delayed because of availability of a lithotripter. Additionally, given the varying effectiveness of SWL depending on factors such as type of machine (fixed/mobile) and operator skill, the total time to clear the stone if multiple sessions are needed, would also add to the risk level. Therefore they agreed to recommend URS for adults with ureteric stones of 10 to 20 mm, but SWL can be considered if local facilities allow up to 2 sessions of SWL within 4 weeks of the decision to treat.

Evidence (mainly in a group with impacted stones) suggested a benefit of percutaneous nephrolithotomy (PCNL) for stone removal compared with URS, but there was a shorter hospital stay with URS. The committee agreed that PCNL is not usually performed in the UK, but that it could be considered for larger impacted stones, particularly in the proximal ureter.

Adults, ureteric stones, larger than 20 mm

No evidence was identified, and the committee agreed that this is a very small group. Usual practice depends on local availability of treatments and expertise. The committee decided that they could not make a recommendation for this group.

Adults, renal stones, smaller than 10 mm

There was evidence comparing SWL with URS, SWL with PCNL and surgery with non-surgical treatment, which suggested a benefit of URS in terms of retreatment rate and ancillary procedures, and a benefit of SWL in terms of readmission, failed technology, and major adverse events. Limited evidence from 1 small study suggested a benefit of PCNL over SWL in terms of stone-free state and ancillary procedures. There was also evidence of a benefit of surgery compared with non-surgical treatment.

Because SWL offered a better balance of benefits and costs, the committee agreed that it should be offered in the first instance, and that URS should be considered if there are contraindications for SWL, anatomical reasons (such as multiple stones) or a previous course of SWL has failed . Because of concerns around the limited evidence for PCNL, this should only be considered as an option when both SWL and URS have failed.

Adults, renal stones, 10 to 20 mm

There was evidence comparing SWL with URS, SWL with PCNL, URS with PCNL, tubeless with standard PCNL, and surgery with non-surgical treatment. Standard PCNL in this comparison was defined as with a tube.

Some evidence showed a benefit of SWL in terms of length of stay, quality of life and some major adverse events compared with URS and PCNL. Both URS and PCNL had clinical benefits in terms of stone-free state, retreatment rate and ancillary procedures, compared with SWL. There was no difference between PCNL and URS for most outcomes. One study showed a benefit of surgery in terms of ancillary procedures and stone-free state compared with non-surgical treatment, and one study showed a benefit of tubeless compared with standard PCNL in terms of stone-free state.

The committee agreed that URS or SWL offered a better balance of benefits and costs compared with PCNL and this intervention should be considered only if URS or SWL have failed. In terms of a choice between URS and SWL, the size of the stone was a concern for

the committee, however factors such as quality of life and the risks associated with larger stones were difficult to quantify in any costing work. The committee agreed that the stone size itself would be a factor in the treatment decision, as effectiveness of SWL can also vary by stone size, and a stone nearer to the lower end of the range (10 to 20mm) could be an appropriate candidate for SWL. Overall, the committee felt that a recommendation to consider URS or SWL would allow flexibility for clinicians in choosing a treatment option.

The committee agreed that they did not have enough confidence in the evidence to recommend tubeless over standard PCNL, but agreed that either approach could be used, according to clinical judgement.

Adults, renal stones, larger than 20 mm

Very limited evidence from a single study showed a benefit of PCNL in terms of stone-free state compared with SWL, but no difference when compared with URS. Several low to very low quality studies showed a benefit of URS in terms of ancillary procedures, length of stay and adverse events compared with PCNL.

Limited evidence suggested a benefit of tubeless PCNL in terms of length of stay and pain, and of mini PCNL in terms of length of stay and major adverse events compared with standard PCNL (with a tube, or standard size depending on comparison) There was a benefit of supine PCNL in terms of length of stay and adverse events compared with prone PCNL, although a benefit of prone PCNL was found for retreatment. There were no differences between interventions for stone-free state, ancillary procedures or minor adverse events.

Current practice for renal stones greater than 20 mm is PCNL, and the committee agreed that there was insufficient evidence to change this. However the committee considered that PCNL may not always be an option (for example for people with high co-morbidity, anaesthetic risks, or anatomical considerations) and so URS could be considered in these circumstances. The committee agreed that all evidence for types of PCNL was based on small studies, and there was no difference between them for many outcomes. Therefore any approach should be available and considered based on clinical judgement.

Adult, renal stones, staghorn

There was no evidence for renal staghorn stones in adults. Current practice for these stones is to use PCNL. The committee agreed that staghorn stones are all over 20 mm and so would be treated as renal stones larger than 20 mm.

Children and young people, ureteric stones, smaller than 10 mm

Limited evidence from a single small study showed a benefit of URS over SWL in terms of stone-free state, retreatment rate, and ancillary procedures. The committee agreed to recommend SWL as the first treatment for these stones in adults because of the better balance of benefits and costs. However, they noted that evidence for children and young people was much more limited. They also discussed that unlike adults, children may need a general anaesthetic for each session of SWL, depending on their age. As both URS and SWL are used in current practice, the committee agreed that either should be considered for children and young people with stones less than 10 mm.

Children and young people, ureteric stones, 10 to 20 mm

No evidence was identified so the committee made a recommendation based on their knowledge and experience. They noted that children have a higher incidence of spontaneous passage of larger stones and have less risk of obstruction than adults so the risk of waiting for treatment is not as high. Additionally children tend to be treated in specialist centres where SWL is more readily available, therefore the committee agreed that unlike the adult population where URS should be offered in the first instance and SWL considered if facilities

allow quick stone clearance, for children and young people both SWL and URS could be treatment options so allowing clinical flexibility.

Children and young people, ureteric stones, larger than 20 mm

No evidence was identified and the committee agreed that currently these stones are treated on a case-by-case basis. They decided that they could not make a recommendation for this group.

Children and young people, renal stones, smaller than 10 mm

No evidence was identified. The committee discussed current practice and used their knowledge and experience to recommend that URS or SWL should be considered in the first instance, and PCNL when other treatment has failed.

Children and young people, renal stones, 10 to 20 mm

Very limited evidence from a single study showed a benefit of URS in terms of stone-free state, retreatment and significant residual stones when compared with SWL. Limited evidence from another single study showed benefits of PCNL in terms of stone-free state, retreatment rate and ancillary procedures when compared with SWL. The only evidence showing a benefit for SWL was for fewer minor adverse events, when SWL was compared with PCNL. Two non-randomised studies comparing URS and PCNL had inconclusive results. The committee agreed that clinical judgement should be used when deciding which treatment to use (URS, SWL or PCNL).

Children and young people, renal stones, larger than 20 mm

Evidence from a single study showed a benefit of URS compared with PCNL, in terms of length of stay and adverse events, but a benefit of PCNL in terms of stone-free state and retreatment rate. Evidence from 2 small studies showed a benefit of tubeless PCNL compared with standard PCNL in terms of length of stay, ancillary procedures and minor adverse events, but a benefit of standard PCNL in terms of retreatment. One non-randomised study showed a benefit of PCNL compared with SWL for stone-free state and retreatment, but a benefit of SWL for length of stay.

The committee agreed that PCNL may be effective, but carries more risks than URS. They decided that either URS or PCNL could be considered and that SWL should not be ruled out.

Children and young people, renal stones, staghorn

No evidence was identified. The committee agreed that staghorn stones in children would be treated in the way same as stones larger than 20 mm.

1.9.2 Impact of the recommendations on practice

Changes in practice are likely for adults with ureteric stones smaller than 10 mm because SWL is recommended whereas currently URS is more frequently used. Economic analysis showed there will be a saving from using SWL over URS, although this may be more longer term because of short-term implementation costs required. Having good referral systems may mean that additional lithotripters are not needed. Alternatively more investment in mobile or fixed lithotripters could be an option, or networks of mobile or fixed-site lithotripters allowing patients timely access to treatment. However, more staff may be needed to undertake SWL (for example, ultrasonographers) to meet the additional demand. Additional training to maximise the effectiveness of lithotripsy may also be needed. Increases in staffing can provide benefits to other areas of the NHS as it is likely that not all their time will be spent treating renal and ureteric stones.

In adults with ureteric stones of 10 to 20mm, URS tends to be used, so recommendations to consider SWL could lead to a change in practice, with potential longer term savings, depending on uptake..

In adults with renal stones of 10 to 20mm; PCNL tends to be used, so recommendations to consider URS or SWL as first line could lead to a change in practice, with likely savings, depending on uptake.

Other recommendations for adults reflect current practice. In children; multiple treatment options have been recommended to allow for clinical judgement, and therefore a change in practice is unlikely.

1.10 The committee's discussion of the evidence

1.10.1 Interpreting the evidence

1.10.1.1 The outcomes that matter most

The committee agreed that stone-free state, recurrence rate, use of healthcare services (length of hospital stay, readmission, retreatment rate and ancillary procedure), kidney function, quality of life, major adverse events, minor adverse events and failure to treat were the outcomes that were critical for decision-making. Pain was also considered as an important outcome.

Evidence was reported for all of the critical outcomes except for kidney function. There was evidence for the important outcome of pain.

1.10.1.2 The quality of the evidence

For the majority of evidence in this review, the quality ranged from a GRADE rating of moderate to very low. This was due to lack of blinding, presence of selection bias, and risk of measurement bias, resulting in a high or very high risk of bias rating. Additionally, the imprecise nature of the results extracted and analysed in this review and the presence of heterogeneity for some outcomes further downgraded the quality of the evidence.

1.10.1.3 Benefits and harms

Evidence for people with both symptomatic and asymptomatic stones was searched for, however only 3 studies with a primarily asymptomatic population was identified. Therefore, committee agreed that the recommendations should only apply to those with symptomatic stones.

It is important to note that the population that surgery would be appropriate for would generally be people who have had failed medical expulsive therapy or medical expulsive therapy is not indicated, there is ongoing pain or the stone is not likely to pass spontaneously.

Adults, ureteric stones, less than 10 mm

SWL versus URS

When SWL was compared to URS, the committee noted that there was a benefit of URS for outcomes that assessed the effectiveness of the interventions, such as stone-free state, ancillary procedures and retreatment, as well as patient-centred outcomes such as quality of life and pain. It was noted that SWL had a clinically important benefit in terms of major

adverse events and length of hospital stay; however, the committee was aware that SWL is generally performed as a day procedure and therefore the length of hospital stay would inherently be much shorter compared to both URS and PCNL. The committee were also aware that the evidence for length of stay came from studies that were not carried out in the UK and that in UK practice URS is more likely to be performed as a day procedure. The committee considered the evidence for adverse events and weighed the reduction in major adverse events when using SWL, with the increase in stone-free status when using URS.

Surgery (URS, SWL or PCNL) versus non-surgical treatment

When compared to non-surgical treatment, the committee noted that there was a clinical benefit of surgery in terms of stone-free state. No other outcomes were reported. The committee discussed that in usual practice, small stones would normally be treated conservatively, through non-surgical treatment such as medical expulsive therapy or watching and waiting, as there is a higher chance of spontaneous passage. However, it was noted that the evidence suggests that there is not a benefit in non-surgical treatment compared to surgical intervention for stones less than 10 mm in terms of becoming stone free. The committee noted that the evidence for this comparison was from a single study of symptomatic participants, and that there was no evidence for observation only. The committee also noted that it was not possible to split the data further into less than 5 mm and 5 to 10 mm groups, however they considered from their clinical practice that stones less than 5 mm are likely to pass spontaneously, and that watchful waiting may be preferable when pain is not a factor, to avoid undergoing surgical treatment. They considered that for stones larger than 5 mm, watchful waiting may also be an option after discussion of the potential risks.

Overall

The committee noted that although the evidence suggests a clinical benefit of URS, this benefit appears to be modest. Further, the economic analysis suggests that an SWL strategy is substantially lower cost, with exploratory QALY work showing that URS will not provide adequate benefit to justify its additional cost. They considered resourcing implications of SWL. It was noted that not all hospitals have fixed units, but instead use mobile lithotripters and therefore are not available at all times. The committee discussed that for stones in the ureter, treatment needs to occur urgently, and therefore SWL may not always be available within the required time period, however the committee discussed the use of electronic referral systems between centres with resulting patient transfers and more frequent mobile lithotripters as possible implementation models to enable faster treatment with SWL.

The committee also discussed patient preference, and that some people may prefer a less invasive procedure, whereas other people may prefer a procedure under a general anaesthesia.

Therefore, based on this balance of benefits and harms, availability of SWL and the economic evidence, the committee concluded that SWL should be offered in the first instance in this population, and that URS should be offered when there are contraindications to SWL (such as pregnancy, an aneurysm, or abnormal clotting/anticoagulation), if the stone is not targetable, or if a course of SWL has been failed before.

Adults, ureteric stones, 10 to 20 mm

SWL versus URS

The committee reviewed the evidence for SWL when compared to URS. They noted that there were fewer people achieving a stone-free state and more retreatments and ancillary procedures in those receiving SWL; however, there were also shorter hospital stays, and fewer major and minor adverse events. The committee again noted that the evidence for length of stay may not be representative of UK practice, and took this into account when considering the evidence.

URS versus PCNL

The committee noted that compared to PCNL, there were fewer stone-free people after URS, more retreatments and more ancillary procedures. There was no difference between interventions in terms of adverse events, suggesting that for ureteric stones 10 to 20 mm, PCNL may be more effective than, and just as safe as, URS. The committee noted that the majority of the evidence for this comparison was for people with proximal stones however, they agreed that in UK practice it is unusual to perform PCNL for a proximal ureteric stone of this size because of the perceived increased risk. They noted that it may be the preferred option when the stone cannot be accessed from below or if the stone is impacted, however there is likely to be a small number of people suitable for PCNL. The committee discussed that in some countries, URS is not performed as commonly as in UK practice, which may account for the use of PCNL in this population. The committee also considered that in countries where URS is performed infrequently, the surgical experience and expertise of clinicians in this procedure might not be representative or reflective of that of clinicians in the UK, in which case the effectiveness of URS could be higher in the UK than in the RCTs. The committee noted that these differences in practice are due to differences in the healthcare system in the UK compared to other countries. The committee also noted that the adverse events rate was lower than expected based on the committee's clinical experience.

Overall

The committee considered the evidence for this population and discussed that although SWL had fewer adverse events within the controlled circumstances of a clinical trial; it was not as clinically effective compared to URS. Further, it was noted that SWL is less common in current practice for this population. The committee discussed that this may be partly due to the lower effectiveness and the likely need for more retreatments or ancillary procedures, but also to do with the availability of SWL and the safety concerns around waiting for treatment. They noted that large ureteric stones are associated with a risk of obstruction, which could lead to renal loss if not resolved within 4-6 weeks, therefore this group of patients is more vulnerable compared to smaller stones or renal stones, and the potential harm of delayed or less effective treatment is greater. There are also many patient factors to consider that would make URS a first choice for clinicians and people with stones, such as it being the preferred option for people with recurrent stones, and other complicated groups. The committee considered that it is possible the results of the ureteric <10mm economic analysis could be extrapolated to this group, but agreed that the clinical evidence and concerns regarding safety outweighed this. The committee agreed that URS is the most appropriate option in the first instance. Therefore, the committee concluded that for this population, URS should be offered. A consider recommendation was made for SWL in order to not preclude it from being used, as long as it was available to allow up to 2 sessions within 4 weeks of the decision to treat. This is to ensure that SWL is only carried out when there is access to close follow up and early review. The committee considered that although PCNL was shown to be clinically effective, this does not reflect current practice and is not cost effective. The committee agreed PCNL should only be considered for people with an impacted proximal ureteric stone 10-20 mm, where URS has failed.

Adults, ureteric stones, larger than 20 mm

No evidence was identified for this population. The committee discussed that this is a small patient group, due to the fact that stones larger than 20 millimetres very rarely enter the ureter. It was noted that usual practice would usually depend on local availability and expertise; therefore the committee concluded that a recommendation could not be made.

Adults, renal stones, smaller than 10 mm

SWL versus URS

The committee noted that when compared to SWL, there was very low to moderate quality evidence of clinical benefit of URS in terms of retreatment and ancillary procedures, however there was a benefit of SWL in terms of readmission, major adverse events and failed technology. The committee also noted that there was no clinical difference between the two interventions in terms of stone-free state, based on moderate quality evidence from 4 studies.

SWL versus PCNL

The committee noted a benefit of PCNL in terms of stone-free state, compared to SWL. There was no difference between the interventions for the retreatment rate or ancillary procedure outcomes. The committee noted, however, that the evidence for this comparison came from 1 small study and all outcomes had serious or very serious imprecision around the point estimate.

Surgery (URS, SWL or PCNL) versus non-surgical treatment

When compared to non-surgical treatment, there was a clinical benefit of surgery in terms of both stone-free state and ancillary procedures. The committee noted that of the 2 studies included in the evidence, 1 included symptomatic and 1 included asymptomatic people. The committee considered that for this comparison, in renal stones, quality of life is the primary outcome of interest, however there was no extractable quality of life data.

Overall

The committee considered the evidence for this population, and noted that all surgical options carried benefits and harms. The committee considered that there was no difference between URS and SWL in terms of stone-free state, and each intervention had different benefits in terms of use of healthcare services outcomes. On the basis that SWL and URS are clinically equivalent, the committee considered that SWL was more cost effective. Therefore they agreed that SWL should be offered as first line treatment for renal stones <10 mm, and that URS should be considered if there are contraindications to SWL, such as pregnancy, an aneurysm, concerns about clotting, if a course of SWL has previously failed, or if there are anatomical considerations. The committee agreed that although they did not have confidence in the evidence for PCNL, there was no evidence of harms associated with this treatment and noted that it is sometimes used in this population in current practice. They agreed that PCNL could be considered as third line option for those people who had failed treatment with SWL and URS.

The committee considered that although there was a benefit of surgery compared to no treatment/non-surgical treatment in terms of becoming stone free, for those with asymptomatic stones a watch and wait approach may be preferable. They noted from clinical practice that very small stones (<5 mm) are likely to pass without intervention, and therefore watch-and-wait could be considered. The committee noted that stones greater than 5 mm may still pass spontaneously, but are more likely to require intervention. They agreed that watchful waiting could also be considered for these stone, after consideration of the associated risks.

Adults, renal stones, 10 to 20 mm

SWL versus URS

The committee reviewed the evidence for SWL compared to URS. The evidence demonstrated that fewer people who received SWL achieved a stone-free status, whereas there were more retreatments and ancillary procedures, compared to URS. The length of hospital stay was lower for those receiving SWL; however, the committee noted that this was due to the nature of SWL, which is performed as a day procedure. The committee considered that there was no difference in the interventions in terms of adverse events or pain. This indicates that for this population, URS is more clinically effective and no less superior to SWL in terms of safety.

SWL versus PCNL

SWL was also compared to PCNL. The evidence demonstrated that fewer people who received SWL achieved stone-free status compared to those who received PCNL, and there were more retreatments and ancillary procedures for those having SWL. SWL was shown to lead to a shorter length of stay than PCNL and had fewer major adverse events. The committee noted that the evidence for quality of life was mixed, as those receiving SWL had better social functioning and emotional role scores, but scores on the bodily pain and general health scores were worse. For other SF36 domains, there was no difference between interventions.

URS versus PCNL

The committee noted that there was no clinical difference between the interventions for any clinical effectiveness, safety or patient-centred outcomes, except for self-reported pain score and major adverse events, which demonstrated a clinical benefit for URS.

PCNL: tubeless versus standard

Standard PCNL in this comparison was defined as with a tube. Only stone-free state and length of hospital stay was reported for this comparison. The committee noted that there was a clinical benefit for tubeless PCNL in terms of stone-free state. The interventions were similar in terms of the length of stay. The committee noted that the evidence for this stratum comparison came from a single, small RCT of 80 participants. The committee also noted that the PCNL procedure used in this comparison for both groups was mini PCNL.

Surgery (URS, SWL or PCNL) versus non-surgical treatment

The committee noted that there was no clinical difference between surgery and non-surgical treatment in terms of stone-free state; however, there was a clinical benefit of surgery in terms of ancillary procedures.

Overall

The committee considered that, based on the evidence, both URS and PCNL are more clinically effective compared to SWL, in terms of stone-free state, and use of healthcare services outcomes, and that the evidence for the URS versus PCNL comparison showed no difference between the two interventions. The committee considered that current practice for these stones is mixed, but that generally URS or PCNL would be used. This is because these procedures aim to remove the whole stone and not leave fragments (PCNL) or fragment the stone to fragments which will pass spontaneously (URS) because larger remaining fragments may cause problems if not fully removed. There was concern that treatment with SWL could result in larger fragments that would not pass spontaneously particularly when treating larger stones. They further noted that PCNL might less frequently require post-operative stenting in this patient group compared with URS, and stenting is associated with adverse effects and further procedures to remove the stent. However, the committee also considered that from the health economics evidence, PCNL was not cost effective, and SWL was likely to be the most cost effective treatment option. The committee considered both URS and SWL and agreed that both may be suitable depending on the size of the stone within the 10-20 mm size band. For instance, they noted from clinical practice that SWL may be effective for stones less than 15 mm, but is much less likely to be effective for stones greater than 15 mm.

Overall the committee considered that although SWL was the most cost effective treatment option, it was not as clinically effective compared to URS or PCNL and may not be appropriate for all stones. PCNL was shown to be equivalent to URS and more clinically effective than SWL, but the cost difference was much more substantial. Based on this balance of the clinical and cost effectiveness evidence, the committee agreed that URS and SWL should be considered, and that PCNL should only be considered if other treatments

have failed. When considering tubeless versus standard PCNL, based on the concerns about the lack of evidence and study size, the committee concluded that a clinical decision based on judgement and expertise should be made when considering what type of PCNL to perform in this population.

Adults, renal stones, larger than 20 mm

SWL versus PCNL

The committee reviewed the evidence for SWL compared to PCNL and noted that people who were given SWL were much less likely to be stone free compared to those who received PCNL. However, it was noted that this evidence came from a single study of 14 people, and therefore the committee did not have confidence in the findings. The committee further noted that of those 14 participants, not all were treated at the same centre by the same surgeon. Given these concerns, the committee decided that it could not place any weight on this evidence due to the lack of confidence in the findings.

URS versus PCNL

The evidence for this comparison demonstrated that there was no difference between the interventions in terms of stone-free state, retreatment rate, pain or major adverse events. Those who received URS did, however, have fewer ancillary procedures, shorter length of stays, and fewer minor adverse events. The committee noted that for these outcomes, the quality of evidence was very low due to very serious imprecision, which reduced the committee's confidence in the point estimates. The committee also noted that the procedures used in this comparison were diverse, with mini, ultra mini and standard PCNL being compared to standard URS, RIRS and staged RIRS. The committee considered that mini and ultra mini PCNL is not a standard technique in the UK and considered that a URS/RIRS may be more likely to be used in these cases rather than a mini PCNL technique. Further, it was noted that the mean stone sizes of the participants in the included studies were variable, where one study had a small mean stone size of just over 20mm, whereas another study had a mean stone size of over 30mm. The committee discussed that in current practice, URS is not usually offered for stones larger than 20mm, unless there is a contraindication to PCNL, due to the perception that larger stones treated with URS will require a longer operating time, may need more than one treatment session, and are likely to need a post-operative stent which will involve another procedure to be removed.

PCNL: tubeless versus standard

Standard PCNL in this comparison was defined as with a tube. The evidence demonstrated that there was no difference between interventions in terms of clinical effectiveness or safety outcomes. There was a benefit of tubeless PCNL in terms of patient-centred outcomes such as length of stay and pain. The committee noted that the majority of the evidence for this comparison came from 1 or 2 small studies (131 and 95 participants) and had very serious imprecision. The committee also noted that for these studies the randomisation process was often not clearly described, and therefore they were unclear about whether true randomisation took place, or whether allocation was determined by intraoperative factors. Due to these concerns, the committee agreed that they could not place weight on this evidence.

PCNL: supine versus prone

The committee noted that people who had PCNL in the supine position had a shorter length of hospital stay and fewer major adverse events compared to those in the prone position. However, the evidence demonstrated no benefit of supine PCNL for any outcomes assessing the success of the intervention, that is, stone-free state, recurrence rate, retreatment rate or ancillary procedures. Evidence from 3 RCTs demonstrated a benefit of supine PCNL for length of stay and major adverse events but not minor adverse events.

PCNL: mini versus standard

Standard PCNL in this comparison was defined as using standard size. The evidence for this comparison demonstrated that there was no difference between interventions, except for the length of stay and major adverse events outcomes. Length of stay was lower in the mini PCNL intervention, but this intervention had more major adverse events. The committee discussed the evidence and noted that the studies were heterogeneous in terms of how mini PCNL was defined as well as the size of the instruments employed by the different studies.

Overall

The committee concluded that given the concerns about the quality and strength of the evidence, there was a lack of sufficient evidence to change current practice. The committee discussed that in current practice PCNL would usually be performed for a stone larger than 20 mm, and that SWL is unlikely to be used for stones of this size. The GC discussed that based on clinical experience; PCNL is quicker than URS, and potentially results in less residual fragments. It was noted that URS performed for stones of this size is technically challenging, often requiring long surgery times, multiple sessions and placement of a stent which will require a further procedure to remove the stent. The committee agreed that although the evidence seems to favour URS, the evidence is very low quality and based on very small RCTs, therefore much stronger evidence from a larger number of participants would be needed to warrant a change current practice. The committee were also concerned about the studies in the comparison of URS vs PCNL, because in one study for example; the mean stone size was much bigger in the PCNL group which would have affected the results. The committee also used their own clinical expertise and discussed anecdotal evidence and also audit data they were aware of, and felt that in reality PCNL is more effective than URS in larger stones and this is not being reflected in the evidence. Therefore, the committee concluded that PCNL should be offered to people with renal stones larger than 20 mm.

The committee discussed that for some people PCNL may not be possible, due to contraindications such as unfavourable anatomy, multiple comorbidities or anticoagulants. Therefore, the committee concluded that URS should be considered in cases where PCNL is not an option. The evidence for tubeless versus standard, mini versus standard and supine versus prone PCNL was considered, and due to lack of compelling evidence for any particular technique it was decided that clinicians should use their judgement and experience when considering which type of procedure can be offered.

Adult, renal stones, staghorn

No evidence was identified for this population. The committee discussed that current practice for staghorn stones would usually be PCNL. It was also discussed that as staghorn stones are always larger than 20 mm in size, evidence from the adult, renal, larger than 20 mm group could be extrapolated to this population. Therefore, the committee recommended that adults with staghorn stones should be offered PCNL.

Children and young people, ureteric stones, smaller than 10 mm

SWL versus URS

A clinical benefit of URS was seen in this population when compared to SWL for stone-free state, ancillary procedures and retreatment. The committee noted that although the size of the effects for these outcomes was very large, all evidence came from one very small RCT of 31 participants. Further, both outcomes were imprecise and had a serious risk of bias. The committee considered that for adults with these stones, SWL should be offered and URS should be considered if SWL is not possible. However, they noted that the evidence for these stones in the paediatric population was much less convincing. They also noted that children often need a general anaesthetic for each SWL session, and due to the nature of SWL, may require 2-3 sessions. Further, the impact of this potential prolonged treatment may have an impact on quality of life for children. The committee therefore decided to make a consensus

recommendation based on clinical expertise and experience to consider URS or SWL, rather than extrapolate from the adult population. This also reflects current practice.

Children and young people, ureteric stones, 10 to 20 mm

No evidence was identified for this population. The committee therefore decided to make a consensus recommendation to consider URS or SWL, based on the clinical judgement and expertise of the committee. The committee considered that for adults with these stones, URS should be offered and SWL should be considered if up to 2 sessions can be done within 4 weeks of the decision to treat. The committee agreed that rather than extrapolate from this adult population, recommendations should be made that reflect current practice and give clinicians the choice which should be based on clinical judgement and expertise. They also noted that in the adult population, PCNL would be considered for impacted stones, however agreed that in a paediatric population this was very uncommon and so PCNL would not often be used. Therefore the committee agreed not to make a recommendation for PCNL for children with 10-20 mm ureteric stones.

Children and young people, ureteric stones, larger than 20 mm

No evidence was identified for this population. As in adults, the committee discussed that this is a small patient group. It was noted that usual practice would usually depend on local availability and expertise; therefore the committee concluded that no recommendation could be made for this population.

Children and young people, renal stones, smaller than 10 mm

No evidence was identified for this population. The committee considered that for adults with these stones, SWL would be offered, and URS would be considered if SWL was not possible. PCNL would only be considered if SWL or URS had failed. The committee considered the differences in SWL between adults and children, as in the ureteric <10 mm population, and agreed that the need for a general anaesthetic and increased disability caused by stone pain in children may make SWL a less favourable option. Taking into account these factors and the clinical experience of the committee, consensus was these stones could be managed using URS or SWL primarily depending on patient factors, stone factors and local availability of equipment and expertise. PCNL could be considered, as in adult practice, for treatment failures or when anatomically more favourable. The committee noted that asymptomatic stones <10mm may be managed conservatively.

Children and young people, renal stones, 10 to 20 mm

SWL versus URS

The committee reviewed the evidence for SWL compared to URS in this population. Evidence was from 1 RCT with a small population of 60 participants. The committee noted that SWL had a lower stone-free rate and resulted in more significant residual stones compared to URS; however, there was no evidence of a clinically important difference between interventions in terms of insignificant residual stones, retreatment or length of hospital stay.

SWL versus PCNL

There was also evidence for SWL compared to PCNL in this population. Evidence was from 1 moderately sized RCT indicated inferiority of SWL with respect to stone-free state, retreatment and ancillary procedures. In terms of safety outcomes, there was no difference for major adverse events, but there were less minor adverse events in the SWL group. The committee considered that this study was carried out in India, where URS may not be routinely offered. Based on clinical experience and expertise of the committee, it was felt that in many developed countries this population is increasingly offered URS, and concluded this study is not representative of UK practice.

URS versus PCNL

Two non-randomised studies showed conflicting findings for this population. One study suggested that URS is associated with more stone free participants, shorter hospital stays but more adverse events, whereas another study suggested no difference between the two interventions in terms of stone-free state or length of stay. The committee considered that this evidence was very low quality. They agreed that due to the quality of the evidence and the conflicting findings, there was not sufficient evidence favouring one treatment modality over the other.

Overall

The committee concluded that although the reviewed data were suggestive of a possible clinical benefit for URS or PCNL in children with renal stones of 10-20mm, the fact that the evidence was based on a small number of studies with small numbers of participants meant that they did not have confidence in the evidence. The committee considered current practice for these stones is mixed, and all treatments can be used. Based on this lack of confidence, as well as current practice and clinical expertise, and the committee agreed that all surgical treatment options should be available for this patient group. Therefore, the committee recommended that URS, SWL or PCNL should be considered.

Children and young people, renal stones, larger than 20 mm

URS versus PCNL

Evidence from a small single study was identified that included children with renal stones larger than 20mm. The committee noted that both stone-free state and retreatment rate were better for PCNL. However, URS demonstrated a shorter length of stay and fewer adverse events. It was noted that these adverse events included three patients in the PCNL group who required transfusion, one who sustained an ileal injury and one a hydrothorax, which are serious events and may require further surgical intervention. Although the stone burden was similar in each arm, there were more staghorn calculi in the URS group (n=5 versus n=3) which may have impacted outcome in a small study. Additionally, a 22F access tract was used, which may have impacted on complication rate. The committee also noted that the risk of bias was very high due to concerns about randomisation, and that the evidence was indirect as the results of the study were reported in terms of renal unit, rather than number of participants. Therefore, this study did not conclusively demonstrate the optimum treatment modality for this patient group.

SWL versus PCNL

One non-randomised study suggested a benefit of PCNL in terms of stone-free state and retreatment, but a benefit of SWL in terms of length of stay. The committee noted that the evidence was very low quality. They agreed that the evidence was unconvincing and not sufficient to draw conclusions regarding the preferred treatment modality.

PCNL: Tubeless versus standard

Evidence for this comparison demonstrated that tubeless PCNL had fewer ancillary procedures, shorter length of stays and fewer minor adverse events. There was no benefit of tubeless over standard PCNL in terms of stone-free state and retreatment rate. The committee considered the evidence for this comparison, taking into account that all evidence came from 2 small RCTS of 23 and 60 participants. The committee also considered that for one of the studies it was unclear whether true randomisation had taken place, or whether group allocation was based on intraoperative factors.

Overall

The committee discussed that all the evidence for this population was low quality and based on a small number of studies with small numbers of participants, therefore they did not have confidence in the findings and agreed that they could not draw conclusions from the evidence. They considered usual practice for this population of larger stones, and noted that PCNL will usually be the most appropriate management. However, it was noted that PCNL is associated with more adverse events and may carry more risks compared to URS. Improvement in URS technology has led to increased use of this modality for this patient group. The committee also noted that some experts also consider SWL as first line management for this group. If undertaken, due consideration must be given to securing proximal drainage before commencing treatment. Therefore, the committee decided to make a recommendation based on current practice and clinical expertise, that PCNL, URS or SWL should be considered for this population, to allow clinicians to use clinical judgement and so as to not limit the options available.

Children and young people, renal stones, staghorn

No evidence was identified for this stratum. The committee discussed that as with the adult population, treatment of staghorn stones would be similar to the treatment of stones larger than 20 mm. The committee considered from their clinical experience that contrary to adult practice, SWL is used in current practise in the treatment of paediatric staghorn calculi. They considered that URS and PCNL are also used as part of standard practice. Therefore the committee made a consensus recommendation that PCNL, SWL or URS should be considered for this population, to allow for clinicians to use clinical judgement.

Overall

When considering the evidence for tubeless versus standard PCNL, the committee was aware that the studies were heterogeneous in terms of the type of tubeless PCNL that was used. For instance, it was noted that in some studies, tubeless was defined as neither a stent nor nephrostomy tube being placed at the end of the procedure, whereas in other studies tubeless was defined as a stent only being placed, and no nephrostomy tube. The committee considered this heterogeneity when discussing the evidence.

The committee recognised that across the strata, there was no strong evidence that SWL was superior to other surgical treatment options. When considering URS and PCNL, it was felt that URS may be more effective than PCNL in some populations; however, for many outcomes there was no clinical difference between the 2 interventions.

1.10.2 Cost effectiveness and resource use

No economic evidence was identified for this question. The costs of different surgical interventions were identified from the NHS reference costs data of 2016/17 and presented to the committee members. Significant unit costs variation between the different types of surgeries was highlighted; SWL has the lowest cost, £452 (day case), URS costing £2,172 (50% elective weighted average, and 50% day case weighted average to reflect UK practice) and PCNL £5,195 (elective weighted average). According to current practice, PCNL and URS are preferred for larger types of stones and SWL for smaller stone sizes, but PCNL is not preferred for ureteric stones. The most costly procedures (URS and PNCL) are more invasive as well, requiring higher resource use in terms of hospitalisation and the need for general anaesthesia compared to SWL that is a day case without the need of general anaesthesia (except for in children). Other resource use is also associated more with the invasive procedures for example stents are more commonly used after URS which adds further costs.

Data on retreatment rates favoured the more invasive procedures in the majority of the comparisons; therefore, the less invasive procedures with lower unit costs were shown to be associated with a higher need for retreatments. Hence, it was highlighted that there is the trade-off of an initially more inexpensive intervention (e.g. SWL) that could turn out costing

more due to the cost of additional interventions needed after the primary intervention, as SWL can require several sessions. Therefore, the committee discussed that outcomes such as retreatment or ancillary procedures have significant economic weight as potential areas where less expensive interventions can prove more costly.

Comparison: Ureteric stones in adults <10mm: URS versus SWL

A costing comparison was undertaken comparing a strategy starting with URS versus a strategy starting with SWL. The analysis is weighing up whether the initially cheaper intervention will ever be more costly than the alternative, once the additional resource use is considered.

Clinical review data was used for the probabilities of retreatment, ancillary procedures, readmission, and major and minor adverse events. Because of concerns about heterogeneity in the data, as well as differences in how stone free outcomes are being reported, and what it is possible to infer about the treatment pathway; multiple scenarios have been undertaken which are informed by different data and with differing assumptions. Although all scenarios are cost comparisons in the base case, some scenarios have QALY threshold or exploratory QALY work to infer the likelihood of the most expensive intervention being cost effective. More details in brief about each scenario and an overview of results are provided below. For full details of the costing work please see appendix 1.

The results showed that overall for all scenarios, there was a significant cost difference between the two strategies. In scenarios 1 and 2 there was a similar magnitude of cost difference of around £2,300. In other words; it would cost over an extra £2,000 for a patient to be stone free using a URS strategy than a SWL strategy. This was mainly being driven by the difference in primary intervention costs because URS is a much more expensive procedure. The incremental cost of scenario 3 was smaller than in the other scenarios (£1,212). This is because it is based only on the resource use of one study and costing up the pathway in that study where; there are many more ancillary procedures for SWL, and also the types of ancillary procedures are driving the results as they were more expensive for the SWL strategy e.g. some were PCNL.

Sensitivity analyses showed that the magnitude of the incremental cost was affected by factors such as the effectiveness of SWL, the type of secondary procedure, and the proportion using stents. The cost of an SWL session would have to be very high to make the comparators cost neutral. Some exploratory threshold analyses on QALYs and quality of life was also undertaken which showed that it is unlikely URS will be cost effective, as the base case showed that the quality of life difference needed between a stone free and non-stone free health state for URS to be cost effective would be outside the possible range on the EQ-5D. When this was tested by varying the effectiveness of SWL to lower levels, and varying the time between initial and further treatments, then quality of life differences were more possible, but still unlikely to be feasible given that the quality of life of someone with a stone is the average of the small ureteric stone population; with pain levels varying and being episodic. Therefore the quality of life gains calculated can only demonstrate potential cost effectiveness of URS, but are likely to be overestimates for a number of reasons. Overall the analysis demonstrated that the cost differences between URS and SWL are likely to be substantial even when testing various parameters, and exploratory QALY work showed that the gains in quality of life needed in those individuals stone free from the more effective treatment, was beyond feasible values.

The analysis has limitations in terms of assumptions made, possible underestimation of resource use, and in some cases very few data sources that make the inputs potentially uncertain. Additionally, the QALY work is exploratory and assumption based. There also may be factors omitted such as the risk of obstruction from a ureteric stone. However there was extensive sensitivity analysis and results were strongly in favour of SWL.

The committee agreed that it did not come as a surprise that an intervention that was much cheaper would provide savings overall, even when other trade-offs like more retreatments are considered. The committee agreed overall that there are likely to be savings from using SWL rather than URS in people with ureteric stones of this size, but there may be some implementation costs that might mean these savings are achieved in the longer term.

There was however some concern around the risk of obstruction with ureteric stones. It was not possible to quantify what this might be, but the committee were concerned that treatment with SWL, which is known to be less effective may mean a long period of treatment for some individuals which could be putting the kidney at risk. A long discussion was had around implementation of SWL. There are likely to be many options for implementation e.g. having good referral systems may mean additional machines are not needed. Alternatively more investment in mobile lithotripters could be one option rather than needing fixed site lithotripters in all hospitals (or regions) (however the effectiveness between mobile and fixed can differ which has not been addressed here). Other resources may be affected however such as more staff being needed to undertake SWL (e.g. ultrasonographers) to meet the demand of the machines being used. Additional training to maximise effectiveness of lithotripsy may also be needed. Increases in staffing can also provide benefits to other areas of the NHS as it is likely that not all their time will be spent with this population specifically and so other areas may also benefit. The cost of SWL itself from NHS reference costs include costs on a full absorption basis, which means that the purchase and running costs are included in the cost per procedure that is reported. If SWL was more widely available then without adequate numbers of people using them (in say rural areas) that may well drive up the average in NHS reference costs. On the other hand, if resources are allocated in a way that ensures machines are used to more of their capacity (e.g. if patients travel) then this could drive the cost of SWL down as the costs are spread over more people. In summary, the implementation costs are difficult to predict, but based on these being included in NHS reference costs (except for other factors affected like staff), the committee agreed there are likely to be long term savings and they recommended SWL as a first line treatment.

If SWL was more available, then the committee agreed with the results of the model that this provided a better balance of benefits and costs, and a recommendation was made to offer SWL in this group. URS was considered for certain groups where SWL was either contraindicated or had other reasons for being a less viable option such as the patient having failed a course of SWL before; as patients tend to form the same types of stones and this would be a predictor of success.

Comparison: Renal stones in adults <10 mm: URS vs SWL

Cost offset calculations were undertaken for this group only incorporating the cost of the initial interventions, and retreatment and ancillary procedures. The definition here of a cost offset is; the difference in initial intervention costs traded off against the difference in downstream resource use of retreatments and ancillary procedures. A range of scenarios were undertaken varying what the ancillary procedure might be. Additionally, exploratory work around the feasibility of cost effectiveness was also undertaken for these simpler calculations.

Results showed a range of cost offsets from £988 to £1,537, depending on the ancillary assumptions made. The main difference in cost is again from the difference in primary procedure costs. The main conclusion being that the initial costs are being offset very little by downstream resource use. Exploratory QALY calculations showed that QoL differences may be possible with longer timeframes between treatments, but again these are likely to be overestimates given that small renal stones have a smaller QoL impact than ureteric stones.

Access to BAUS SWL snapshot audit data was also obtained and the data analysed for people with renal stones <10mm (101 patients) to find the cost of an SWL strategy using real data. Costing up the average number of sessions, as well as the resource use from the subsequent management decided at 3 months, led to an overall cost of around £1,300 per

person. Therefore there would still be a large cost difference with URS as that would cost at least the cost of the procedure itself (i.e. over £2,200).

The committee agreed that for renal stones <10mm, SWL offers a better balance of benefits and costs, and current practice is also that SWL would mainly be used for these stones. Therefore a recommendation was made to offer SWL to this groups of patients. There may however be some exceptions to this such as when SWL in contraindicated (for reasons such a pregnancy), or a course of SWL has failed before, or if there are anatomical considerations for example multiple stones that are not in the same location.

There was limited clinical evidence for PCNL, and current practice is that this sometimes has a place as a treatment for this group, therefore PCNL was considered as a third line treatment if URS and SWL have been unsuccessful.

Comparison: Renal stones in adults 10-20 mm: PCNL vs URS vs SWL

Two pairwise comparisons were compared here of PCNL vs URS, and URS vs SWL in simple cost offset calculations. Similar to the method above, as well as analysis of BAUS SWL snapshot data for this size stone group.

Cost offset calculations showed that PCNL had a cost offset of nearly £3,000 versus URS, and is therefore very unlikely to be cost effective given that the effectiveness of the two interventions was similar.

URS vs SWL showed a similar result to that of the small renal stone analysis with cost offsets ranging from £836 to £1,391.

Costing up resource use from the BAUS audit data showed that people had on average 2.2 sessions of SWL, and this led to a 35% effectiveness at 3 months. This is lower than the smaller renal stone group. Costing up the average number of sessions as well as the resource use from the subsequent management decided at 3 months led to an overall cost of around £1,600 per person. This again confirms that even with low levels of effectiveness for SWL, it is still a lower cost strategy than URS. However, this incremental difference may be smaller than for the smaller stone groups (renal or ureteric) because SWL effectiveness is lower in this group. Then whether this cost difference can be justified by the additional benefit from URS remains uncertain and depends on many factors which are unknown such as the quality of life from living with a stone of this size and location.

The committee acknowledged that PCNL is unlikely to be a cost effective alternative compared too URS as the effectiveness is similar and therefore the additional benefit will not justify the large cost difference. PCNL was therefore added as a consider recommendation if other treatment has failed.

With regards to the choice between SWL or URS: It was discussed that SWL could be cost effective in this group, as once again it was shown that this is likely to be a lower cost strategy than URS, and benefits may not justify the additional cost of URS, although this is uncertain and was difficult to explore without being able to quantify the health outcomes. The committee were reluctant to have SWL as a first line treatment for this size of stone, because whilst SWL may offer a better balance of benefits and costs, there are also risks with larger stones that have not been quantified. The effectiveness of SWL can vary widely depending on the size of the stone. The committee felt that strata of stone size per 10mm was perhaps too wide to capture these nuances that impact treatment choice in practice. Although the ureteric <10mm economic analysis had showed that varying effectiveness of SWL to low levels (as well as varying time between treatments) did allow for some possible quality of life differences, it was still dependent on many caveats whether these would be feasible. The committee opinion was that as the strata is wide, then a 11mm stone may well be a candidate for SWL, whereas a 19mm stone for example is likely to have a much lower SWL success rate. Therefore both SWL and URS would be choices in practice depending on many factors including stone size. Overall, the committee felt that a recommendation to

consider URS or SWL would allow flexibility for clinicians in choosing a treatment option, and would not preclude SWL from being used.

This could have a change in practice as PCNL is used in these size stones, so there may be a saving from using other interventions instead.

A discussion on the economic perspective for the other patients subgroups where no economic analysis was undertaken can be found below;

Ureteric stones in adults 10 to 20mm:

For ureteric stones 10-20mm; SWL versus URS; The review of clinical data showed that SWL is associated with lower stone-free states, more retreatments and ancillary procedures, but it had fewer adverse events. SWL intervention costs are significantly lower compared to URS, but there is more downstream resource use for SWL which would add to the cost of an SWL treatment strategy. We may be able to extrapolate from the costing analysis undertaken for the adult ureteric stones of <10mm which showed that even when considering retreatments and ancillary procedures, there is still a large cost difference per person between the two interventions. There is however likely to be more of a quality of life impact from having a larger ureteric stone compared to a smaller one, meaning that there may be more benefit from URS than was demonstrated in the economic analysis for those with stones <10mm. After discussion with the committee, the consensus was that even if SWL was cost effective compared to URS, there were safety concerns because of the risk of obstruction with a larger ureteric stone, and so the population was not comparable to that of smaller ureteric stones. The safety concern stems from the fact that following an obstruction, the kidney can lose function within 6 weeks. Obstruction associated with sepsis can be associated with high morbidity or death. Therefore treatment should be undertaken as soon as possible for a ureteric stone particularly of this size. As SWL is a less effective treatment, the time between sessions will add to the total time to stone clearance, and this is a safety concern because it increases the risk of a persisting obstruction. This risk is difficult to quantify because some obstructed patients may be excluded from trials and patients in clinical trials may be more closely monitored than some in real-life practice. Therefore the committee felt the clinical review has not captured the risks that they would be concerned about in practice and it was also not possible to include this risk in the economic analysis for those with stones <10mm.

The committee felt that URS should be offered as a first line treatment for stones of this type and size because of their safety concerns. There were also felt to be other reasons as to why URS would be a first choice and this is dependent on patient factors such as URS being more appropriate for recurrent stone formers. However the committee felt that a consider recommendation should be made for SWL so that clinicians would not be precluded from using it, as availability may well increase given that it has been recommended for other populations, and felt that making a consider recommendation would acknowledge that and allow for future use and as a possible intervention choice where it is available and clinically appropriate. A caveat was added of considering SWL if local facilities allow up to 2 SWL sessions within 4 weeks of the decision to treat, to ensure that treatment and close follow up is done in a timely way.

URS or RIRS versus PCNL, in ureteric stones 10-20mm; The data favoured PCNL in all outcomes apart from major adverse events for which there was no clinical difference (although there will still be a difference in resource use) between the groups, and the committee members highlighted that the reported adverse event rate was lower than expected based on their clinical experience. URS, which is the less costly intervention, is associated with higher retreatment and ancillary procedure rates that would add to the overall cost of the intervention, but it would be unlikely that the total cost of URS would ever overtake that of PCNL, as PCNL is over twice as costly. The effectiveness was also not too dissimilar and therefore it is unlikely there would be adequate benefit to justify the additional cost. The committee noted that in current UK practice, it is unusual to perform PCNL for a

ureteric stone, however it might be considered for a large impacted ureteric stone. The studies included for this comparison were a mix of populations some of which had impacted/obstructed stones but were proximal stones. The committee therefore decided to make recommendations in line with current practice and offer URS, but also to consider PCNL in people with impacted proximal stones.

Renal stones in adults >20mm

For renal stones more than 20mm there was data from one study comparing SWL to PCNL. PCNL is about 10 times more expensive than SWL. The review found SWL was much less effective. SWL is generally not used for stones of this size. The committee felt there was not enough evidence to inform the comparative effectiveness of these interventions in this group.

There was also evidence comparing URS to PCNL. These interventions are closer in cost but there is still a substantial difference. Effectiveness and retreatment rates were quite similar. There was shorter length of stay for URS and also fewer adverse events. Given there is not much difference in effectiveness and also other outcomes signalling lower resource use for URS, the evidence implies URS is likely to be a dominant intervention versus PCNL. The committee discussed the evidence and also their clinical experience that PCNL is usually used for renal stones of this size in current practice. URS also, in the committees experience (and their knowledge of some audit data that exists), is less effective than PCNL and has longer operating time, with the likely need for a stent to be placed (and then later removed, which would add to the cost of the procedure) and generally more residual fragments remaining so more need for retreatment. Therefore, the committee opinion was that the clinical review was not reflective of their experience. Because of the committee's concerns around the quality and applicability of the evidence, they were not confident in changing practice, and decided to recommend current practice of PCNL. This is also likely to be a very small population.

There may be circumstances in which URS is the most appropriate procedure such as in patents less suitable for PCNL for example those who are more complex medically or have comorbidities, and a recommendation was made to consider URS in those cases.

There was also some data on within surgery comparisons; such as tubeless versus conventional PCNL and supine versus prone position of PCNL, showing that tubeless had less pain and shorter length of stay, and length of stay also favouring supine. Mini versus standard PCNL was also compared with length of stay favouring mini and adverse events favouring standard. There were no differences in other outcomes. The GC consensus after discussion was that there should be clinician judgement and did not recommend particular methods for within surgery comparisons.

Children

There was less data in children than in adults. There are also other considerations for children because they will have general anaesthetic when having an SWL for example, unlike adults. This is likely to make the procedure more expensive than for adults as it may also require an inpatient stay. There are no paediatric costs specifically for SWL. If SWL's have to be repeated then this can lead to higher risks and also be an unfavourable choice for children.

In ureteric stones of less than 10mm, only one study was identified which favoured URS for effectiveness by a substantial amount. The lack of evidence however meant that the GC did not feel confident recommending only URS. However it may be similar to the adults in that URS may not be cost effective because it is much more expensive. Cost effectiveness remains uncertain as clinical data was limited, and so the committee decided to recommend both URS and SWL in this group. Availability and skills are also a factor when it comes to which treatment is decided for children.

There was also some evidence for children in renal stones of between 10 and 20 mm comparing SWL with URS, SWL with PCNL, and URS with PCNL (some of this evidence for children was non-randomised). SWL was found to be less effective (in terms of stone free) than URS and PCNL. URS was found to be more effective than PCNL. These pairwise comparisons were from individual studies. PCNL is considered to be a much riskier procedure for children than for adults, but there are times when that is felt to be the best clinical option. Therefore the committee decided to recommend all treatment options for children in this group.

A final group where there was evidence for children was in renal stones more than 20mm. URS was compared to PCNL, and found that PCNL is more effective and requires fewer retreatments, but has a longer hospital stay and more adverse events. SWL was also compared to PCNL, and PCNL was more effective. These were gain single studies. The committee discussed how generally PCNL is used for larger stones, but given the child population and the risks that might be involved, if this is performed it should be performed in specialist centres with the appropriate expertise. The committee recommended all 3 interventions in this group, leaving it to clinician judgement.

Children are a much smaller population, so any recommendations are not likely to have a resource impact, and generally recommendations were made to consider all treatment options that would be clinical alternatives for a particular stone size/location, to give clinicians flexibility.

The committee also made recommendations about watchful waiting for asymptomatic stones, as the surgery recommendations are for symptomatic stones. Although it might be argued that intervening in an asymptomatic stone would have no benefit if the stone is not impacting quality of life, there may be cases where there is benefit to treatment for example, the stone may be in a position where it is likely to move and cause symptoms or adverse events. A management approach should be in discussion with the patient and also dependent on the size of the stone.

1.10.3 Other factors the committee took into account

The committee discussed that there was only 1 UK study, and the majority of the evidence came from studies based in countries such as Turkey, Iran and China and therefore may not reflect current practice in the UK. It was noted that in some countries, URS is not routinely performed, which may impact surgical skill and expertise and not reflect the expertise and experience of surgeons in the UK. It was also noted that the type of stones might be different in these countries compared to the UK; therefore, the included studies may also not reflect a UK population. The committee further noted that in the UK, URS is performed as a day case procedure in 50% of cases, whereas in other countries it more often requires an overnight stay. Therefore, in the UK URS is likely to lead to a shorter hospital stay than the evidence suggests. The committee noted that taking all this into account, the benefit of SWL over URS reduces.

The committee was aware that different surgical treatments would inherently have different retreatment rates and different length of stay. For instance, the committee noted that SWL would generally have multiple sessions within a treatment cycle and is usually performed as a day procedure, whereas URS and PCNL are more likely to require an overnight stay. The committee took these differences in practice into account when considering the evidence.

The committee discussed that when considering the outcome ancillary procedures, many studies don't include stent removal, despite the fact that this often has implications for the person, such as further outpatient attendance and procedures to remove the stent.

The committee also discussed that there was variation in the studies in terms of the follow up period, and for many studies it was unclear if the stone-free state was reported after the

initial treatment, or after retreatments and/or ancillary procedures. The committee took this limitation into consideration when making recommendations.

When considering the URS versus PCNL comparison, the committee noted that in current UK practice it is unusual to perform PCNL for a ureteric stone. The committee considered the evidence for this comparison within the ureteric strata and discussed the potential reasons for this, as well as the impact of different practices in other countries. The committee concluded that this practice may not be relevant to the UK and therefore should not be adopted based on the evidence in this review.

The committee noted that all evidence in the paediatric population was underpowered and often came from small, single RCTs. It was also noted that due to the lack of RCT evidence for some populations, cohort studies were searched for, and three were included in the review. The committee discussed the lack of RCT and cohort evidence available in this population and was aware of audit data, which have demonstrated a trend for increased use of URS, a decline in SWL with PCNL reserved for large renal stones and those anatomically difficult to reach using other modalities. A trend towards smaller instruments was also noted. Therefore, when making recommendations for the paediatric population, the committee extrapolated from other strata, where appropriate, or based recommendations on clinical expertise and experience.

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Appendices

Appendix A: Review protocols

Table 33: Review protocol: What are the most clinically and cost-effective surgical treatment options for people with renal or ureteric stones?

Field	Content
Review question	What are the most clinically and cost-effective surgical treatment options for people with renal or ureteric stones?
Type of review question	Intervention review A review of health economic evidence related to the same review question was conducted in parallel with this review. For details, see the health economic review protocol for this NICE guideline.
Objective of the review	To find the most effective surgical treatment in people with renal and ureteric stones Key issues and questions from the scope: 3 Surgical intervention for symptomatic renal and ureteric stones 3.2 What are the most clinically and cost-effective options for surgical treatment of symptomatic renal or ureteric stones? 4 Managing asymptomatic renal and ureteric stones 4.1 What is the most clinically and cost-effective management (surgical and non-surgical) of asymptomatic renal and ureteric stones?
Eligibility criteria – population / disease / condition / issue / domain	People (adults, children and young people) with symptomatic and asymptomatic renal or ureteric stones
Eligibility criteria – intervention(s) / exposure(s) / prognostic factor(s)	Shock wave lithotripsy (SWL) Ureteroscopy (URS) or retrograde intrarenal surgery (RIRS) Percutaneous nephrolithotomy (PCNL)
Eligibility criteria – comparator(s) / control or reference (gold) standard	Compared to: • Each other (even within the same intervention) • Non-surgical treatment conservative treatment
Outcomes and prioritisation	Critical outcomes: • Stone free state (including insignificant residual fragment) • Recurrence • Use of healthcare services (including length of stay, readmission, retreatment or ancillary procedure) • Kidney function • Quality of life (any validated scale) • Major adverse events (infective complications [sepsis, obstructive pyelonephritis], ureteric injury [ureteral damage, ureteral perforation, ureteral stricture], mortality) • Minor adverse events (infective complications [UTI, fever, infection], ureteric injury [extravasation, submucosal dissection], haemorrhage [any bleeding, transfusion]) • Failure to treat (inaccessible stone, stone not seen/reached) Important outcomes: • Pain (visual analogue scale)
Eligibility criteria – study design	Randomised controlled trials (RCTs), systematic reviews of RCTs. If no RCT evidence is available, search for observational studies for children

Other inclusion exclusion criteria	• Bladder stones • Open surgery for renal (kidney and ureteric) stones • Laparoscopic nephrolithotomy and pyelolithotomy • Non-English language studies

Proposed sensitivity / subgroup analysis, or meta-regression	Strata:
	• Population
	  ○ Adults (≥16 years)
	  ○ Children and young people (<16 years)
	• Stone size:
	  ○ <10 mm
	  ○ 10-20 mm
	  ○ >20 mm
	  ○ staghorn
	• Stone site (not lower/upper pole):
	  ○ Renal stone
	  ○ Ureteric stone
	Subgroups:
	• Pregnant women
	• Lower/non-lower kidney pole
	• Upper/lower ureteric stones
	• Stone composition/hounsfield units
	• Obesity /skin-to-stone distance
	• Neuropathic/ cerebral-palsy /immobility
	• Symptomatic
	  ○ Symptomatic
	  ○ Asymptomatic

Selection process – duplicate screening / selection / analysis	Studies are sifted by title and abstract. Potentially significant publications obtained in full text are then assessed against the inclusion criteria specified in this protocol.
Data management (software)	• Pairwise meta-analyses were performed using Cochrane Review Manager (RevMan5). • GRADEpro was used to assess the quality of evidence for each outcome. • Endnote for bibliography, citations, sifting and reference management • Data extractions performed using EviBase, a platform designed and maintained by the National Guideline Centre (NGC)
Information sources – databases and dates	Clinical search databases to be used: Medline, Embase, Cochrane Library Date: all years Health economics search databases to be used: Medline, Embase, NHSEED, HTA Date: Medline, Embase from 2014 NHSEED, HTA – all years Language: Restrict to English only Supplementary search techniques: backward citation searching Key papers: Not known
Identify if an update	Not applicable

Author contacts	https://www.nice.org.uk/guidance/indevelopment/gid-ng10033
Highlight if amendment to previous protocol	For details, please see section 4.5 of Developing NICE guidelines: the manual.
Search strategy – for one database	For details please see appendix B
Data collection process – forms / duplicate	A standardised evidence table format will be used, and published as appendix D of the evidence report.
Data items – define all variables to be collected	For details, please see evidence tables in Appendix D (clinical evidence tables) or H (health economic evidence tables).
Methods for assessing bias at outcome / study level	Standard study checklists were used to critically appraise individual studies. For details please see section 6.2 of Developing NICE guidelines: the manual The risk of bias across all available evidence was evaluated for each outcome using an adaptation of the 'Grading of Recommendations Assessment, Development and Evaluation (GRADE) toolbox' developed by the international GRADE working group http://www.gradeworkinggroup.org/
Criteria for quantitative synthesis	For details, please see section 6.4 of Developing NICE guidelines: the manual.
Methods for quantitative analysis – combining studies and exploring (in)consistency	For details, please see the separate Methods report for this guideline.
Meta-bias assessment – publication bias, selective reporting bias	For details, please see section 6.2 of Developing NICE guidelines: the manual. [Consider exploring publication bias for review questions where it may be more common, such as pharmacological questions, certain disease areas, etc. Describe any steps taken to mitigate against publication bias, such as examining trial registries.]
Confidence in cumulative evidence	For details, please see sections 6.4 and 9.1 of Developing NICE guidelines: the manual. [Explain rationale and alternative methods if not using GRADE approach]
Rationale / context – what is known	For details, please see the introduction to the evidence review.
Describe contributions of authors and guarantor	A multidisciplinary committee developed the evidence review. The committee was convened by the National Guideline Centre (NGC) and chaired by Andrew Dickinsonin line with section 3 of Developing NICE guidelines: the manual. Staff from NGC undertook systematic literature searches, appraised the evidence, conducted meta-analysis and cost-effectiveness analysis where appropriate, and drafted the evidence review in collaboration with the committee. For details, please see Developing NICE guidelines: the manual.
Sources of funding / support	NGC is funded by NICE and hosted by the Royal College of Physicians.
Name of sponsor	NGC is funded by NICE and hosted by the Royal College of Physicians.
Roles of sponsor	NICE funds NGC to develop guidelines for those working in the NHS, public health and social care in England.
PROSPERO registration number	Not registered

Table 34: Health economic review protocol

Review question	All questions – health economic evidence
Objectives	To identify economic studies relevant to any of the review questions.
Search criteria	• Populations, interventions and comparators must be as specified in the individual review protocol above. • Studies must be of a relevant economic study design (cost-utility analysis, cost-effectiveness analysis, cost-benefit analysis, cost-consequences analysis, comparative cost analysis). • Studies must not be a letter, editorial or commentary, or a review of economic evaluations. (Recent reviews will be ordered although not reviewed. The bibliographies will be checked for relevant studies, which will then be ordered.) • Unpublished reports will not be considered unless submitted as part of a call for evidence. • Studies must be in English.
Search strategy	An economic study search will be undertaken using population-specific terms and an economic study filter – see Appendix G *[in the Full guideline]*.
Review strategy	Studies not meeting any of the search criteria above will be excluded. Studies published before 2002, abstract-only studies and studies from non-OECD countries or the USA will also be excluded. Each remaining study will be assessed for applicability and methodological limitations using the NICE economic evaluation checklist which can be found in Appendix G of the 2014 NICE guidelines manual.[168] **Inclusion and exclusion criteria** • If a study is rated as both 'Directly applicable' and with 'Minor limitations' then it will be included in the guideline. An economic evidence table will be completed and it will be included in the economic evidence profile. • If a study is rated as either 'Not applicable' or with 'Very serious limitations' then it will usually be excluded from the guideline. If it is excluded then an economic evidence table will not be completed and it will not be included in the economic evidence profile. • If a study is rated as 'Partially applicable', with 'Potentially serious limitations' or both then there is discretion over whether it should be included. **Where there is discretion** The health economist will make a decision based on the relative applicability and quality of the available evidence for that question, in discussion with the Committee if required. The ultimate aim is to include economic studies that are helpful for decision-making in the context of the guideline and the current NHS setting. If several studies are considered of sufficiently high applicability and methodological quality that they could all be included, then the health economist, in discussion with the Committee if required, may decide to include only the most applicable studies and to selectively exclude the remaining studies. All studies excluded on the basis of applicability or methodological limitations will be listed with explanation as excluded economic studies in Appendix M. The health economist will be guided by the following hierarchies. *Setting:* • UK NHS (most applicable). • OECD countries with predominantly public health insurance systems (for example, France, Germany, Sweden).

	• OECD countries with predominantly private health insurance systems (for example, Switzerland). • Studies set in non-OECD countries or in the USA will have been excluded before being assessed for applicability and methodological limitations. *Economic study type:* • Cost-utility analysis (most applicable). • Other type of full economic evaluation (cost-benefit analysis, cost-effectiveness analysis, cost-consequences analysis). • Comparative cost analysis. • Non-comparative cost analyses including cost-of-illness studies will have been excluded before being assessed for applicability and methodological limitations. *Year of analysis:* • The more recent the study, the more applicable it will be. • Studies published in 2002 or later but that depend on unit costs and resource data entirely or predominantly from before 2002 will be rated as 'Not applicable'. • Studies published before 2002 will have been excluded before being assessed for applicability and methodological limitations. *Quality and relevance of effectiveness data used in the economic analysis:* • The more closely the clinical effectiveness data used in the economic analysis matches with the outcomes of the studies included in the clinical review the more useful the analysis will be for decision-making in the guideline.

Appendix B: Literature search strategies

The literature searches for this review are detailed below and complied with the methodology outlined in Developing NICE guidelines: the manual 2014, updated 2017 https://www.nice.org.uk/guidance/pmg20/resources/developing-nice-guidelines-the-manual-pdf-72286708700869

For more detailed information, please see the Methodology Review. [Add cross reference]

B.1 Clinical search literature search strategy

Searches were constructed using a PICO framework where population (P) terms were combined with Intervention (I) and in some cases Comparison (C) terms. Outcomes (O) are rarely used in search strategies for interventions as these concepts may not be well described in title, abstract or indexes and therefore difficult to retrieve. Search filters were applied to the search where appropriate.

Table 35: Database date parameters and filters used

Database	Dates searched	Search filter used
Medline (OVID)	1946 – 21 March 2018	Exclusions Randomised controlled trials Systematic review studies Observational studies
Embase (OVID)	1974 – 21 March 2018	Exclusions Randomised controlled trials Systematic review studies Observational studies
The Cochrane Library (Wiley)	Cochrane Reviews to 2018 Issue 3 of 12 CENTRAL to 2018 Issue 2 of 12	None

Database	Dates searched	Search filter used
	DARE, and NHSEED to 2015 Issue 2 of 4 HTA to 2016 Issue 4 of 4	

1 **Medline (Ovid) search terms**

1.	exp urolithiasis/
2.	(nephrolitiasis or nephrolith or nephroliths or urolithias?s or ureterolithias?s).ti,ab.
3.	((renal or kidney* or urinary or ureter* or urethra*) adj3 (stone* or calculi or calculus or calculosis or lithiasis or c?olic*)).ti,ab.
4.	stone disease*.ti,ab.
5.	((calculi or calculus or calcium oxalate or cystine) adj3 (crystal* or stone* or lithiasis)).ti,ab.
6.	or/1-5
7.	letter/
8.	editorial/
9.	news/
10.	exp historical article/
11.	Anecdotes as Topic/
12.	comment/
13.	case report/
14.	(letter or comment*).ti.
15.	or/7-14
16.	randomized controlled trial/ or random*.ti,ab.
17.	15 not 16
18.	animals/ not humans/
19.	exp Animals, Laboratory/
20.	exp Animal Experimentation/
21.	exp Models, Animal/
22.	exp Rodentia/
23.	(rat or rats or mouse or mice).ti.
24.	or/17-23
25.	6 not 24
26.	limit 25 to English language
27.	exp Lithotripsy/
28.	Lithotripsy, Laser/
29.	Lithotripsy.ti,ab.
30.	Litholapaxy.ti,ab.
31.	High-Energy Shock Waves/
32.	(shockwave* or shock wave* or sound wave* or soundwave*).ti,ab.
33.	HESW.ti,ab.
34.	ESWL.ti,ab.
35.	(electrotherap* or electro therap* or extracorporeal or extra corporeal).ti,ab.
36.	(ultra sound* or ultrasound* or ultrasonic* or ultra sonic*).ti,ab.
37.	(Holmium or Ho:YAG).ti,ab.
38.	((fiber or fibre) adj2 laser).ti,ab.

39.	Ureteroscopy/
40.	Ureteroscopes/
41.	Ureteroscop*.ti,ab.
42.	nephroscop*.ti,ab.
43.	renoscop*.ti,ab.
44.	(ureterorenoscop* or uretero renoscop*).ti,ab.
45.	(nephrolithotom* or nephrostom*).ti,ab.
46.	PCNL.ti,ab.
47.	((intrarenal or intra renal) adj2 surger*).ti,ab.
48.	RIRS.ti,ab.
49.	or/27-48
50.	26 and 49
51.	randomized controlled trial.pt.
52.	controlled clinical trial.pt.
53.	randomi#ed.ti,ab.
54.	placebo.ab.
55.	randomly.ti,ab.
56.	Clinical Trials as topic.sh.
57.	trial.ti.
58.	or/51-57
59.	Meta-Analysis/
60.	exp Meta-Analysis as Topic/
61.	(meta analy* or metanaly* or metaanaly* or meta regression).ti,ab.
62.	((systematic* or evidence*) adj3 (review* or overview*)).ti,ab.
63.	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.
64.	(search strategy or search criteria or systematic search or study selection or data extraction).ab.
65.	(search* adj4 literature).ab.
66.	(medline or pubmed or cochrane or embase or psychlit or psyclit or psychinfo or psycinfo or cinahl or science citation index or bids or cancerlit).ab.
67.	cochrane.jw.
68.	((multiple treatment* or indirect or mixed) adj2 comparison*).ti,ab.
69.	or/59-68
70.	Epidemiologic studies/
71.	Observational study/
72.	exp Cohort studies/
73.	(cohort adj (study or studies or analys* or data)).ti,ab.
74.	((follow up or observational or uncontrolled or non randomi#ed or epidemiologic*) adj (study or studies or data)).ti,ab.
75.	((longitudinal or retrospective or prospective or cross sectional) and (study or studies or review or analys* or cohort* or data)).ti,ab.
76.	Controlled Before-After Studies/
77.	Historically Controlled Study/
78.	Interrupted Time Series Analysis/
79.	(before adj2 after adj2 (study or studies or data)).ti,ab.
80.	or/70-79

81.	exp case control study/
82.	case control*.ti,ab.
83.	or/81-82
84.	80 or 83
85.	Cross-sectional studies/
86.	(cross sectional and (study or studies or review or analys* or cohort* or data)).ti,ab.
87.	or/85-86
88.	80 or 87
89.	80 or 83 or 87
90.	50 and (58 or 69)
91.	50 and 89
92.	91 not 90

1 **Embase (Ovid) search terms**

1.	exp urolithiasis/
2.	(nephrolitiasis or nephrolith or nephroliths or urolithias?s or ureterolithias?s).ti,ab.
3.	((renal or kidney* or urinary or ureter* or urethra*) adj3 (stone* or calculi or calculus or calculosis or lithiasis or c?olic*)).ti,ab.
4.	stone disease*.ti,ab.
5.	((calculi or calculus or calcium oxalate or cystine) adj3 (crystal* or stone* or lithiasis)).ti,ab.
6.	or/1-5
7.	letter.pt. or letter/
8.	note.pt.
9.	editorial.pt.
10.	case report/ or case study/
11.	(letter or comment*).ti.
12.	or/7-11
13.	randomized controlled trial/ or random*.ti,ab.
14.	12 not 13
15.	animal/ not human/
16.	nonhuman/
17.	exp Animal Experiment/
18.	exp Experimental Animal/
19.	animal model/
20.	exp Rodent/
21.	(rat or rats or mouse or mice).ti.
22.	or/14-21
23.	6 not 22
24.	limit 23 to English language
25.	exp lithotripsy/
26.	laser lithotripsy/
27.	lithotripsy.ti,ab.
28.	litholapaxy.ti,ab.
29.	(shockwave* or shock wave* or sound wave* or soundwave*).ti,ab.
30.	HESW.ti,ab.

31.	ESWL.ti,ab.
32.	(electrotherap* or electro therap* or extracorporeal or extra corporeal).ti,ab.
33.	ultrasonic lithotripsy/
34.	(ultra sound* or ultrasound* or ultrasonic* or ultra sonic*).ti,ab.
35.	(Holmium or Ho:YAG).ti,ab.
36.	((fiber or fibre) adj2 laser).ti,ab.
37.	ureteroscopy/
38.	exp ureteroscope/
39.	ureteroscop*.ti,ab.
40.	nephroscop*.ti,ab.
41.	renoscop*.ti,ab.
42.	(ureterorenoscop* or uretero renoscop*).ti,ab.
43.	(nephrolithotom* or nephrostom*).ti,ab.
44.	PCNL.ti,ab.
45.	((intrarenal or intra renal) adj2 surger*).ti,ab.
46.	RIRS.ti,ab.
47.	or/25-46
48.	24 and 47
49.	random*.ti,ab.
50.	factorial*.ti,ab.
51.	(crossover* or cross over*).ti,ab.
52.	((doubl* or singl*) adj blind*).ti,ab.
53.	(assign* or allocat* or volunteer* or placebo*).ti,ab.
54.	crossover procedure/
55.	single blind procedure/
56.	randomized controlled trial/
57.	double blind procedure/
58.	or/49-57
59.	systematic review/
60.	meta-analysis/
61.	(meta analy* or metanaly* or metaanaly* or meta regression).ti,ab.
62.	((systematic* or evidence*) adj3 (review* or overview*)).ti,ab.
63.	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.
64.	(search strategy or search criteria or systematic search or study selection or data extraction).ab.
65.	(search* adj4 literature).ab.
66.	(medline or pubmed or cochrane or embase or psychlit or psyclit or psychinfo or psycinfo or cinahl or science citation index or bids or cancerlit).ab.
67.	cochrane.jw.
68.	((multiple treatment* or indirect or mixed) adj2 comparison*).ti,ab.
69.	or/59-68
70.	Clinical study/
71.	Observational study/
72.	family study/
73.	longitudinal study/

74.	retrospective study/
75.	prospective study/
76.	cohort analysis/
77.	follow-up/
78.	cohort*.ti,ab.
79.	77 and 78
80.	(cohort adj (study or studies or analys* or data)).ti,ab.
81.	((follow up or observational or uncontrolled or non randomi#ed or epidemiologic*) adj (study or studies or data)).ti,ab.
82.	((longitudinal or retrospective or prospective or cross sectional) and (study or studies or review or analys* or cohort* or data)).ti,ab.
83.	(before adj2 after adj2 (study or studies or data)).ti,ab.
84.	or/70-76,79-83
85.	exp case control study/
86.	case control*.ti,ab.
87.	or/85-86
88.	84 or 87
89.	cross-sectional study/
90.	(cross sectional and (study or studies or review or analys* or cohort* or data)).ti,ab.
91.	or/89-90
92.	84 or 91
93.	84 or 87 or 91
94.	58 or 69
95.	48 and 94
96.	48 and 93
97.	96 not 95

1 **Cochrane Library (Wiley) search terms**

#1.	MeSH descriptor: [Urolithiasis] explode all trees
#2.	(nephrolitiasis or nephrolith or nephroliths or urolithias?s or ureterolithias?s):ti,ab
#3.	((renal or kidney* or urinary or ureter* or urethra*) near/3 (stone* or calculi or calculus or calculosis or lithiasis or c?olic*)):ti,ab
#4.	stone disease*:ti,ab
#5.	((calculi or calculus or calcium oxalate or cystine) near/3 (crystal* or stone* or lithiasis)):ti,ab
#6.	(or #1-#5)
#7.	MeSH descriptor: [Lithotripsy] explode all trees
#8.	MeSH descriptor: [Lithotripsy, Laser] explode all trees
#9.	Lithotripsy:ti,ab
#10.	Litholapaxy:ti,ab
#11.	MeSH descriptor: [High-Energy Shock Waves] explode all trees
#12.	(shockwave* or shock wave* or sound wave* or soundwave*):ti,ab
#13.	HESW:ti,ab
#14.	ESWL:ti,ab
#15.	(electrotherap* or electro therap* or extracorporeal or extra corporeal):ti,ab
#16.	(ultra sound* or ultrasound* or ultrasonic* or ultra sonic*):ti,ab
#17.	(Holmium or Ho YAG):ti,ab

#18.	((fiber or fibre) near/2 laser):ti,ab
#19.	MeSH descriptor: [Ureteroscopy] explode all trees
#20.	MeSH descriptor: [Ureteroscopes] explode all trees
#21.	Ureteroscop*:ti,ab
#22.	nephroscop*.ti,ab.
#23.	Renoscop:ti,ab
#24.	(ureterorenoscop* or uretero renoscop*):ti,ab
#25.	(nephrolithotom* or nephrostom*):ti,ab
#26.	PCNL:ti,ab
#27.	(intrarenal or intra renal) near/2 surger*:ti,ab
#28.	RIRS:ti,ab
#29.	(or #7-#28)
#30.	#6 and #29

B.2 Health Economics literature search strategy

Health economic evidence was identified by conducting a broad search relating to renal and ureteric stones population in NHS Economic Evaluation Database (NHS EED – this ceased to be updated after March 2015) and the Health Technology Assessment database (HTA) with no date restrictions. NHS EED and HTA databases are hosted by the Centre for Research and Dissemination (CRD). Additional searches were run on Medline and Embase for health economics and quality of life studies.

Table 36: Database date parameters and filters used

Database	Dates searched	Search filter used
Medline	For health economics (line 64): 2014 – 9 March 2018 For quality of life (line 65): 1946 – 9 March 2018	Exclusions Health economics studies Quality of life studies
Embase	For health economics (line 61): 2014 – 9 March 2018 For quality of life (line 62): 1974 – 9 March 2018	Exclusions Health economics studies Quality of life studies
Centre for Research and Dissemination (CRD)	HTA - Inception – 9 March 2018 NHSEED - Inception to March 2015	None

Medline (Ovid) search terms

1.	exp urolithiasis/
2.	(nephrolitiasis or nephrolith or nephroliths or urolithias?s or ureterolithias?s).ti,ab.
3.	((renal or kidney* or urinary or ureter* or urethra*) adj3 (stone* or calculi or calculus or calculosis or lithiasis or c?olic*)).ti,ab.
4.	stone disease*.ti,ab.
5.	((calculi or calculus or calcium oxalate or cystine) adj3 (crystal* or stone* or lithiasis)).ti,ab.
6.	or/1-5
7.	letter/
8.	editorial/

9.	news/
10.	exp historical article/
11.	Anecdotes as Topic/
12.	comment/
13.	case report/
14.	(letter or comment*).ti.
15.	or/7-14
16.	randomized controlled trial/ or random*.ti,ab.
17.	15 not 16
18.	animals/ not humans/
19.	exp Animals, Laboratory/
20.	exp Animal Experimentation/
21.	exp Models, Animal/
22.	exp Rodentia/
23.	(rat or rats or mouse or mice).ti.
24.	or/17-23
25.	6 not 24
26.	limit 25 to English language
27.	Economics/
28.	Value of life/
29.	exp "Costs and Cost Analysis"/
30.	exp Economics, Hospital/
31.	exp Economics, Medical/
32.	Economics, Nursing/
33.	Economics, Pharmaceutical/
34.	exp "Fees and Charges"/
35.	exp Budgets/
36.	budget*.ti,ab.
37.	cost*.ti.
38.	(economic* or pharmaco?economic*).ti.
39.	(price* or pricing*).ti,ab.
40.	(cost* adj2 (effective* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)).ab.
41.	(financ* or fee or fees).ti,ab.
42.	(value adj2 (money or monetary)).ti,ab.
43.	or/27-42
44.	quality-adjusted life years/
45.	sickness impact profile/
46.	(quality adj2 (wellbeing or well being)).ti,ab.
47.	sickness impact profile.ti,ab.
48.	disability adjusted life.ti,ab.
49.	(qal* or qtime* or qwb* or daly*).ti,ab.
50.	(euroqol* or eq5d* or eq 5*).ti,ab.
51.	(qol* or hql* or hqol* or h qol* or hrqol* or hr qol*).ti,ab.
52.	(health utility* or utility score* or disutilit* or utility value*).ti,ab.

53.	(hui or hui1 or hui2 or hui3).ti,ab.
54.	(health* year* equivalent* or hye or hyes).ti,ab.
55.	discrete choice*.ti,ab.
56.	rosser.ti,ab.
57.	(willingness to pay or time tradeoff or time trade off or tto or standard gamble*).ti,ab.
58.	(sf36* or sf 36* or short form 36* or shortform 36* or shortform36*).ti,ab.
59.	(sf20 or sf 20 or short form 20 or shortform 20 or shortform20).ti,ab.
60.	(sf12* or sf 12* or short form 12* or shortform 12* or shortform12*).ti,ab.
61.	(sf8* or sf 8* or short form 8* or shortform 8* or shortform8*).ti,ab.
62.	(sf6* or sf 6* or short form 6* or shortform 6* or shortform6*).ti,ab.
63.	or/44-62
64.	26 and 43
65.	26 and 63

1 **Embase (Ovid) search terms**

1.	exp urolithiasis/
2.	(nephrolitiasis or nephrolith or nephroliths or urolithias?s or ureterolithias?s).ti,ab.
3.	((renal or kidney* or urinary or ureter* or urethra*) adj3 (stone* or calculi or calculus or calculosis or lithiasis or c?olic*)).ti,ab.
4.	stone disease*.ti,ab.
5.	((calculi or calculus or calcium oxalate or cystine) adj3 (crystal* or stone* or lithiasis)).ti,ab.
6.	or/1-5
7.	letter.pt. or letter/
8.	note.pt.
9.	editorial.pt.
10.	case report/ or case study/
11.	(letter or comment*).ti.
12.	or/7-11
13.	randomized controlled trial/ or random*.ti,ab.
14.	12 not 13
15.	animal/ not human/
16.	nonhuman/
17.	exp Animal Experiment/
18.	exp Experimental Animal/
19.	animal model/
20.	exp Rodent/
21.	(rat or rats or mouse or mice).ti.
22.	or/14-21
23.	6 not 22
24.	limit 23 to English language
25.	health economics/
26.	exp economic evaluation/

27.	exp health care cost/
28.	exp fee/
29.	budget/
30.	funding/
31.	budget*.ti,ab.
32.	cost*.ti.
33.	(economic* or pharmaco?economic*).ti.
34.	(price* or pricing*).ti,ab.
35.	(cost* adj2 (effective* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)).ab.
36.	(financ* or fee or fees).ti,ab.
37.	(value adj2 (money or monetary)).ti,ab.
38.	or/25-37
39.	quality adjusted life year/
40.	"quality of life index"/
41.	short form 12/ or short form 20/ or short form 36/ or short form 8/
42.	sickness impact profile/
43.	(quality adj2 (wellbeing or well being)).ti,ab.
44.	sickness impact profile.ti,ab.
45.	disability adjusted life.ti,ab.
46.	(qal* or qtime* or qwb* or daly*).ti,ab.
47.	(euroqol* or eq5d* or eq 5*).ti,ab.
48.	(qol* or hql* or hqol* or h qol* or hrqol* or hr qol*).ti,ab.
49.	(health utility* or utility score* or disutilit* or utility value*).ti,ab.
50.	(hui or hui1 or hui2 or hui3).ti,ab.
51.	(health* year* equivalent* or hye or hyes).ti,ab.
52.	discrete choice*.ti,ab.
53.	rosser.ti,ab.
54.	(willingness to pay or time tradeoff or time trade off or tto or standard gamble*).ti,ab.
55.	(sf36* or sf 36* or short form 36* or shortform 36* or shortform36*).ti,ab.
56.	(sf20 or sf 20 or short form 20 or shortform 20 or shortform20).ti,ab.
57.	(sf12* or sf 12* or short form 12* or shortform 12* or shortform12*).ti,ab.
58.	(sf8* or sf 8* or short form 8* or shortform 8* or shortform8*).ti,ab.
59.	(sf6* or sf 6* or short form 6* or shortform 6* or shortform6*).ti,ab.
60.	or/39-59
61.	24 and 38
62.	24 and 60

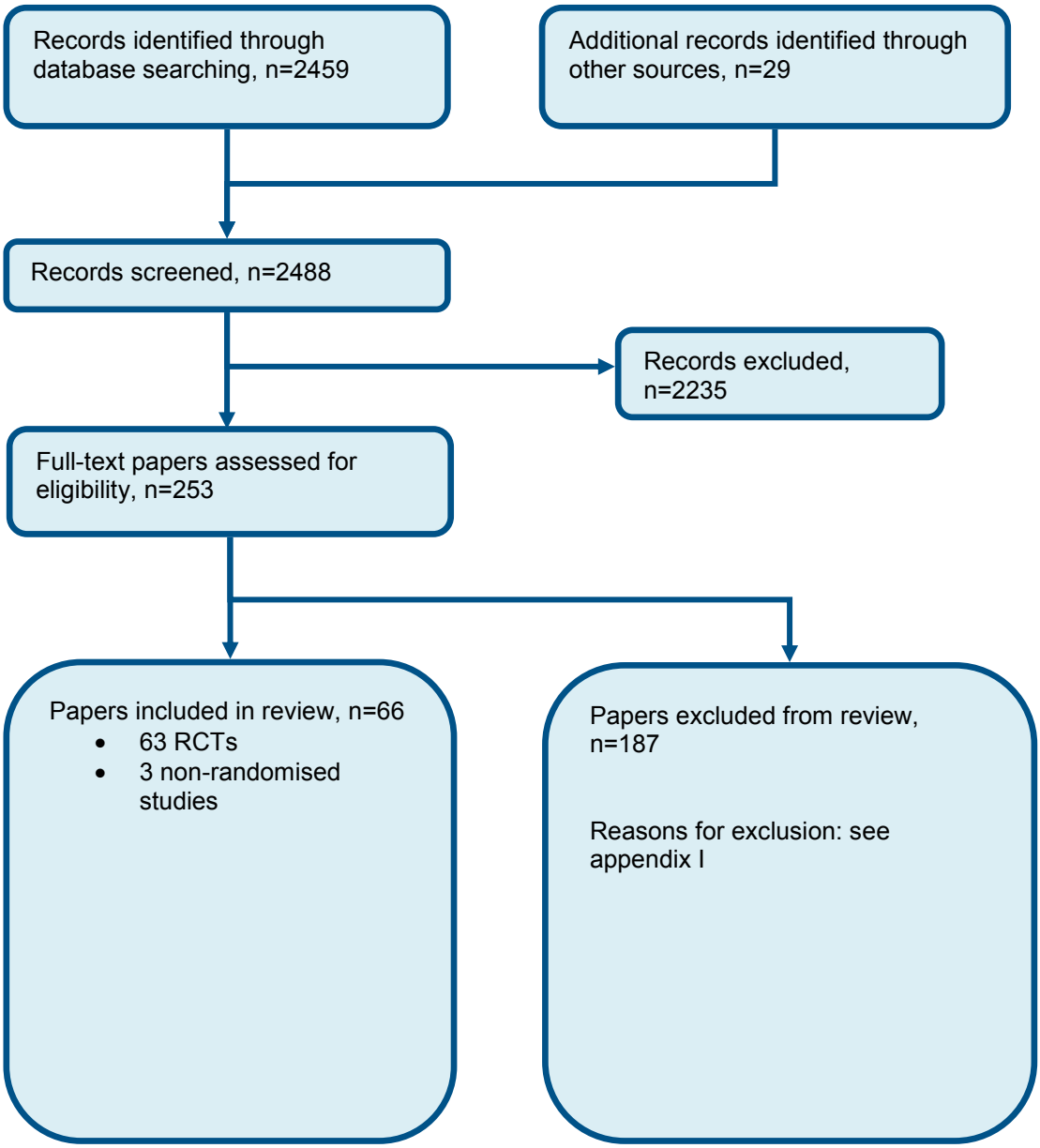
1 **NHS EED and HTA (CRD) search terms**

#1.	MeSH DESCRIPTOR urolithiasis EXPLODE ALL TREES
#2.	(((nephrolitiasis or nephrolith or urolithiasis)))

#3.	((((renal or kidney or urinary or ureteric or ureteral or ureter or urethra*) adj2 (stone* or calculi or calculus or calculosis or lithiasis or colic))))
#4.	((stone disease*))
#5.	((((calculi or calculus) adj2 (stone* or lithiasis))))
#6.	(#1 OR #2 OR #3 OR #4 OR #5)

Appendix C: Clinical evidence selection

Figure 1: Flow chart of clinical study selection for the review of What are the most clinically and cost effective surgical treatment options for people with renal or ureteric stones?



Appendix D: Clinical evidence tables

Study	Aghamir 20124
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=23)
Countries and setting	Conducted in Iran; Setting: Hospital
Line of therapy	1st line
Duration of study	Intervention + follow up: 1 month
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Stone diagnosis made by sonography or KUB radiograph
Stratum	Children (<16 years): renal >20mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Age <14 years, presence of renal stone larger than 25 mm or renal stone with lesser diameter, and SWL failure.
Exclusion criteria	Kidney anomalies, renal failure on admission, and serious bleeding or perforation in the collecting system during the operation
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): Tubeless group10.32 (2.68); standard group 11.10 (1.72). Gender (M:F): 16:7. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear (Mixed: 17.4% upper, 8.7% middle, 30.4% lower, 43.5% pelvis). 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not applicable 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=13) Intervention 1: Percutaneous nephrolithotomy (PCNL). Tubeless PCNL. For all participants, the procedure was started by ureteral catheter insertion. Then puncture was performed in the prone position by 18 gauge nephrostomy needle, under fluoroscopic guidance the tract was dilated, and Amplatz sheath up to 28F and up to 26F Storz nephroscope was used. Fragmentation was performed using a pneumatic lithotripter and residual stones were extracted with a grasper. In the tubeless group, both ureteral stent and the working sheath were removed at the end of procedure without placing any nephrostomy tube.. Duration Not applicable. Concurrent medication/care: Not reported

	(n=10) Intervention 2: Percutaneous nephrolithotomy (PCNL). Standard PCNL. For all participants, the procedure was started by ureteral catheter insertion. Then puncture was performed in the prone position by 18 gauge nephrostomy needle, under fluoroscopic guidance the tract was dilated, and Amplatz sheath up to 28F and up to 26F Storz nephroscope was used. Fragmentation was performed using a pneumatic lithotripter and residual stones were extracted with a grasper. In the standard group, ureteral stent was remained and a nephrostomy tube was placed through the working sheath for 24-48 hours. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PERCUTANEOUS NEPHROLITHOTOMY (PCNL) TUBELESS versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL) STANDARD

Protocol outcome 1: Hospitalisation at Define
- Actual outcome for Children (<16 years): Length of hospital stay (hours) at 1 month; Group 1: mean 39.54 Hours (SD 11.39); n=13, Group 2: mean 58.7 Hours (SD 10.37); n=10
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Children (<16 years): Stone-free state at 1 month; Group 1: 11/13, Group 2: 10/10
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Use of healthcare services/retreatment at Define
- Actual outcome for Children (<16 years): Retreatment at 1 month; Group 1: 1/13, Group 2: 0/10
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 4: Adverse events at Define
- Actual outcome for Children (<16 years): Fever at 1 month; Group 1: 2/13, Group 2: 3/10
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	Albala 2001-111
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=160)
Countries and setting	Conducted in USA; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), renal stone <10 mm
Subgroup analysis within study	Stratified then randomised:
Inclusion criteria	Patients older than 18 years, stone burden of 30mm or less, lower pole stones only, patients agreeable to randomisation between SWL and PCNL
Exclusion criteria	Ureteropelvic junction obstruction; caliceal diverticulum; infundibular stenosis; SWL or PCNL contraindicated or not feasible due to body size or habitus, or coagulopathy; stones in renal pelvis, ureter or mid or upper pole calixes; renal insufficiency with serum creatinine greater than 3.0mg; cystinuria; transplant kidney; patients undergoing simultaneous bilateral procedures; pregnancy
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Other: >18 years. Gender (M:F): Not reported. Ethnicity: Not reported
Further population details	1. Kidney pole: Lower kidney pole 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=22) Intervention 1: Shock wave lithotripsy (SWL). The lithotripters were used according to recognised standards. The power settings and number of shock waves administered in a given session were left to the discretion of the investigator. The goal of SWL was to produce fragments that were 3mm or less in diameter. Ureteral stenting in conjunction with lithotripsy was at the discretion of the individual investigator who adhered to three guidelines: stenting generally recommended for aggregate diameter 25mm or greater; stenting generally not recommended for aggregate diameter less than 15mm; stenting usually indicated when treating solitary renal units. Secondary lithotripsy treatments were performed at the discretion of the investigator. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=20) Intervention 2: Percutaneous nephrolithotomy (PCNL). Percutaneous removal was performed as a

	single stage procedure in the operating room except at one site. No particular nephrostomy tract dilation was specified. An Amplatz sheath was used in all instances, as were standard techniques for power lithotripsy. Routine flexible nephroscopy was encouraged but not mandated. During the course of the study some participating institutions began a percutaneous stone removal protocol designed to minimise perioperative morbidity with a ketorolac drip combined with a small nephrostomy tube. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Stone-free status at 3 months; Group 1: 12/19, Group 2: 20/20
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - High, Crossover - Low, Comments - Data not available for 14 of 121 patients from the whole study, but not clear how many missing for this stratum ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Retreatment at Not reported;
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - High, Crossover - Low, Comments - Data not available for 14 of 121 patients from the whole study, but not clear how many missing for this stratum ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Ancillary procedures at Not reported; Group 1: 3/22, Group 2: 2/20
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - High, Crossover - Low, Comments - Data not available for 14 of 121 patients from the whole study, but not clear how many missing for this stratum ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Adverse events at Define; Pain intensity at Define; Length of stay at Define
Study	**Albala 2001-211**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=160)
Countries and setting	Conducted in USA; Setting: Not reported
Line of therapy	1st line

Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), renal stone 10-20 mm
Subgroup analysis within study	Stratified then randomised
Inclusion criteria	Patients older than 18 years, stone burden of 30mm or less, lower pole stones only, patients agreeable to randomisation between SWL and PCNL
Exclusion criteria	Ureteropelvic junction obstruction; caliceal diverticulum; infundibular stenosis; SWL or PCNL contraindicated or not feasible due to body size or habitus, or coagulopathy; stones in renal pelvis, ureter or mid or upper pole calixes; renal insufficiency with serum creatinine greater than 3.0mg; cystinuria; transplant kidney; patients undergoing simultaneous bilateral procedures; pregnancy
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Other: >18 years. Gender (M:F): Not reported. Ethnicity: Not reported
Further population details	1. Kidney pole: Lower kidney pole 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=33) Intervention 1: Shock wave lithotripsy (SWL). The lithotripters were used according to recognised standards. The power settings and number of shock waves administered in a given session were left to the discretion of the investigator. The goal of SWL was to produce fragments that were 3mm or less in diameter. Ureteral stenting in conjunction with lithotripsy was at the discretion of the individual investigator who adhered to three guidelines: stenting generally recommended for aggregate diameter 25mm or greater; stenting generally not recommended for aggregate diameter less than 15mm; stenting usually indicated when treating solitary renal units. Secondary lithotripsy treatments were performed at the discretion of the investigator. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=29) Intervention 2: Percutaneous nephrolithotomy (PCNL) . Percutaneous removal was performed as a single stage procedure in the operating room except at one site. No particular nephrostomy tract dilation was specified. An Amplatz sheath was used in all instances, as were standard techniques for power lithotripsy. Routine flexible nephroscopy was encouraged but not mandated. During the course of the study some participating institutions began a percutaneous stone removal protocol designed to minimise perioperative morbidity with a ketorolac drip combined with a small nephrostomy tube. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness

	(n=60) Intervention 3: Percutaneous nephrolithotomy (PCNL). Same as above. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=68) Intervention 4: Shock wave lithotripsy (SWL). Same as above. Duration Not reported. Concurrent medication/care: Not applicable. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Quality of life at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Physical functioning at 3 months; Group 1: mean 2.3 (SD 18.9); n=39, Group 2: mean -0.4 (SD 21.3); n=42; SF-36 0-100 Top=High is good outcome
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - Data not available for 14 of 121 patients from the whole study, but not clear how many missing for this stratum ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Physical role at 3 months; Group 1: mean 16.4 (SD 39.1); n=38, Group 2: mean 14.9 (SD 48.5); n=42; SF36 0-100 Top=High is good outcome
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - Data not available for 14 of 121 patients from the whole study, but not clear how many missing for this stratum ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Bodily pain at 3 months; Group 1: mean 16.2 (SD 25.9); n=39, Group 2: mean 26.3 (SD 26.3); n=42; SF36 0-100 Top=High is good outcome
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - Data not available for 14 of 121 patients from the whole study, but not clear how many missing for this stratum ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: General health at 3 months; Group 1: mean -0.8 (SD 19.5); n=37, Group 2: mean 4.9 (SD 17.4); n=42; SF36 0-100 Top=High is good outcome
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - Data not available for 14 of 121 patients from the whole study, but not clear how many missing for this stratum ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Vitality at 3 months; Group 1: mean 9.5 (SD 22.3); n=39, Group 2: mean 8.7 (SD 20.6); n=42; SF36 0-100 Top=High is good outcome
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - Data not available for 14 of 121 patients from the whole study, but not clear how many missing for this stratum ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Social functioning at 3 months; Group 1: mean 10.9 (SD 25.5); n=39, Group 2: mean 5.7

(SD 22.6); n=42; SF36 0-100 Top=High is good outcome
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - Data not available for 14 of 121 patients from the whole study, but not clear how many missing for this stratum ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Emotional role at 3 months; Group 1: mean 12 (SD 42.9); n=39, Group 2: mean 4 (SD 43.7); n=42; SF36 0-100 Top=High is good outcome
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - Data not available for 14 of 121 patients from the whole study, but not clear how many missing for this stratum ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Mental health at 3 months; Group 1: mean 1.8 (SD 17.5); n=39, Group 2: mean 3.1 (SD 20.9); n=42; SF36 0-100 Top=High is good outcome
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - Data not available for 14 of 121 patients from the whole study, but not clear how many missing for this stratum ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Total physical at 3 months; Group 1: mean 3.3 (SD 8.1); n=36, Group 2: mean 5.1 (SD 8.8); n=42; SF36 0-100 Top=High is good outcome
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - Data not available for 14 of 121 patients from the whole study, but not clear how many missing for this stratum ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Total mental at 3 months; Group 1: mean 2.1 (SD 9.5); n=36, Group 2: mean 1.4 (SD 11); n=42; SF36 0-100 Top=High is good outcome
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - Data not available for 14 of 121 patients from the whole study, but not clear how many missing for this stratum ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Overall health at 3 months; Group 1: mean 6.7 (SD 18); n=36, Group 2: mean 8.2 (SD 18); n=42; SF36 0-100 Top=High is good outcome
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - Data not available for 14 of 121 patients from the whole study, but not clear how many missing for this stratum ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Length of stay at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Length of hospital stay at Not reported; Mean; SWL group 0.55 (range 0-9); PCNL group 2.66 (range 1-7), Units: Days;
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - Data not available for 14 of 121 patients from the whole study, but not clear how many missing for this stratum ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Treatment success (stone free state, clinically insignificant residual fragments) at Define

	- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Stone free status at 3 months; Group 1: 6/26, Group 2: 26/28 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - Data not available for 14 of 121 patients from the whole study, but not clear how many missing for this stratum ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 4: Use of healthcare services/retreatment at Define - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Retreatment at 3 months; Group 1: 6/33, Group 2: 1/29 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - Data not available for 14 of 121 patients from the whole study, but not clear how many missing for this stratum ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Ancillary procedures at 3 months; Group 1: 7/33, Group 2: 1/29 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - Data not available for 14 of 121 patients from the whole study, but not clear how many missing for this stratum ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 5: Adverse events at Define - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: UTI at Not reported; Group 1: 1/59, Group 2: 1/57 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - Data not available for 14 of 121 patients from the whole study, but not clear how many missing for this stratum ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Sepsis at Not reported; Group 1: 0/59, Group 2: 1/57 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - Data not available for 14 of 121 patients from the whole study, but not clear how many missing for this stratum ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Perforation at Not reported; Group 1: 0/59, Group 2: 3/57 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - Data not available for 14 of 121 patients from the whole study, but not clear how many missing for this stratum ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Transfusion at Not reported; Group 1: 0/59, Group 2: 1/57 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - Data not available for 14 of 121 patients from the whole study, but not clear how many missing for this stratum ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
Protocol outcomes not reported by the study	New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Hospitalisation at Define

Study	Albala 2001-311
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=160)
Countries and setting	Conducted in USA; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), renal stone >20 mm
Subgroup analysis within study	Stratified then randomised
Inclusion criteria	Patients older than 18 years, stone burden of 30mm or less, lower pole stones only, patients agreeable to randomisation between SWL and PCNL
Exclusion criteria	Ureteropelvic junction obstruction; caliceal diverticulum; infundibular stenosis; SWL or PCNL contraindicated or not feasible due to body size or habitus, or coagulopathy; stones in renal pelvis, ureter or mid or upper pole calixes; renal insufficiency with serum creatinine greater than 3.0mg; cystinuria; transplant kidney; patients undergoing simultaneous bilateral procedures; pregnancy
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Other: >18 years. Gender (M:F): Not reported. Ethnicity: Not reported
Further population details	1. Kidney pole: Lower kidney pole 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=9) Intervention 1: Shock wave lithotripsy (SWL). The lithotripters were used according to recognised standards. The power settings and number of shock waves administered in a given session were left to the discretion of the investigator. The goal of SWL was to produce fragments that were 3mm or less in diameter. Ureteral stenting in conjunction with lithotripsy was at the discretion of the individual investigator who adhered to three guidelines: stenting generally recommended for aggregate diameter 25mm or greater; stenting generally not recommended for aggregate diameter less than 15mm; stenting usually indicated when treating solitary renal units. Secondary lithotripsy treatments were performed at the discretion of the investigator. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness

	(n=9) Intervention 2: Percutaneous nephrolithotomy (PCNL) . Percutaneous removal was performed as a single stage procedure in the operating room except at one site. No particular nephrostomy tract dilation was specified. An Amplatz sheath was used in all instances, as were standard techniques for power lithotripsy. Routine flexible nephroscopy was encouraged but not mandated. During the course of the study some participating institutions began a percutaneous stone removal protocol designed to minimise perioperative morbidity with a ketorolac drip combined with a small nephrostomy tube. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL) Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define - Actual outcome for Adults (≥16 years), renal stone >20 mm: Stone free state at 3 months; Group 1: 1/7, Group 2: 6/7 Risk of bias: All domain - Very high, Selection - Very high, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 2: Use of healthcare services/retreatment at Define - Actual outcome for Adults (≥16 years), renal stone >20 mm: Retreatment at Not reported; Group 1: 2/9, Group 2: 2/9 Risk of bias: All domain - Very high, Selection - Very high, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), renal stone >20 mm: Ancillary procedures at Not reported; Group 1: 0/9, Group 2: 0/9 Risk of bias: All domain - Very high, Selection - Very high, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Adverse events at Define; Pain intensity at Define; Length of stay at Define

Study	**Al-dessoukey 201410**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=203)
Countries and setting	Conducted in Egypt; Setting: Not reported

Line of therapy	1st line
Duration of study	Intervention + follow up: 1 day
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: KUB or ultrasound
Stratum	Adults (≥16 years), renal stone >20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Single or multiple renal stones >25 mm or upper ureteral stones >10 mm. Patients with smaller stones with previously failed SWL were also included.
Exclusion criteria	Uncorrectable bleeding disorders, active urinary tract infection and pregnancy
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): Supine group 3.68 (1.42); prone group 3.93 (1.26). Gender (M:F): 136:67. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear (Mixed). 2. Neuropathic/ cerebral-palsy /immobility: Not applicable 3. Obesity /skin-to-stone distance: Non-obese / short skin-to-stone distance 4. Pregnant women: Non-pregnant 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=102) Intervention 1: Percutaneous nephrolithotomy (PCNL) . All patients received general anesthesia. In the prone position PCNL, with the patient in the lithotomy position, cystoscopy is done in the supine position, then a ureteral catheter is fixed and the Foley's catheter is inserted alongside the ureteral catheter. The patient is repositioned in the prone position. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=101) Intervention 2: Percutaneous nephrolithotomy (PCNL) . In the oblique supine lithotomy position PCNL, the ipsilateral lower limb is placed on the leg elevator, the hip and knee were flexed and the ipsilateral buttock and shoulder were supported using a roll to make an angle ranging from 20-50 degrees according to the ideal position for the track and free movement of the nephroscope. The patient was placed with the stone bearing side near the operating table edge. The patient's ipsilateral upper limb was crossed over their chest to provide working space for the surgical team. The contralateral limb is extended. Cystoscopy is done and a ureteral catheter is fixed. Retrograde pyelography is done, and skin incision is made medial to the posterior axillary line and an 18 gauge nephrostomy needle is passed into the desired calix, then a guide wire is passed antegradely across the renal pelvis and into the ureter, upper or lower calix. When multiple punctures were needed, they were done at this stage of the procedure, and other guide wires were passed. Following this, a second safety guide wire 0.038 is passed into the system. Dilation is done using a nephrostomy balloon catheter. A 30F Amplatz sheath is passed over the balloon until it resides within the calix. In cases of failed balloon dilation, metal coaxial dilators or malleable dilators were used. A

	rigid 26F nephroscope was used. Stones were removed or fragmented using a pneumatic lithotripter or holmium YAG laser. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PRONE PERCUTANEOUS NEPHROLITHOTOMY (PCNL) versus SUPINE PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Length of stay at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Length of hospital stay at Not reported; Group 1: mean 81.2 Hours (SD 35.1); n=102, Group 2: mean 49.88 Hours (SD 19.7); n=101
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Stone free state at 1 day; Group 1: 89/102, Group 2: 89/101
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Adverse events at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Blood transfusion at Not reported; Group 1: 3/102, Group 2: 1/101
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Fever at Not reported; Group 1: 6/102, Group 2: 5/101
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Colonic injury at Not reported; Group 1: 2/102, Group 2: 0/101
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Hospitalisation at Define

Study	Bas 2017{#6272}
Study type	Non-randomised study
Number of studies (number of participants)	1 (n=81)
Countries and setting	Conducted in Turkey; Setting: Data were gathered from the medical databases of hospitals in Turkey
Line of therapy	Unclear
Duration of study	Other: Retrospective analysis of patients who underwent MPCNL or RIRS between August 2011 and June 2015
Method of assessment of guideline condition	Unclear method of assessment/diagnosis: Not reported
Stratum	Children (<16 years): Children, renal 10-20mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Paediatric patients with renal stones that were 10-20mm in size, who underwent MPCNL or RIRS in referral centres in Turkey, between August 2011 and June 2015
Exclusion criteria	Patients with anomalous kidneys, bleeding diatheses, musculoskeletal deformities, or a stone size >20mm
Recruitment/selection of patients	The preferences of patients and/or parents, and the urologist determined the treatment method, after both potential risks and benefits of the procedures had been reviewed
Age, gender and ethnicity	Age - Mean (SD): MPCNL group: 5.62 (4.50 years)(range 1-15 years); RIRS group: 8.39 (4.72)(range 1-16 years) . Gender (M:F): MPCNL group: 23/22; RIRS group: 15/21. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not applicable 5. Stone composition/hounsfield units: Not stated / Unclear 6. Uteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=45) Intervention 1: Percutaneous nephrolithotomy (PCNL). The stones were fragmented by using Ho: YAG laser fiber, under direct vision. The maintenance of the visualisation and the removal of stone debris through the ureter were achieved by using an irrigation pump controlled by the surgeon, and drainage of the intrarenal fluid was performed by using an open-ended ureteral catheter. The stone-free status was evaluated with endoscopic and fluoroscopic images at the end of the procedure. The procedure was terminated without any need for a nephrostomy tube.. Duration Not reported. Concurrent medication/care: All procedures were performed under general anaesthesia. . Indirectness: No indirectness (n=36) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. The patient was placed in the lithotomy position. Rigid ureteroscopy was routinely performed before flexible ureteroscopy for dilation of the ureter. A 0.035/0.038-inch hydrophilic safety guidewire was inserted into the renal pelvis under fluoroscopic guidance.

	Thereafter, a ureteral access sheath (9.5/11.5F, 35cm) was placed over the hydrophilic guidewire in most of the patients. In two patients, the ureteral access sheath was not used, based on the surgeon's preference. When the rigid/flexible ureteroscope or access sheath could not be advanced easily, the stent was left for ~1 to 2 weeks before repeating the procedure (this was necessary in six patients). In selected cases, ureteral orifice dilation was performed with balloon dilators (only in two patients). A flexible ureterorenoscope (Flex-X2, Karl Storz, Tuttlingen, Germany/Karl Storz, Flex X2, GmbH, Tuttlingen, Germany) was inserted through the ureteral access sheath. Stone fragmentation was achieved with a 200µm holmium laser fiber until the stone fragments were deemed small enough to be passed spontaneously. In some cases, lower pole stones were relocated to a more favorable location by basketing. Double-J stents were placed in most of the patients based on the surgeon's decision, and they were removed ~14 to 21 days after surgery, under brief anaesthesia. All patients were evaluated with plain radiography and/or ultrasonography the day after, and 1 month after surgery to determine stone clearance status. . Duration Not repotred. Concurrent medication/care: All procedures were performed under general anaesthesia. . Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PERCUTANEOUS NEPHROLITHOTOMY (PCNL) versus SEMI-RIGID OR FLEXIBLE

Protocol outcome 1: Length of stay at Define
- Actual outcome for Children (<16 years): Length of stay at Days; Group 1: mean 2.29 days (SD 0.92); n=45, Group 2: mean 1.55 days (SD 0.77); n=36
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - Very high, Outcome reporting - Low, Measurement - Very high; Indirectness of outcome: No indirectness ; Baseline details: Mean age of MPCNL group 5.62 (4.50); mean age of RIRS group 8.39 (4.72) (p-value 0.010); Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: New stone formation/incidence of stones/recurrence rate at Define
- Actual outcome for Children (<16 years): Stone-free state (stone-free or residual fragments <3mm) at Unclear (end of procedure or 1 month later); Group 1: 39/45, Group 2: 33/36
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - Very high, Outcome reporting - Low, Measurement - Very high; Indirectness of outcome: No indirectness ; Baseline details: Mean age of MPCNL group 5.62 (4.50); mean age of RIRS group 8.39 (4.72) (p-value 0.010); Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Adverse events at Define
- Actual outcome for Children (<16 years): Minor adverse events (fever; urinary tract infection) at Not reported; Group 1: 2/45, Group 2: 4/36
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - Very high, Outcome reporting - Low, Measurement - Very high; Indirectness of outcome: No indirectness ; Baseline details: Mean age of MPCNL group 5.62 (4.50); mean age of RIRS group 8.39 (4.72) (p-value 0.010); Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; Treatment success (stone free state, clinically insignificant residual fragments) at Define; Use of healthcare services/retreatment rate at Define; Kidney function at Define; Recurrence rate at Define; Mortality at Define; Pain intensity at Define; Hospitalisation at Define
Study	**Basiri 200822**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=100)
Countries and setting	Conducted in Iran; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 weeks
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), ureteric stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with urinary stones of the upper ureter (ureteropelvic junction to iliac crest), with a stone size ≥15mm
Exclusion criteria	Not reported
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): URS group 39 (15); PCNL group 48 (13). Gender (M:F): 55:35. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Upper ureteric stones
Indirectness of population	No indirectness
Interventions	(n=50) Intervention 1: Ureteroscopy or RIRS - Semi-rigid or flexible. Retrograde ureteroscopic lithotripsy using a semirigid ureteroscope, performed in the lithotomy position and under general anaesthesia with a semirigid 7.8F ureteroscope using a pneumatic and laser lithotripter. At first, a guidewire was passed into the ureteral orifice through the ureteroscope, and the ureteroscope was inserted over the guidewire directly to the stone location. In some patients, ureteral dilatation was necessary. After stone breaking and/or removal, a 5F ureteral catheter was regularly left in place for 48 hours when there was no overt ureteral injury and no large or multiple residual stone. Otherwise, a double-j catheter was used. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=50) Intervention 2: Percutaneous nephrolithotomy (PCNL). Percutaneous nephrolithotripsy, access was achieved through the middle or upper calix with the patient in the prone position using radiography for

	guidance. The rest of the procedure was performed in the classic manner. Consequently, stone breaking or removal was performed with a rigid nephroscope. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: URS versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Length of stay at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Length of hospital stay at Not reported; Group 1: mean 0.53 Days (SD 0.12); n=50, Group 2: mean 4.4 Days (SD 1.4); n=50
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone-free at 3 weeks; Group 1: 38/50, Group 2: 43/50
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone-free at Discharge; Group 1: 28/50, Group 2: 32/50
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Retreatment at Not reported; Group 1: 11/50, Group 2: 7/50
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Adverse events at Define; Pain intensity at Define; Hospitalisation at Define

Study	Bryniarski 201232
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=64)
Countries and setting	Conducted in Poland; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 weeks
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Diagnosis was based on ultrasonography of the abdomen and intravenous urography
Stratum	Adults (≥16 years), renal stone >20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Single stone located in the renal pelvis; stone more than 20 mm in diameter
Exclusion criteria	Previous stone treatment; staghorn stone; anatomic anomalies of the kidney
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): PCNL group 51.8 (11.8), RIRS group 53.4 (12.4). Gender (M:F): 31:33. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=32) Intervention 1: Percutaneous nephrolithotomy (PCNL). Before the procedure, a 5F ureteral catheter is inserted through a cystoscope. The percutaneous access to the renal pelvis is performed by the urologist. Retrograde pyelography is conducted at the beginning of the procedure. The telescopic dilation with the PCNL set is used under fluoroscopic control through the lower calix. Finally a 30F Amplatz sheath is positioned and an ultrasonic lithotripter with continuous irrigation is put in the sheath. After completion of PCNL, a 20F nephrostomy tube is inserted and clamped for 6 hours. Duration Not applicable. Concurrent medication/care: All patients were given prophylactic antibiotics (norfloxacin 400mg twice a day) 1 day before the procedure, at the day of procedure and 2 days afterwards. On the day of surgery, patients were given 2500ml of fluids intravenously, and the next day oral fluids. Paracetamol 1g was given intravenously for each patient after surgery with 4 hour intervals at 4g/d. Pethidine hydrochloride 50mg was injected intramuscularly on patient demand post operatively. Indirectness: No indirectness (n=32) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. Retrograde intrarenal surgery (RIRS). A standard semirigid ureteroscope 10/12F with tapered tip is used. The patient is in the dorsal lithotomy

	position. A polytetrofluoroethylene guidewire is put in the ureter to allow safe passage of a 6/12 dilator. The guidewire is evacuated and a 5F stent is put in the ureter through the working channel. The ureteroscope is inserted within the 5F stent, until the kidney pelvis and stone are visualized. Disintegration of the stone is achieved with a holmium laser. Smaller stones are evacuated with baskets or graspers. Routinely, a double J catheter is placed and a radiography of the abdomen is obtained. . Duration Not applicable. Concurrent medication/care: All patients were given prophylactic antibiotics (norfloxacin 400mg twice a day) 1 day before the procedure, at the day of procedure and 2 days afterwards. On the day of surgery, patients were given 2500ml of fluids intravenously, and the next day oral fluids. Paracetamol 1g was given intravenously for each patient after surgery with 4 hour intervals at 4g/d. Pethidine hydrochloride 50mg was injected intramuscularly on patient demand post operatively. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PERCUTANEOUS NEPHROLITHOTOMY (PCNL) versus RIRS

Protocol outcome 1: Length of stay at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Hospital stay at Not reported; Group 1: mean 11.3 Days (SD 4.4); n=32, Group 2: mean 6.8 Days (SD 5.7); n=32
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Stone-free status at 3 weeks; Group 1: 30/32, Group 2: 24/32
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Stone-free status at 1 day; Group 1: 26/32, Group 2: 16/32
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Retreatment at Not reported; Group 1: 0/32, Group 2: 4/32
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Ancillary procedures at Not reported; Group 1: 2/32, Group 2: 0/32
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 4: Adverse events at Define

- Actual outcome for Adults (≥16 years), renal stone >20 mm: Sepsis at Not reported; Group 1: 0/32, Group 2: 0/32 Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), renal stone >20 mm: fever at Not reported; Group 1: 9/32, Group 2: 8/32 Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), renal stone >20 mm: blood transfusion at Not reported; Group 1: 5/32, Group 2: 1/32 Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 5: Pain intensity at Define - Actual outcome for Adults (≥16 years), renal stone >20 mm: Pain at 1 day; Group 1: mean 3.5 (SD 0.4); n=32, Group 2: mean 2.5 (SD 0.6); n=32; VAS 0-10 Top=High is poor outcome Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Hospitalisation at Define

Study	Carlsson 199235
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=49)
Countries and setting	Conducted in Sweden; Setting: Three hospitals in Sweden
Line of therapy	1st line
Duration of study	Intervention + follow up: 12 months
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), renal stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Stones of4-30mm in diameter and eligible for either ESWL or PNL
Exclusion criteria	Not reported
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): PCNL group 48.2, SWL group 49.0. SD not reported. Gender (M:F): 32:17. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	Serious indirectness: Includes some stones less than 10 mm and some stones more than 20 mm (range 5-27mm)
Interventions	(n=30) Intervention 1: Shock wave lithotripsy (SWL). All SWL treatments were carried out at one hospital using an unmodified Dornier HM3 lithotripter. From 1 July 1987 all patients (n=15) were treated without anaesthesia, due to a voltage reduction to 14-16kV and premedication with pethidine and diazepam given intramuscularly 30 minutes before treatment. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=25) Intervention 2: Percutaneous nephrolithotomy (PCNL) . PCNL was done under epidural anaesthesia in the department of diagnostic radiology with the collaboration of a radiologist and a urologist. A nephrostomy was made with the patient prone, and the track was dilated to 27F. The nephroscope was introduced and the stone was usually extracted with forceps under fluoroscopic control. Ultrasonic disintegration was used for stones larger than 15mm. A catheter was used for nephrostomy, often with a coaxial pigtail catheter to keep it in place. The catheters were removed on the following day if there were no residual stones. If residual stones were found, a second PCNL was done. Duration Not applicable.

	Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Length of stay at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Length of hospital stay at Not reported; Group 1: mean 4.1 Days (SD 2.6); n=28, Group 2: mean 7.4 Days (SD 4.5); n=21
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2; Group 2 Number missing: 4

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Stone-free status at 1 month; Group 1: 8/25, Group 2: 11/15
Risk of bias: All domain - Very high, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 5; Group 2 Number missing: 10
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Stone-free status at 1 year; Group 1: 11/26, Group 2: 15/19
Risk of bias: All domain - Very high, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 4; Group 2 Number missing: 6

Protocol outcome 3: Adverse events at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Fever at 1 day; Group 1: 8/24, Group 2: 6/18
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2; Group 2 Number missing: 4
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Septicaemia at Not reported; Group 1: 0/28, Group 2: 1/21
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2; Group 2 Number missing: 4
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Perforation of renal pelvis at Not reported; Group 1: 0/28, Group 2: 1/21
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2; Group 2 Number missing: 4

Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Hospitalisation at Define

Study	Chang 201139
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=131)
Countries and setting	Conducted in Taiwan; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: Mean follow up 18-18.92 months
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), renal stone >20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Adult patients, who were scheduled for a PCNL due to impacted ureteropelvic junction stone or single renal pelvic stone larger than 20mm and less than 40mm
Exclusion criteria	Stone <20mm, history of ipsilateral renal surgery, bilateral stones, urosepsis or solitary kidney, more than one tract, a second look (>24 h), or if supracostal approach was used
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): Tubeless group 59.22 (12.44); standard group 58.70 (10.85). Gender (M:F): 101:30. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear (Renal pelvis). 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/Hounsfield units: Not stated / Unclear (Mixed). 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=63) Intervention 1: Percutaneous nephrolithotomy (PCNL). A modified technique was used for PCNL. Following placement of a 16Fr Foley catheter, the patient was turned prone under endotracheal general anaesthesia, and access to the collecting system was obtained using a puncture needle under sonographic guidance. The track was formed using serial plastic dilators until Amplatz sheath (Fr 30) was inserted. The stones were fragmented with pneumatic lithoclast and removed piece by piece with stone forceps. At the end of the procedure, the surgeon conducted a visual and fluoroscopic check for residual stone fragments. Patients in the standard group underwent antegrade double J catheter and nephrostomy tube placement. After removal of the working sheath, the wound was closed with 3-O Nylon sutures for subcutaneous bleeding control. . Duration Not applicable. Concurrent medication/care: During hospitalisation, all patients were prescribed parenteral cefazolin 1gm q6h, oral Ketorolac 10mg three times per day and allowed to use sublingual buprenorphine 0.2mg on demand. Indirectness: No indirectness

	(n=68) Intervention 2: Percutaneous nephrolithotomy (PCNL). The same procedure as the standard group was used except for catheter and tube placement. Duration Not reported. Concurrent medication/care: During hospitalisation, all patients were prescribed parenteral cefazolin 1gm q6h, oral Ketorolac 10mg three times per day and allowed to use sublingual buprenorphine 0.2mg on demand. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: STANDARD PERCUTANEOUS NEPHROLITHOTOMY (PCNL) versus TUBELESS PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Length of stay at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Length of hospital stay at Mean 18-18.92 months; Group 1: mean 4.21 Days (SD 1.27); n=63, Group 2: mean 3.37 Days (SD 1.07); n=68
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 9; Group 2 Number missing: 8

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Stone free state at Mean 18-18.92 months; Group 1: 47/63, Group 2: 50/68
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 9; Group 2 Number missing: 8

Protocol outcome 3: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Retreatment at Mean 18-18.92 months; Group 1: 5/63, Group 2: 8/68
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 9; Group 2 Number missing: 8
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Ancillary procedures at Mean 18-18.92 months; Group 1: 2/63, Group 2: 2/68
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 9; Group 2 Number missing: 8

Protocol outcome 4: Adverse events at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Calvien grade 3a at Mean 18-18.92 months; Group 1: 0/63, Group 2: 2/68
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 9; Group 2 Number missing: 8
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Calvien grade 2 at Mean 18-18.92 months; Group 1: 6/63, Group 2: 4/68
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 9; Group 2 Number missing: 8
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Calvien grade 1 at Mean 18-18.92 months; Group 1: 4/63, Group 2: 6/68
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low,

Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 9; Group 2 Number missing: 8 Protocol outcome 5: Pain intensity at Define - Actual outcome for Adults (≥16 years), renal stone >20 mm: Pain at 2 days; Group 1: mean 6.26 (SD 0.98); n=63, Group 2: mean 4.97 (SD 1.15); n=68; VAS 0-10 Top=High is poor outcome Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 9; Group 2 Number missing: 8	
Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Hospitalisation at Define

Study	**De dominicis 200550**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=31)
Countries and setting	Conducted in Italy; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 6-8 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Ultrasonography and IVU were used in all cases for the diagnosis
Stratum	Children (<16 years): Ureter, <10mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Radio-opaque calculi in the distal ureter treated with ESWL or URS as primary therapy. The distal ureter was defined as from the inferior aspect of the sacrum bone to the ureteric orifice in the bladder.
Exclusion criteria	Not reported
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (range): SWL group 6.9 (2.5-17); URS group 8.1 (2-14). Gender (M:F): 10:21. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not applicable 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Lower ureteric stones
Indirectness of population	No indirectness

Interventions	(n=17) Intervention 1: Ureteroscopy or RIRS - Semi-rigid or flexible. URS comprised ureteroscopy (7.5 F ureteroscope) and lithotripter (1.9 F tapered semiflexible probe) or holmium-YAG laser (400 mm fibres) for disintegrating the stones in the distal ureter. All procedures were carried out with the patient under general anaesthesia and in the dorsal lithotomy position. Retrograde endoscopy with or without basket extraction of the stone fragments was used by the following technique. A paediatric cystoscope was used to place a 4.8 F open-ended catheter to the level of the intramural ureter, and a low-pressure retrograde ureteropyelogram taken. A 0.9 mm PTFE guidewire was positioned in the renal pelvis through the open-ended catheter and used as a safety wire and for placing the ureteric catheter at the end of the procedure. The second guidewire was stopped in the intramural ureter, positioned through the working channel of the ureteroscope. The ureteroscope was then advanced between the guidewires under direct fluoroscopic and endoscopic guidance up to the level of the stone. The working wire was them removed. After the stone was detected, the semiflexible probe of the Lithoclast or laser fibre was passed through the endoscope working channel and energy discharged with the distal tip in contact with the stone surface under direct vision. Lithotripsy was continued until the stone fragments allowed the guidewire to be passed. A retrograde ureteropyelogram then confirmed the absence of residual stone and extravasation at the end of the procedure. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=14) Intervention 2: Shock wave lithotripsy (SWL). Children were treated by distal ureteric ESWL on an EDAP-Sonolith 4000+ lithotripter while prone. 2500 shock waves (1900–3500) were delivered, usually at 450 KJ (330–694). Patients treated with ESWL were under general anaesthesia, to obtain the best results. In all patients a ureteric open-ended catheter was left in place and removed in the next 24–72 h. If ureteric dilatation was used, a double-pigtail ureteric stent was left in place for 1 week. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: URS versus SHOCK WAVE LITHOTRIPSY (SWL)

Protocol outcome 1: Length of stay at Define
- Actual outcome for Children (<16 years): Length of hospital stay at 6-8 months; Mean; SWL group 30 (24-48); URS group 55 (48-72);
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Children (<16 years): Stone free state at 6-8 months; Group 1: 16/17, Group 2: 6/14
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low,

Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 3: Use of healthcare services/retreatment at Define - Actual outcome for Children (<16 years): Retreatment at 6-8 months; Group 1: 0/17, Group 2: 8/14 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Children (<16 years): Ancillary procedures at 6-8 months; Group 1: 1/17, Group 2: 5/14 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Adverse events at Define; Pain intensity at Define; Hospitalisation at Define

Study	Deem 201151
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=32)
Countries and setting	Conducted in USA; Setting: Medical centre
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Diagnosed by non-contrast CT scan
Stratum	Adults (≥16 years), renal stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients aged between 18 and 80 years, with kidney stones between 10 and 20 mm in largest dimension
Exclusion criteria	Patients with contraindications such as pregnancy, bleeding diathesis or need for anticoagulants, Hounsfield units >1000 or skin to stone distance >12cm from skin surface measured on CT scan, ureteropelvic junction obstruction, and solitary kidney
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): SWL group 52.25 (14.07); PCNL group 47.2 (14.88). Gender (M:F): 17:15. Ethnicity: 100% white
Further population details	1. Kidney pole: Not stated / Unclear (Mixed: upper 12.5%, middle 78.1%, pelvis 9.4%). 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear (Skin to stone distance: SWL group 9.25 (1.61); PCNL group 10.21 (1.37)). 4. Pregnant women: Non-pregnant 5. Stone composition/Hounsfield units: Stone composition (Hounsfield units <1000). 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=12) Intervention 1: Shock wave lithotripsy (SWL). Flexible cystoscopy was performed with placement of a ^-F double J ureteral stent. The patient underwent general anaesthesia and the Medispec Lithotripter used was fluoroscopically centred over the stone. As many as 2000 shocks were delivered at a of 60, to the centre of the stone or until the stone was completely fragmented. After recovery, the patient was discharged home with the ureteral stent in place. The stent was removed 1 week later. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=20) Intervention 2: Percutaneous nephrolithotomy (PCNL) . A flexible cystoscopy was performed with placement of a 6Fr ureteral stent. The patient was placed in the prone position. Using fluoroscopic guidance, renal mapping was performed and desired access location was determined and achieved using the eye of

	the needle technique. Balloon dilation was achieved and a 34Fr clear access sheath was placed. The stone was retrieved with graspers as possible or fragmented with a combined ultrasonic and pneumatic device. Flexible nephroscopy was then performed. Only when significant collecting system injury or bleeding was encountered was a 12 Fr nephrostomy tube placed. Nephrostomy tube was removed a week later. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Quality of life at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: SF8 Physical Health score at 3 months; Mean; , Comments: Results reported graphically - not extractable;
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: SF8 Mental Health score at 3 months; Mean; , Comments: Results reported graphically - not extractable;
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Stone-free status at 3 months; Group 1: 4/12, Group 2: 17/20
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Stone-free status at 1 week; Group 1: 2/12, Group 2: 19/20
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Retreatment at Not reported; Group 1: 8/12, Group 2: 0/20
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Adverse events at Define; Pain intensity at Define; Length of stay at Define

Study	Demirbas 201753
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=73)
Countries and setting	Conducted in Turkey; Setting: Hospital clinic
Line of therapy	1st line
Duration of study	Intervention + follow up: 1 month
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), renal stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	People diagnosed with renal stones
Exclusion criteria	Kidney abnormality, bleeding diathesis, refractory to treatment, obesity (>30kg/m²), skeletal deformity, previous kidney surgery, and untreated urinary tract infection
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): RIRS group 48.72 (16.87); PCNL group 43.73 (14.62). Gender (M:F): 41:32. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear (Mixed: pelvis 47.9%, upper pole 2.7%, middle pole 4.1%, lower pole 30.1%, multicaliceal 15%). 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Non-obese / short skin-to-stone distance 4. Pregnant women: Not stated / Unclear 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=43) Intervention 1: Ureteroscopy or RIRS - Semi-rigid or flexible. RIRS procedure was done using a 9.5/11.5F ureteral access sheath, a 7.5F flexible ureterorenoscope, and a holmium YAG laser lithotripter. Following completion of fragmentation, ureter was observed all along its length to see any ureteral injury. Double J stent was not routinely places after the procedure, and it was placed if there was mucosal injury or oedema, or the duration of the procedure was long. Ureteral double J stents were removed 2-4 weeks after surgery. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=30) Intervention 2: Percutaneous nephrolithotomy (PCNL) . Ultra-mini PCNL. An appropriate calix access was obtained, then Amplatz renal dilator set was used for dilation up to 14F, and a 17cm renal access sheath sized 14F was placed. A 6/7.5F nephroscope was used to view inside the kidney, and the stones were fragmented with holmium laser lithotripter until they were suitable for spontaneous passage. The stone-free status was controlled with nephroscopic visualisation and fluoroscopy, and an antegrade double J stent,

	or a re-entry catheter was placed by taking stone-free status and bleeding into consideration, or the procedure was ended tubeless. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: RIRS versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL) Protocol outcome 1: Length of stay at Define - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Length of hospital stay at Not reported; Group 1: mean 1.37 Days (SD 1.48); n=43, Group 2: mean 2.46 Days (SD 3.02); n=30 Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Significantly different for location of stones e.g. in PCNL group 50% had lower pole stones and 16.3% of RIRS group had lower pole stones; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Stone-free status at 1 month; Group 1: 32/43, Group 2: 24/30 Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Significantly different for location of stones e.g. in PCNL group 50% had lower pole stones and 16.3% of RIRS group had lower pole stones; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 3: Adverse events at Define - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Clavien 1-2 at Not reported; Group 1: 3/43, Group 2: 2/30 Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Significantly different for location of stones e.g. in PCNL group 50% had lower pole stones and 16.3% of RIRS group had lower pole stones; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Clavien 3A-3B at Not reported; Group 1: 3/43, Group 2: 5/30 Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Significantly different for location of stones e.g. in PCNL group 50% had lower pole stones and 16.3% of RIRS group had lower pole stones; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Hospitalisation at Define

Study	Falahatkar 200868
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=80)
Countries and setting	Conducted in Iran; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 1 day
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Sonography
Stratum	Adults (≥16 years), renal stone >20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Single or multiple renal stones treatable with a single percutaneous access, stone diameter >20mm, and no contraindications to perform the operation in the prone position
Exclusion criteria	Renal anomalies, uncontrolled coagulopathy, pregnancy, immunosuppression and ages <10 years old.
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): Supine group 45.35; prone group 43.02 (SD not reported). Gender (M:F): 41:39. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear (Mixed). 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=40) Intervention 1: Percutaneous nephrolithotomy (PCNL). General anaesthesia was used for all patients. A ureteral catheter was placed in the lithotomy position for opacification. Patients in group A were placed in the prone position. A collecting system puncture was achieved by 18 gauge needle under fluoroscopic guide from posterior auxiliary line. Access was subcostal. In cases in which access to the upper part of the kidney including upper or middle pole was necessary, the kidney was pulled down by initial access and a subcostal second access tract to the upper pole was created. Return of urine on removal of stylet of needle confirmed entrance to the collecting system. Then, a 0.035 inch J-tip guide wire was inserted. Then, the access to the kidney was dilated by one shot dilation. Dilation was performed by 9Fr dilator. A single 28 F Amplatz dilator was pulled in the Alkan guide. The single passage allowed insertion of the 20 F Amplatz working sheath. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness

	(n=40) Intervention 2: Percutaneous nephrolithotomy (PCNL). Patients in group B were placed in complete supine position without flank elevation. There was not any rolled towel under the flank, and there was no change in leg position in this group. The rest of the procedure was the same as in the other group. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PRONE PERCUTANEOUS NEPHROLITHOTOMY (PCNL) versus SUPINE PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Length of stay at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Length of hospital stay at Not reported; Mean; Prone 73.2; supine 80.02 , Units: Hours;
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Stone free state at 1 day; Group 1: 31/40, Group 2: 32/40
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Adverse events at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Transfusion at Not reported; Group 1: 3/40, Group 2: 8/40
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Extravasation at Not reported; Group 1: 1/40, Group 2: 2/40
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Fever at Not reported; Group 1: 8/40, Group 2: 1/40
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Mortality at Not reported; Group 1: 0/40, Group 2: 0/40
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Hospitalisation at Define

Study	Falahatkar 201166
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=33)
Countries and setting	Conducted in Iran; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 2 weeks
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Ultrasonography, plain radiography and IVU
Stratum	Adults (≥16 years), renal stone >20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Renal stone >20mm in diameter, stone size >15 mm in lower calyx, and stones resistant to ESWL >10 mm and no contraindication to perform PCNL in the prone position
Exclusion criteria	Renal anomalies, uncontrolled coagulopathy, pregnancy, immunosuppression, history of previous PCNL and retroperitoneal surgery
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): Supine group 49.9; prone group 47.06 (SD not reported). Gender (M:F): 25:8. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Non-obese / short skin-to-stone distance 4. Pregnant women: Non-pregnant 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=18) Intervention 1: Percutaneous nephrolithotomy (PCNL). Ureteral catheter was placed for opacification or saline injection. Patients in group A were placed in complete supine position without flank elevation. There was not any rolled towel under the flank and there was no change in leg position. Percutaneous access was performed under fluoroscopic guidance. Guidance was subcostal. Collecting system puncture was done by 18 gauge needle. Return of urine on removal of stylet of needle confirmed entrance into the collecting system. Then, a 0.035 inch J tip guide wire was inserted. The access to the kidney was dilated by one shot dilation. Dilation was performed by a 9Fr dilator. Then a single 28Fr Amplatz dilator was pulled in the alkan guide. The single passage allowed insertion of the 30F Amplatz working sheath. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness

	(n=15) Intervention 2: Percutaneous nephrolithotomy (PCNL). Patients in group B were placed in the prone position. The procedure was the same as group A. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SUPINE PERCUTANEOUS NEPHROLITHOTOMY (PCNL) versus PRONE PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Length of stay at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Length of hospital stay at Not reported; Mean; Supine 2.7; prone 3.1, Units: Days;
Risk of bias: All domain - Low, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Stone free state at 2 weeks; Group 1: 14/18, Group 2: 12/15
Risk of bias: All domain - Low, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Adverse events at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Fever at Not reported; Group 1: 1/18, Group 2: 3/15
Risk of bias: All domain - Low, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Transfusion at Not reported; Group 1: 1/18, Group 2: 1/15
Risk of bias: All domain - Low, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Colon injury at Not reported; Group 1: 0/18, Group 2: 0/15
Risk of bias: All domain - Low, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Mortality at Not reported; Group 1: 0/18, Group 2: 0/15
Risk of bias: All domain - Low, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Hospitalisation at Define

Study	Fayad 201771
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=120)
Countries and setting	Conducted in Egypt; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 12 weeks
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Adults (≥16 years), renal stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Adult patients with solitary lower calyceal stones of ≤20 mm, as measured by multi-slice spiral CT
Exclusion criteria	Patients aged<18 years, multiple renal stones, renal pelvic stone, stones of >20 mm, renal stones in anomalous kidney, bilateral renal stones, patients with renal failure, patients with bleeding tendency, and pregnant women.
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): Mini-PCNL group 37.23 (9.24); RIRS group 37.7 (9.76). Gender (M:F): 72:48. Ethnicity: Not reported
Further population details	1. Kidney pole: Lower kidney pole 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=60) Intervention 1: Percutaneous nephrolithotomy (PCNL). Patients underwent mini-PCNL in the prone position under general anaesthesia. Localisation and proper selection of the puncture sites was aided by contrast injection through the 6-F ureteric catheter placed at the beginning of the procedure. The time needed for the insertion of the ureteric catheter, as well as that needed for patient positioning were included in the overall operating time. Calyceal puncture was performed using a 22-G needle. A 0.035-mm J-tipped guidewire was inserted through the calyceal puncture into the renal pelvis. Dilatation of the tract was performed using the first three Alkan dilators. After tract dilatation, a 16-F sheath was inserted. A rigid 10-F ureteroscope was introduced and stone fragmentation was carried out using a Ho:YAG laser (365 lm fibre; energy 0.8 J; frequency 12Hz). At the end of the procedure a 16-F urethral catheter was left in situ for 48 h together with the ureteric catheter without placing a nephrostomy tube (i.e. tubeless).. Duration Not applicable. Concurrent medication/care: All patients in both groups received a prophylactic antibiotic immediately before the procedure in the form of ceftriaxone 1 g, which was continued for the ensuing 48 h.

	Indirectness: No indirectness (n=60) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. Patients underwent RIRS in the dorsal lithotomy position under general anaesthesia. Thorough cystoscopy was performed with a 22-F sheath. A 0.035-mm straight guidewire was inserted through the ureteric orifice to the renal pelvis. We used a 12/14-F ureteric access sheath (Cook Medical). A 7.5-F flexible ureteroscope was passed in a retrograde fashion to access the stone. The stones were fragmented using a Ho:YAG laser (365 lm fibre; energy 0.8 J; frequency 12 Hz). We left the resulting very small stone fragments after laser vaporisation for spontaneous passage. At the end of the procedure a 6-F ureteric catheter together with a 16-F urethral silicone catheter was routinely placed to be removed after 48 h. . Duration Not applicable. Concurrent medication/care: All patients in both groups received a prophylactic antibiotic immediately before the procedure in the form of ceftriaxone 1 g, which was continued for the ensuing 48 h. Indirectness: No indirectness
Funding	No funding
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PERCUTANEOUS NEPHROLITHOTOMY (PCNL) versus RIRS Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Stone free state at 12 weeks; Group 1: 15/55, Group 2: 43/51 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 5; Group 2 Number missing: 9 Protocol outcome 2: Adverse events at Define - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Bleeding at Not reported; Group 1: 2/55, Group 2: 0/51 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 5; Group 2 Number missing: 9 - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Minor mucosal injury at Not reported; Group 1: 1/55, Group 2: 2/51 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 5; Group 2 Number missing: 9 - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Fever at Not reported; Group 1: 2/55, Group 2: 3/51 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 5; Group 2 Number missing: 9	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define
Study	**Feng 200172**

Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=30)
Countries and setting	Conducted in USA; Setting: Not reported
Line of therapy	1st line
Duration of study	Not clear:
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), renal stone >20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	People referred for a percutaneous renal procedure, including stone extraction, antegrade endopyelotomy, or simultaneous stone extraction and endopyelotomy. Stone burden was 15 mm in length or greater, stones in the presence of obstruction (ureteropelvic junction obstruction, caliceal diverticula with narrowed infundibulum) or ureteropelvic junction obstruction
Exclusion criteria	For the tubeless PCN, exclusion criteria included procedures lasting more than 3 hours, more than two percutaneous accesses required, significant perforation of the collecting system, or significant residual stone burden
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): Tubeless group 62; standard group 53; mini group 56. Gender (M:F): Not reported. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=10) Intervention 1: Percutaneous nephrolithotomy (PCNL). The standard PCN renal access was obtained by placement of an 18 gauge access needle into the desired calix under fluoroscopic guidance. A 0.035-in angled tipped glide wire was passed into the collecting system. A torque vice was used when necessary to negotiate the glide wire past stones or areas of narrowing into and down the ureter. The access needle was removed, and the skin and fascia were incised. The nephrostomy tract was dilated to 30F with Amplatz dilators and a 34F sheath passed. A 26F ACMI rigid nephroscope was used and a 22F re-entry nephrostomy tube was placed at the end of the procedure. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=9) Intervention 2: Percutaneous nephrolithotomy (PCNL). The mini-PCNL technique involved initial

	percutaneous tract dilation to 22F to allow passage of a 26F working sheath. A 19F ACMI rigid nephroscope was used and a 22F re-entry nephrostomy tube was placed at the end of the procedure. Tubes were left for postoperative drainage for 48 hours. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: STANDARD PERCUTANEOUS NEPHROLITHOTOMY (PCNL) versus MINI PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Length of stay at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Length of hospital stay at Not reported; Group 1: mean 4.1 Days (SD 1.739); n=10, Group 2: mean 3.22 Days (SD 0.66); n=9
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Stone free state at Not reported; Group 1: 5/8, Group 2: 5/8
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Retreatment at Not reported; Group 1: 0/10, Group 2: 0/9
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 4: Adverse events at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Bleeding at Not reported; Group 1: 1/10, Group 2: 1/9
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 5: Pain intensity at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Pain at 1 day; Group 1: mean 3.7 (SD 1.2649); n=10, Group 2: mean 3.3 (SD 1.5); n=9; VAS 0-10 Top=High is poor outcome
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Hospitalisation at Define

Study	**Gu 201380**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=59)
Countries and setting	Conducted in China; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Plain roentgenogram for the kidneys, ureters, and bladder, ultrasound, and computed tomography
Stratum	Adults (≥16 years), ureteric stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with impacted proximal ureteral stones >15 mm in size
Exclusion criteria	Patients with the calculi in the kidney (C10 mm) or the bilateral or distal ureter and those with serumcreatinine (Scr) concentrations >1.5 mg/dL
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): MPCNL group 42.5 (10.1), RIRS group 44.22 (13.0). Gender (M:F): URS group 1:0.64; PCNL group 1:0.81. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Upper ureteric stones
Indirectness of population	No indirectness
Interventions	(n=30) Intervention 1: Percutaneous nephrolithotomy (PCNL). Minimally invasive PCNL was performed with the patients under general anaesthesia. In the lithotomy position, an 8/9.8F ureteroscope was inserted into the urinary bladder and a 5F ureteral catheter inserted into the ureter. The distal end of a 5F ureteral catheter was fixed to the 18F Foley bladder catheter. Then, the patient was turned prone position. Fluoroscopic guidance was used for stone location, and an 4F puncture needle was used to puncture the

	collecting system. The middle calix was punctured (although upper caliceal access can provide more direct access down the ureter than middle caliceal access, it could take more damage to body). When the needle was safely positioned in the collecting system (as ascertained by urine flow through the needle), contrast material was given through the needle to make the collecting system visible under fluoroscopy. A 0.038-inch guidewire was inserted through the needle into the collecting system. After making a small skin incision, the needle was removed. The dilatation procedure was performed under fluoroscopic guidance, and isotonic saline was used for irrigation and visualization. The nephrostomy tract was dilated with fascial dilators up to 12F–18F, a corresponding peel-away sheath was inserted above the last dilator, the dilators were removed, a rigid 8.5/9.8F ureteroscope (Richard Wolf) was inserted, and then the peel-away sheath was inserted further and guided by the ureteroscope until the tip of it reached ureteropelvic junction. Holmium:YAG laser lithotripsy was used for stone fragmentation in all cases; small stone fragments were removed by irrigation, and larger fragments were removed with stone forceps. Continuous irrigation and/or intermittent manual pumping of irrigant was done to maintain a clear ureteroscopic view when appropriate. At the end, double J (DJ) was placed antegrade in all patients. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=29) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. Ureteroscopic lithotripsy was completed under spinal or general anaesthesia in the lithotomy position with intravenous antibiotic prophylaxis. In the majority of cases, retrograde access to the upper urinary tract was obtained over safety guidewire with a 8.5/9.8F semi-rigid ureteroscope (Richard Wolf, Knittlingen, Germany). When the stone was difficult to visualize, and to look for residual fragments, a 7.4 F fibre-optic flexible ureteroscope was used, usually with the aid of an access sheath (Gyrus ACMI, Southborough, MA, USA). A holmium:YAG laser (Dornier Medical Systems, Germany) using a 365 lm (rigid ureteroscope) or 200 lm (Olympus digital flexible ureteroscope) fibre or lithoclast lithotripsy was used to disintegthe calculi. Sterile saline was used as irrigation under hydrostatic pressure. Intermittent irrigation was used to obtain a clear operative visual field. The laser energy was set at 1–1.5 J per pulse, and the frequency was between 5 and 15 Hz. A DJ stent was placed retrograde in all patients. Stone manipulation was carried out using wires, laser fibre, and a variety of Dormia/Gemini baskets.. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PERCUTANEOUS NEPHROLITHOTOMY (PCNL) versus URS

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone-free state at 1 month; Group 1: 30/30, Group 2: 26/29
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone-free state at 2 weeks; Group 1: 27/30, Group 2: 12/29 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 2: Use of healthcare services/retreatment at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Ancillary procedures at Not reported; Group 1: 6/-3, Group 2: 23/29 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Retreatment at Not reported; Group 1: 0/30, Group 2: 0/29 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 3: Adverse events at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Fever at Not reported; Group 1: 17/30, Group 2: 5/29 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Ureteral perforation at Not reported; Group 1: 0/30, Group 2: 1/29 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Transfusion at Not reported; Group 1: 0/30, Group 2: 0/29 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Upward stone migration at Not reported; Group 1: 0/30, Group 2: 9/29 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	Hendrikx 1999-188
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=156)
Countries and setting	Conducted in Netherlands; Setting: Three regional hospitals
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), ureteric stone <10 mm: Stone size 0-5mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Extended-mid or distal ureteral stone ≥5mm or <5mm but not successfully treated conservatively (2 weeks in same position); age >18 years; life expectancy > 1 year; fit for anaesthesia; provision of informed consent
Exclusion criteria	Seriously diminished kidney function (plasma creatinine >250µmol/L); malignancy of the urinary tract; expected difficulties in follow-up; bleeding tendency; imminent urosepsis; pregnancy; body weight >130 kg
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Other: >18 years. Gender (M:F): 125:31. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Lower ureteric stones
Indirectness of population	No indirectness
Interventions	(n=15) Intervention 1: Shock wave lithotripsy (SWL). No details reported. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=22) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. Ureterorenoscopy was performed in combination with either pulsed dye laser, or EHL. Semi rigid ureterorenoscopes of 7-9.5F were used by one experienced urologist in each hospital. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Other (Financial support from the scientific foundation of the Catharina Hospital, the SWEN and the Cook Company)
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS	

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define - Actual outcome for Adults (≥16 years), ureteric stone <10 mm: Stone free state at 12 weeks; Group 1: 11/15, Group 2: 21/22 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low, Subgroups - High; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Adverse events at Define; Pain intensity at Define; Length of stay at Define

Study	**Hendrikx 1999-288**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=156)
Countries and setting	Conducted in Netherlands; Setting: Three regional hospitals
Line of therapy	1st line
Duration of study	Intervention + follow up: 12 weeks
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), ureteric stone <10 mm: Stone size 6-10mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Extended-mid or distal ureteral stone ≥5mm or <5mm but not successfully treated conservatively (2 weeks in same position); age >18 years; life expectancy > 1 year; fit for anaesthesia; provision of informed consent
Exclusion criteria	Seriously diminished kidney function (plasma creatinine >250µmol/L); malignancy of the urinary tract; expected difficulties in follow-up; bleeding tendency; imminent urosepsis; pregnancy; body weight >130 kg
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Other: > 18 years. Gender (M:F): 125:31. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Lower ureteric stones
Indirectness of population	No indirectness
Interventions	(n=42) Intervention 1: Shock wave lithotripsy (SWL). No details reported. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness

	(n=52) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. Ureterorenoscopy was performed in combination with either pulsed dye laser, or EHL. Semi rigid ureterorenoscopes of 7-9.5F were used by one experienced urologist in each hospital. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Other (Financial support from the scientific foundation of the Catharina Hospital, the SWEN and the Cook Company)
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define - Actual outcome for Adults (≥16 years), ureteric stone <10 mm: Stone free state at 3 months; Group 1: 22/42, Group 2: 47/52 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low, Subgroups - High; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Adverse events at Define; Pain intensity at Define; Length of stay at Define

Study	**Hendrikx 1999-388**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=156)
Countries and setting	Conducted in Netherlands; Setting: Three regional hospitals
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), ureteric stone 10-20 mm: Stone size >11mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Extended-mid or distal ureteral stone ≥5mm or <5mm but not successfully treated conservatively (2 weeks in same position); age >18 years; life expectancy > 1 year; fit for anaesthesia; provision of informed consent
Exclusion criteria	Seriously diminished kidney function (plasma creatinine >250µmol/L); malignancy of the urinary tract; expected difficulties in follow-up; bleeding tendency; imminent urosepsis; pregnancy; body weight >130 kg

Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Other: >18 years. Gender (M:F): 125:31. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Lower ureteric stones
Indirectness of population	No indirectness
Interventions	(n=12) Intervention 1: Shock wave lithotripsy (SWL). No details reported. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=13) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. Ureterorenoscopy was performed in combination with either pulsed dye laser, or EHL. Semi rigid ureterorenoscopes of 7-9.5F were used by one experienced urologist in each hospital. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Other (Financial support from the scientific foundation of the Catharina Hospital, the SWEN and the Cook Company)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone free state at 3 months; Group 1: 2/12, Group 2: 11/13
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low, Subgroups - High; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Adverse events at Define; Pain intensity at Define; Length of stay at Define

Study	Hendrikx 1999-488
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=156)
Countries and setting	Conducted in Netherlands; Setting: Three regional hospitals
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), ureteric stone <10mm
Subgroup analysis within study	Post-hoc subgroup analysis
Inclusion criteria	Extended-mid or distal ureteral stone ≥5mm or <5mm but not successfully treated conservatively (2 weeks in same position); age >18 years; life expectancy > 1 year; fit for anaesthesia; provision of informed consent
Exclusion criteria	Seriously diminished kidney function (plasma creatinine >250µmol/L); malignancy of the urinary tract; expected difficulties in follow-up; bleeding tendency; imminent urosepsis; pregnancy; body weight >130 kg
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Other: >18 years. Gender (M:F): 125:31. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Lower ureteric stones
Indirectness of population	No indirectness
Interventions	(n=69) Intervention 1: Shock wave lithotripsy (SWL). No details reported. Duration Not applicable . Concurrent medication/care: Not reported. Indirectness: No indirectness (n=87) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. Ureterorenoscopy was performed in combination with either pulsed dye laser, or EHL. Semi rigid ureterorenoscopes of 7-9.5F were used by one experienced urologist in each hospital. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Other (Financial support from the scientific foundation of the Catharina Hospital, the SWEN and the Cook Company)
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS	

Protocol outcome 1: Length of stay at Define - Actual outcome for Adults (≥16 years), ureteric stone <10mm: Length of hospital stay at Not reported; Group 1: mean 2.2 Days (SD 2.6); n=69, Group 2: mean 4.4 Days (SD 3.1); n=87 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - High; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 2: Use of healthcare services/retreatment at Define - Actual outcome for Adults (≥16 years), ureteric stone <10mm: Retreatment at Not reported; Group 1: 8/69, Group 2: 0/87 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - High; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone <10 mm: Ancillary procedures at Not reported; Group 1: 26/69, Group 2: 8/87 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - High; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 3: Adverse events at Define - Actual outcome for Adults (≥16 years), ureteric stone <10mm: Perforation at Not reported; Group 1: 0/69, Group 2: 9/87 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - High; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone <10mm: Bleeding at Not reported; Group 1: 1/69, Group 2: 0/87 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - High; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone <10mm: Stone not seen/reached at Not reported; Group 1: 1/69, Group 2: 3/87 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - High; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; Treatment success (stone free state, clinically insignificant residual fragments) at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Hospitalisation at Define

Study	**Imran 201791**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=30)
Countries and setting	Conducted in Pakistan; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 4 weeks

Method of assessment of guideline condition	Adequate method of assessment/diagnosis: KUB or CT
Stratum	Adults (≥16 years), ureteric stone 10-20 mm: Mean (SD) stone size: SWL group 1.6 (0.39); URS group 2.05 (0.32)
Subgroup analysis within study	Not applicable
Inclusion criteria	Proximal ureteral stones sized 10 mm or larger located between the ureteropelvic junction and pelvic brim
Exclusion criteria	Pregnancy, ureteral stone with renal failure, previous open surgery for ureteric or renal stone, incomplete follow up during or after treatment
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): SWL group 34.1 (9.1); URS group 33 (9.5). Gender (M:F): 16/14. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Upper ureteric stones
Indirectness of population	No indirectness
Interventions	(n=16) Intervention 1: Shock wave lithotripsy (SWL). No details reported. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=14) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. URS was performed with patient under spinal or general anaesthesia using 8.9 FR ureteroscope. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS

Protocol outcome 1: New stone formation/incidence of stones/recurrence rate at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: stone free at 1 week; Group 1: 6/16, Group 2: 7/14
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Previous stone treatments: SWL group 0%; URS group 14%; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: stone free at 4 weeks; Group 1: 6/16, Group 2: 9/14
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Previous stone treatments: SWL group 0%; URS group 14%; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Use of healthcare services/retreatment rate at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: length of stay at 4 weeks; Group 1: mean 1.4 Hours (SD 0.6); n=16, Group 2: mean 22.1 Hours (SD 4.9); n=14 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Previous stone treatments: SWL group 0%; URS group 14%; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: retreatment at 4 weeks; Group 1: 7/16, Group 2: 0/14 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Previous stone treatments: SWL group 0%; URS group 14%; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: ancillary procedures at 4 weeks; Group 1: 5/16, Group 2: 3/14 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Previous stone treatments: SWL group 0%; URS group 14%; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 3: Adverse events at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: minor adverse events at 4 weeks; Group 1: 1/16, Group 2: 2/14 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Previous stone treatments: SWL group 0%; URS group 14%; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 4: Pain intensity at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: pain at post-operative; Group 1: mean 1.5 (SD 1.8); n=16, Group 2: mean 1.6 (SD 0.98); n=14; VAS 0-10 Top=High is poor outcome Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Previous stone treatments: SWL group 0%; URS group 14%; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; Treatment success (stone free state, clinically insignificant residual fragments) at Define; Kidney function at Define; Recurrence rate at Define; Mortality at Define; Length of stay at Define

Study	Islam 201294
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=136)
Countries and setting	Conducted in Pakistan; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Diagnosis by x-ray KUB, intravenous urography and ultrasonography
Stratum	Adults (≥16 years), ureteric stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Ureteric stones less than 25mm, not passed spontaneously within 3 weeks, located in the lower ureter occurring in adult patients with age above 18 years
Exclusion criteria	Patients with solitary kidney, renal insufficiency with creatinine more than 3mg/dl, ipsilateral ureteric stricture, active renal tract infection, failure to apply swiss lithoclast, transplanted kidney, morbid obesity, pregnancy, previous surgery for ureteric stones, coagulation disorders and patients with the co-existent renal stone and post SWL Steinstrasse
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): SWL group 12.8 (3.7); URS group 12.82 (3.5). Gender (M:F): 2.4:1. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Lower ureteric stones
Indirectness of population	No indirectness
Interventions	(n=68) Intervention 1: Shock wave lithotripsy (SWL). SWL was performed using the Modulith SLX-F2. All patients were put in prone position and the calculi were localised with fluoroscopy for the radiopaque stones and ultrasound guidance was used for radiolucent stones for focusing. All patients were given analgesics and the level of shock wave energy was progressively stepped up taking into consideration patient's comfort and level of pain until stone fragmentation was achieved. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=68) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. URS was performed with a semirigid 8Fr ureteroscope. The stones were disintegrated with pneumatic lithotripsy using the Swiss Lithoclast. Placement of a ureteral stent was left at the discretion of the operating surgeon. . Duration Not applicable.

	Concurrent medication/care: All patients had prophylactic antibiotics. . Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone-free state at 3 months; Group 1: 50/68, Group 2: 64/68
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Retreatment at Not reported; Group 1: 13/68, Group 2: 5/68
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Ancillary procedures at Not reported; Group 1: 13/68, Group 2: 4/68
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Adverse events at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Infection at Not reported; Group 1: 5/68, Group 2: 0/68
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: UTI at Not reported; Group 1: 0/68, Group 2: 4/68
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: ureteric perforation at Not reported; Group 1: 0/68, Group 2: 2/68
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	Javanmard 201599
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=46)
Countries and setting	Conducted in Iran; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: CT
Stratum	Adults (≥16 years), renal stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with renal pelvic stones 10-20 mm and BMI>30
Exclusion criteria	Kidney anomalies, uncontrolled coagulopathies, positive urinary culture, ureteral obstruction, pregnancy, and renal failure (serum creatinine ≥3 mg/dl) and history of failed previous procedure for treatment of stone
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): SWL group 36.1 ± 13.1; RIRS group 33.2 ± 11.4. Gender (M:F): 28:18. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Obese / long skin-to-stone distance (BMI > 30). 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=25) Intervention 1: Shock wave lithotripsy (SWL). Procedures were performed by an experienced urologist on ESWL therapy and a technician with Dornier Lithotripter (Dornier MedTech, Wessling, Germany). An intravenous sedative anaesthesia was administered before the sessions. Stone location was identified with the aid of fluoroscopy/ultrasound guidance. A maximum of 3000 shocks were applied at 80 shocks per minute during each session or until complete disintegration of the stones were observed. Duration Not applicable. Concurrent medication/care: Prophylactic intravenous antibiotics were administered before surgery. Indirectness: No indirectness (n=21) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. The procedure was performed under spinal anaesthesia while in lithotomy position by a surgeon. After inserting a semirigid ureteroscope under endovision guidance through the bladder, a 0.035-inch hydrophilic coated guide-wire was introduced through the channel into the ureteral orifice and then ureteroscopy was performed with hydrodilation to dilate the ureter. Thereafter, an 11 Fr ureteral access sheath was placed. A 4 Fr or 6 Fr feeding tube was placed

	transurethrally to maintain low pressure of the bladder. The 8.5/5.3 Fr flexible ureteroscope (Olympus) was introduced under fluoroscopic guidance up to the renal pelvis until the stone was identified. Stone fragmentation was performed using a Holmium:YAG laser (manufacture in Iran) with 200 mm fibres. When fragmentation was complete, final ureteronephroscopy followed by a control fluoroscopy were carried out for any residual stone detection. JJ stent was placed in the ureter for 2 weeks in cases of difficult dilation, prolonged procedure or residual stone. If no ureteral injury occurred, a ureteral stent was inserted and fixed to the Foley catheter. The ureteral catheter was removed the day after the procedure. Duration Not applicable. Concurrent medication/care: Prophylactic intravenous antibiotics were administered before surgery. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Stone free state at 3 months; Group 1: 17/25, Group 2: 19/21
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - High, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Retreatment at 3 months; Group 1: 11/25, Group 2: 2/21
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - High, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Adverse events at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Fever at 3 months; Group 1: 2/25, Group 2: 2/21
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - High, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	Javanmard 201698
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=120)
Countries and setting	Conducted in Iran; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: CT urography
Stratum	Adults (≥16 years), renal stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Presence of renal stones ≤ 20 mm in diameter
Exclusion criteria	Kidney anomalies, uncontrolled coagulopathies, ureteral obstruction, history of previous renal surgery or SWL, pregnancy and renal failure (serum creatinine ≥ 3mg/dl)
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): SWL group 31.3 ± 6.5; RIRS group 32.4 ± 7.8. Gender (M:F): 76:44. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear (Mixed: superior calyx 26.7%, middle calyx 19.2%, inferior calyx 9.2%, pelvis 35.8%, multiple 9.2%). 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=60) Intervention 1: Shock wave lithotripsy (SWL). The SWL procedure was performed using the Dornier HM3 Lithotripter (Dornier MedTech, Wessling, Germany) on sedated patient in the supine position. All SWL procedures were performed by a single urologist. The therapeutic power was started from 15 kV and increased stepwise up to 20 kV. The rate of delivered shocks was 60 to 90 per minute. The number of shock waves was limited to 3,000 per session. Shocks were given based on stone dissolution while stones were fragmented under f1uoroscopic/ultrasonic guidance. The therapy head of the electromagnetic lithotripter was positioned below the treatment table and conductive gel was applied. Duration Not applicable. Concurrent medication/care: Routine prophylactic intravenous antibiotics were administered before surgery. Indirectness: No indirectness (n=60) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. Patients received spinal anaesthesia and then were turned into the lithotomy position. After inserting an 11 Fr semirigid ureteroscope (Olympus)

	under endovision guidance thorough the bladder, a 0.035-inch hydrophilic coated guide-wire was introduced through the channel into the ureteral orifice and then ureteroscopy was performed with hydrodilation to dilate the ureter. Thereafter, an 11 Fr ureteral access sheath was placed and a 4Fr/6Fr feeding tube was placed trans-urethrally to maintain low pressure of the bladder. An 8.5/5.3 Fr flexible ureteroscope (Olympus) was introduced under fluoroscopic guidance to the renal pelvis to identify the stone. Stone fragmentation was performed using holmium:YAG laser with 200 µm fibres. Lower and middle calyceal stones were relocated into renal pelvis or upper calyx by basketing before lithotripsy if it was not possible to fragment them in their primary position. Final ureteronephroscopy was performed after fragmentation, followed by a control fluoroscopy to detect any probable residual stones. A double-J stent was placed in the ureter for two weeks in cases of difficult dilation, prolonged procedure or residual stone. In case of no ureteral injury, a ureteral stent was inserted and fixed to the Foley catheter. The ureteral catheter was removed the day after surgery. RIRS procedures were performed by a single experienced endourologist. Duration Not applicable. Concurrent medication/care: Routine prophylactic intravenous antibiotics were administered before surgery. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus RIRS

Protocol outcome 1: Hospitalisation at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Hospital stay at Not reported; Group 1: mean 6.7 Hours (SD 1.3); n=60, Group 2: mean 18.9 Hours (SD 4.3); n=60
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Stone free state at 3 months; Group 1: 53/60, Group 2: 58/60
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Stone free state at After 1 session; Group 1: 45/60, Group 2: 52/60
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Retreatment at Not reported; Group 1: 15/60, Group 2: 6/60
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 4: Adverse events at Define - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Fever at Not reported; Group 1: 4/60, Group 2: 1/60 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 5: Pain intensity at Define - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Pain at Not reported; Group 1: mean 5.2 (SD 2.8); n=60, Group 2: mean 3.1 (SD 2.7); n=60; VAS 0-10 Top=High is poor outcome Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Length of stay at Define

Study	**Jun-ou 2010105**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=224)
Countries and setting	Conducted in Pakistan; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 2 weeks
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Complete clinical evaluation (history, examination, urin culture, xray KUB, ultrasound KUB and excretory urography)
Stratum	Adults (≥16 years), renal stone >20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	(1) a single access site, (2) non obstructive renal unit, (3) no significant perforation or bleeding, and (4) a second look would not be required.
Exclusion criteria	Not reported
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): tubeless group 51.49 (12.77); standard group 50.63 (12.18). Gender (M:F): 58:37. Ethnicity: Not reported

Further population details	1. Kidney pole: Not stated / Unclear (Mixed). 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	Serious indirectness: majority of stones were renal (62%) but note that also includes staghorn and some ureteral stones
Interventions	(n=43) Intervention 1: Percutaneous nephrolithotomy (PCNL). As regards tubeless PCNL, the ureteral catheter (the same 6F ureteral catheter that was placed at the beginning of the operation) was adjusted nephroscopically, the tip being placed at the renal pelvis. The working sheath was removed with the safety guide wire still in place. The nephrostomy site was examined and, if there was no evidence of active bleeding for 5 minutes, the wound was closed with sutures. The guide wire was then removed and the ureteral catheter was left attached to the Foley catheter for 48 hours. The nephrostomy tube sized 20F was routinely inserted in the remained cases (Group-II). The prolong placement of the ureteral catheter and nephrostomy tube depended on postoperative fever, bleeding or other complications. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=52) Intervention 2: Percutaneous nephrolithotomy (PCNL). Single stage percutaneous nephrolithotomy was done in all patients. Intravenous antibiotic was given before the operation in all cases. After the induction of general anaesthesia, an open-end 6F ureteral catheter was placed via a transurethral approach into the ureter with the patient in a supine position. The tip of the ureteral catheter was placed at the ureteropelvic junction or at the renal pelvis. The percutaneous access was created by a single urologist (BL) in all cases. Under fluoroscopic guidance in the prone position and after injection of contrast media via ureteral catheter, 95 sites were supracostal upper pole access. The needle was pushed through the diaphragm and retroperitoneum in full expiration, whereas the needle was passed through the kidney during deep inspiration. The working and safety guide-wires were inserted after the tip of the needle was in the collecting system. Tract dilatations were performed by Amplatz fascial dilators (Cook Urological Spencer, Indiana, USA) or telescopic metal dilators sizes from 8F-30F, with an inserted 30F Amplatz sheath. Using a standard nephroscope (26F), stone disintegration was obtained with ultrasonic and/or pneumatic lithotripsy. Fluoroscopy and contrast nephrostogram with systematic nephroscopy were performed to evaluate the stone-free status. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: STANDARD PERCUTANEOUS NEPHROLITHOTOMY (PCNL) versus TUBELESS PCNL

Protocol outcome 1: Length of stay at Define

- Actual outcome for Adults (≥16 years), renal stone >20 mm: Length of stay at Not reported; Group 1: mean 4.83 Days (SD 1.44); n=52, Group 2: mean 3.45 Days (SD 1.01); n=43 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Difference in gender; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define - Actual outcome for Adults (≥16 years), renal stone >20 mm: Stone free state at 1 day; Group 1: 44/52, Group 2: 39/43 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Difference in gender; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), renal stone >20 mm: Clinically insignificant fragments (<4mm) at 1 day; Group 1: 7/52, Group 2: 4/43 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Difference in gender; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Adverse events at Define; Pain intensity at Define; Hospitalisation at Define

Study	**Karakan 2017113**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=97)
Countries and setting	Conducted in Turkey; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 1 month
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: KUB x-ray, CT, ultrasonography, intravenous urolography
Stratum	Adults (≥16 years), renal stone >20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with a stone size equal to or smaller than 25mm, patients with dilation from a single tract
Exclusion criteria	Patients with bleeding diathesis, abnormal renal anatomy, skeletal tract abnormalities, non-opaque stones and paediatric patients under 18 years old
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (range): mPCNL group 43.3 (19-69); standard PCNL group 46.5 (26-84). Gender (M:F): 59:38. Ethnicity: Not reported

Further population details	1. Kidney pole: Not stated / Unclear (Mixed). 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=47) Intervention 1: Percutaneous nephrolithotomy (PCNL). A 6F open-end ureter catheter was inserted to all patients while they were in the lithotomy position. The patients were then positioned to a prone position and all pressure points were supported with cushions. The contrast agent was given through the ureteral catheter to image calyceal anatomy. The suitable calyx was chosen under fluoroscopy, and a percutaneous 18 gauge access needle was introduced into the collecting system. A guidewire was placed into the collecting system. The tract was created by a single shot 14 F dilator in patients that had an ultra-mini PCNL. A 8/9.8 Fr semirigid ureteroscope was used for ultramini technique. The stones were fragmented using a 365 um holmium YAG laser at a power setting of 10-20 W. Ultrasonic and pneumatic lithotripters were used in PCNL. The stones were removed with graspers when needed. After the procedure, the presence of any residual stones were checked with fluoroscopy, and the integrity of the collected system was examined with retrograde pyelography. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=50) Intervention 2: Percutaneous nephrolithotomy (PCNL). The same procedure was used as the ultra mini PCNL group, apart from that the tract was dilated up to 26F, and a 22-25F rigid endoscope was used. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: ULTRA MINI PERCUTANEOUS NEPHROLITHOTOMY (PCNL) versus STANDARD PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Length of stay at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Length of hospital stay at Not reported; Mean; Standard group 3 (2-5); ultra mini group 1 (1-4), Units: Days;
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Stone free state at 1 month; Group 1: 42/47, Group 2: 44/50
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Use of healthcare services/retreatment at Define - Actual outcome for Adults (≥16 years), renal stone >20 mm: Ancillary procedure at Not reported; Group 1: 4/47, Group 2: 6/50 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 4: Adverse events at Define - Actual outcome for Adults (≥16 years), renal stone >20 mm: Blood transfusion at Not reported; Group 1: 0/47, Group 2: 4/50 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), renal stone >20 mm: Fever at Not reported; Group 1: 1/47, Group 2: 1/50 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), renal stone >20 mm: UTI at Not reported; Group 1: 1/47, Group 2: 2/50 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Hospitalisation at Define

Study	**Karakoyunlu 2017115**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=60)
Countries and setting	Conducted in Turkey; Setting: Hospital
Line of therapy	1st line
Duration of study	Intervention + follow up: 2 weeks
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Confirmed by CT
Stratum	Adults (≥16 years), renal stone >20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Kidney pelvic stones more than 20 mm in diameter
Exclusion criteria	Patients aged below 15 years, multiple stones, those who had previously received SWL or surgical intervention for the same stone, suspect of infection or pyonephrosis and those with a stone smaller than 20 mm in diameter.

Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): PCNL group 45.8 (14.1), RIRS group 48.4 (15.5). Gender (M:F): 34:26. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/hounsfield units: Stone composition (Mixed: calcium oxalate 60%, calcium phosphate 21.7%, uric acid 8.3%, struvite 8.3%, cystine 1.7%). 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=30) Intervention 1: Percutaneous nephrolithotomy (PCNL). Patients were in the lithotomy position. A 6F ureter catheter was placed cystoscopically. In the prone position under fluoroscopic guidance, the most appropriate calyx was determined and a glide wire was introduced with a diamond tipped needle and dilation up to 30F was achieved with an Amplatz dilator. Then the sheath was placed and by entering with a Storz nephroscope, the stones were broken with a pneumatic lithotripter and removed with forceps. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=30) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. A 9.5-11/5F access sheath was placed in all patients in the lithotomy position. Standard retrograde FURS was applied with a 7.5F flexible ureteroscope. Stone fragmentation was achieved using a 4-12W holmium laser with 200 or 365 µm laser fibers at 5-10Hz at 800-1200 mj intervals. The fragments were collected in a 1.9F basket. It was attempted to achieve fragmentation of all stones with holmium lithotripsy and where stone-free was not anticipated or in patients with a single kidney, a double J stent was placed. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PERCUTANEOUS NEPHROLITHOTOMY (PCNL) versus URS

Protocol outcome 1: Hospitalisation at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Length of hospital stay at Not reported; Group 1: mean 3.13 Days (SD 0.43); n=30, Group 2: mean 3.66 Days (SD 1.29); n=30
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Stone free state (stone free + insignificant fragments) at 2 weeks; Group 1: 27/30, Group 2: 30/30

Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), renal stone >20 mm: Clinically insignificant fragments at 2 weeks; Group 1: 1/30, Group 2: 10/30 Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Adverse events at Define; Pain intensity at Define; Length of stay at Define

Study	**Keeley 2001120**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=228)
Countries and setting	Conducted in United Kingdom; Setting: In the lithotripsy units at Southmean Hospital, Bristol and Withington Hospital, Manchester, UK
Line of therapy	1st line
Duration of study	Intervention + follow up: Mean follow up 2.2 years
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: KUB
Stratum	Adults (≥16 years), renal stone <10 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with asymptomatic or minimally symptomatic single or multiple calyceal stones of a combine diameter of <15mm in a single kidney on a plain film of the kidneys, ureters and bladder
Exclusion criteria	Patients experiencing symptoms of loin pain or colic requiring strong analgesics, or dull ache/mild pain once a week were excluded. Other exclusion criteria were bleeding disorders or anticoagulant therapy, pregnancy, treatment for infertility, medullary sponge kidney, stones in calyceal diverticula or cysts, radiolucent stones and obesity (>100kg)
Recruitment/selection of patients	Recruited from urologists within the South-west and the North-west regions
Age, gender and ethnicity	Age - Mean (SD): SWL group 53.7 (10.8), observation group 53.2 (12.8). Gender (M:F): 189:39. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear (Mixed: upper calyx 23.7%, middle calyx 28.1%, lower calyx 72.3%). 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated /

	Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Not stated / Unclear 6. Uteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=113) Intervention 1: Shock wave lithotripsy (SWL). Patients underwent treatment according to a standard protocol as follows. A single treatment was administered, after which fragmentation was assessed by a KUB. Further treatment was given if the fragmentation was felt to be incomplete and repeated until all fragments were <5mm. Patients treated at Bristol were treated on the lithostar tube-C throughout the trail. Patients treated in Manchester were treated on a Lithostar tube-C until November 1994, and then the Siemens Multiline tube-M. Number of shocks delivered, maximum power of the shocks delivered, type of analgesia required, complications and assessment of fragmentation, was recorded. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=115) Intervention 2: Non-surgical / conservative management. Observation. Patients received no treatment unless symptoms developed. The subsequent treatment of these patients depended on the clinical presentation and the current practice at the admitting hospital. Duration Not reported. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Academic or government funding (Funded by UK Medical Research Council)
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus NON-SURGICAL / CONSERVATIVE MANAGEMENT Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define - Actual outcome for Adults (≥16 years), renal stone <10 mm: Stone-free state at Mean 2.2 years; Group 1: 28/101, Group 2: 16/99 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 12; Group 2 Number missing: 16	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Adverse events at Define; Pain intensity at Define; Length of stay at Define

Study	**Kumar 2015129**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=221)

Countries and setting	Conducted in India; Setting: Urology outpatient department
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Children (<16 years): Renal 10-20mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Age <15 years; single radiopaque lower caliceal renal stone of 10-20mm
Exclusion criteria	Patients with a bleeding disorders; radiolucent stones; active urinary tract infection; severe hydronephrosis; severe comorbid illness making the patient unfit for general anaesthesia; serum creatinine level >1.5mg/dL; anatomically abnormal kidney; coexisting ureteral pathology including tumour/stricture
Recruitment/selection of patients	Consecutive patients
Age, gender and ethnicity	Age - Mean (SD): SWL group 10.7 (1.3); PCNL group 10.3 (1.2). Gender (M:F): 103:109. Ethnicity: Not reported
Further population details	1. Kidney pole: Lower kidney pole 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not applicable 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=111) Intervention 1: Shock wave lithotripsy (SWL). All SWL procedures were performed as an outpatient procedure using the electromagnetic lithotripter. At 60 minutes before the procedure 5gm of a eutectic mixture of lidocaine and prilocaine was applied on approximately 30cm² area of skin corresponding to the site of entry of shockwaves. The shockwave delivery was 90 pulses per minute. The maximum number of shockwaves was 2500 per session. A maximum of 4 sessions of SWL was repeated for incomplete clearance. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=110) Intervention 2: Percutaneous nephrolithotomy (PCNL) . Patients were admitted to hospital. All procedures were performed by one consultant urologist. A 5F open ended ureteral catheter was placed in the renal pelvis cystoscopically with the patient in the lithotomy position. Then the patient was positioned prone. The selected calix was punctured under fluoroscopy guidance by an 18 gauge needle using the bulls eye technique and the tract was dilated to 18F, then a 15F miniature nephroscope was used with pneumatic intracorporeal lithotripsy. Stone fragmentation and clearance were confirmed by direct vision and under fluoroscopy. A 12F nephrostomy tube was removed once urine was clear. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness

Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Hospitalisation at Define
- Actual outcome for Children (<16 years): Length of hospital stay at Not reported; Mean; SWL group 0.3; PCNL group 3.7, Units: Days;
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 4, Reason: ; Group 2 Number missing: 5

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Children (<16 years): Stone-free at 3 months; Group 1: 88/106, Group 2: 100/106
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 4, Reason: ; Group 2 Number missing: 5

Protocol outcome 3: Use of healthcare services/retreatment at Define
- Actual outcome for Children (<16 years): Ancillary procedures at Not reported; Group 1: 15/106, Group 2: 6/106
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 4, Reason: ; Group 2 Number missing: 5
- Actual outcome for Children (<16 years): Retreatment at Not reported; Group 1: 44/106, Group 2: 3/106
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 4, Reason: ; Group 2 Number missing: 5

Protocol outcome 4: Adverse events at Define
- Actual outcome for Children (<16 years): UTI at Not reported; Group 1: 1/106, Group 2: 9/106
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 4, Reason: ; Group 2 Number missing: 5
- Actual outcome for Children (<16 years): Ureteral extravasation at Not reported; Group 1: 0/106, Group 2: 0/106
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 4, Reason: ; Group 2 Number missing: 5
- Actual outcome for Children (<16 years): Ureteral perforation at Not reported; Group 1: 0/106, Group 2: 0/106
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 4, Reason: ; Group 2 Number missing: 5

Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	Kumar 2015128
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=158)
Countries and setting	Conducted in India; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Ultrasound, CT urogram
Stratum	Adults (≥16 years), renal stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with a single lower caliceal radiolucent renal stone, aged greater than 15 years
Exclusion criteria	Patients with coagulopathy, radiopaque stones, active urinary tract infection, sever comorbidity that would interfere with positioning during SWL or general anaesthesia during RIRS and miniperc, anatomical renal anomaly, coexisting ureteral pathology or a matrix stone and those who did not provide written informed consent
Recruitment/selection of patients	Consecutive patients
Age, gender and ethnicity	Age - Mean (SD): SWL group 33.1 (1.3); RIRS group 33.4 (1.4); PCNL group 33.7 (1.6). Gender (M:F): 61:65. Ethnicity: Not reported
Further population details	1. Kidney pole: Lower kidney pole 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=52) Intervention 1: Shock wave lithotripsy (SWL). SWL was performed on an outpatient basis using the Alpha Compact electromagnetic lithotripter with an integrated ultrasound system. A eutectic mixture of lidocaine and prilocaine (5gm) was applied on an approximately 30cm² area of skin corresponding to the entry site of shock waves 60 minutes before the procedure. The stone was localised and fragmentation was monitored using an integrated ultrasound device with a 3.5-5 MHz probe. The shock wave delivery was 90 pulses per minute with a maximum of 2500 shock waves per session. Patients remained under observation for 2 hours after SWL. A maximum of 4 sessions was allowed. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=53) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. All procedures were done by one consultant urologist experienced with the techniques and with the patient under general anaesthesia. For

	RIRS, an 8/9.8Fr dual channel flexible Cobra ureteroscope was used with a 12Fr ureteral access sheath. If required, the ureteral orifice was dilated with a balloon catheter. The 100 W VersaPulse holmium laser was used for intracorporeal lithotripsy with a 200µm fibre and a 2.2Fr nitinol stone basket for fragment removal. The holmium laser power setting was 0.5-1 J with the pulse set at 20-40 Hz. In patients with large stone burden or pelvicalyceal extravasation/perforation a DJ stent remained in situ and was removed at 4 weeks. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=53) Intervention 3: Percutaneous nephrolithotomy (PCNL) . All procedures were performed by one consultant urologist experienced with the technique and with the patient under general anaesthesia. A 5Fr open-ended ureteral catheter was placed in the renal pelvis with the patient in the lithotomy position. The patient was then positioned prone and all pressure points were padded. Contrast medium was infused via the ureteral catheter to assess pelvicalyceal system anatomy. Using the bull's eye technique, the selected superior or inferior calyx was punctured under fluoroscopy guidance with an 18 gauge needle and the puncture tract was dilated to 18Fr. A 15Fr miniature nephroscope was used with a pneumatic LithoClast. Stone fragmentation was clearances were confirmed under direct vision. A 12Fr nephrostomy tube remained in situ for drainage and was removed after urine was clear. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus RIRS

Protocol outcome 1: Length of stay at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Length of hospital stay at Not reported; Mean; SWL group 0.13; RIRS group 1.3, Units: Days;
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10; Group 2 Number missing: 12

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Stone free state at 3 months; Group 1: 31/42, Group 2: 37/43
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10; Group 2 Number missing: 10

Protocol outcome 3: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Retreatment at Not reported; Group 1: 27/42, Group 2: 1/43
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10; Group 2 Number missing: 12
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Ancillary procedures at Not reported; Group 1: 8/42, Group 2: 4/43

Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10; Group 2 Number missing: 12

Protocol outcome 4: Adverse events at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: UTI at Not reported; Group 1: 1/42, Group 2: 2/43
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10; Group 2 Number missing: 10

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Length of stay at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Length of hospital stay at Not reported; Mean; SWL group 0.13; PCNL group 3.1, Units: Days;
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Stone free state at 3 months; Group 1: 31/42, Group 2: 39/41
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10; Group 2 Number missing: 12

Protocol outcome 3: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Retreatment at Not reported; Group 1: 27/42, Group 2: 1/41
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10; Group 2 Number missing: 12
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Ancillary procedures at Not reported; Group 1: 8/42, Group 2: 3/41
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10; Group 2 Number missing: 12

Protocol outcome 4: Adverse events at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: UTI at Not reported; Group 1: 1/42, Group 2: 2/41
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10; Group 2 Number missing: 12

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: RIRS versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Length of stay at Define

- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Length of hospital stay at Not reported; Mean; RIRS group 1.3; PCNL group 3.1, Units: Days; Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10; Group 2 Number missing: 12 Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Stone free state at 3 months; Group 1: 37/43, Group 2: 39/41 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10; Group 2 Number missing: 12 Protocol outcome 3: Use of healthcare services/retreatment at Define - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Retreatment at Not reported; Group 1: 1/43, Group 2: 1/41 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10; Group 2 Number missing: 12 - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Ancillary procedures at Not reported; Group 1: 4/43, Group 2: 3/41 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10; Group 2 Number missing: 12 Protocol outcome 4: Adverse events at Define - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: UTI at Not reported; Group 1: 2/43, Group 2: 2/41 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10; Group 2 Number missing: 12	
Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Hospitalisation at Define

Study	Kumar 2015-1131
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=190)
Countries and setting	Conducted in India; Setting: Urology outpatient department
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), ureteric stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with a single upper ureteral radiopaque calculus less than 20 mm
Exclusion criteria	Patients with a stone larger than 20 mm, bleeding disorders, radiolucent stones, active urinary tract infection, age >60 years and <15 years, severe hydronephrosis, weight >100kg and <40kg, comorbid cardiovascular and respiratory illnesses, pregnancy, fever >37 degrees, serum creatinine level >1.5mg/dL, total leucocyte count >12000/dL, solitary kidney, coexisting ureteral pathology including tumour/stricture, and those who did not give written informed consent
Recruitment/selection of patients	Consecutive patients
Age, gender and ethnicity	Age - Mean (SD): SWL group 36.1 (2.1); URS group 35.1 (2.4). Gender (M:F): 49:53. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Upper ureteric stones
Indirectness of population	No indirectness
Interventions	(n=53) Intervention 1: Shock wave lithotripsy (SWL). SWL was performed as an outpatient procedure using the Dornier Compact Delta. Five grams of eutectic mixture and prilocaine was applied on a 30cm² skin area corresponding to the entry site of the shockwaves, 60 minutes before the procedure. A tablet of diclofenac sodium was given orally at the same time. The shockwave was delivered at a rate of 100 impulses per minute. Three thousand shockwaves were the maximum number of shockwaves to be given per session. During each session, the patient was observed for 2 hours and KUB radiography and ultrasonography were used to check stone clearance at 2 weeks. Retreatment SWL was given for incomplete clearance for a maximum of 4 sessions. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=49) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. The URS procedure was performed

	using a 6/7.5F semi rigid ureteroscope. The holmium laser was used for intracorporeal lithotripsy. The power setting of holmium laser was 0.6-1.2J. The pulse rate was set between 5-15Hz. The ureteral orifice was dilated as needed and in cases of large stone burden, a double J stent was kept in situ. Extravasation of perforation of the ureter also mandated placement of a stent. Stent removal was performed 4 weeks after surgery. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), ureteric stone <10 mm: Stone-free status at 3 months; Group 1: 45/53, Group 2: 43/49
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), ureteric stone <10 mm: Retreatment at Not reported; Group 1: 25/53, Group 2: 3/49
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone <10 mm: Ancillary procedures at Not reported; Group 1: 9/53, Group 2: 4/49
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Adverse events at Define
- Actual outcome for Adults (≥16 years), ureteric stone <10 mm: UTI at Not reported; Group 1: 0/53, Group 2: 1/49
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone <10 mm: stone up-migration at Not reported; Group 1: 0/53, Group 2: 1/49
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	Kumar 2015-1132
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=195)
Countries and setting	Conducted in India; Setting: A urology outpatient department
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Ultrasound, KUB x-ray and non-contrast CT
Stratum	Adults (≥16 years), renal stone <10 mm
Subgroup analysis within study	Post-hoc subgroup analysis: Randomised and then sub grouped for analysis
Inclusion criteria	People with single lower caliceal radiopaque calculus <20 mm (including stones <5mm)
Exclusion criteria	Patients with bleeding disorders, active urinary infection, age >60 years and <15 years, weight >100 and <40kg, comorbid cardiovascular and respiratory illnesses, fever >38 degrees C, total leukocyte count >12000/dL, serum creatinine >1.5mg/dL, solitary kidney, coexisting ureteric pathology, including tumour/stricture. pregnancy, moderate and sever hydronephrosis, unfavourable lower caliceal anatomy, radiolucent stones, caliceal diverticulum associated with the targeted stone, and pelvic kidney
Recruitment/selection of patients	Consecutive patients
Age, gender and ethnicity	Age - Mean (SD): SWL group 37.1 (2.1); RIRS group 35.1 (1.9). Gender (M:F): 90:90. Ethnicity: Not reported
Further population details	1. Kidney pole: Lower kidney pole 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=55) Intervention 1: Shock wave lithotripsy (SWL). SWL was performed as an outpatient procedure using the Dornier Compact Delta. 5grams of eutectic mixture of lignocaine and prilocaine was applied on 30cm² skin area corresponding to the entry site of the shock waves, 60 minutes before the procedure. A tablet of diclofenac sodium was given orally at the same time. The rate of shock delivery was 100 impulses per minute. The maximum number of shock waves to be given per session was 3000 shock waves. The patient was observed for 2 hours after each session. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=51) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. The procedure was performed using a 6F/7.5F flexible ureteroscope dual channel. Dilation of the ureteral orifice was done whenever required. Ureteral access sheath was used in all cases. The holmium laser was used for intracorporeal lithotripsy. The

	power setting of the holmium laser was 0.5-1J. The pulse rate was set between 20-40Hz. A 2.2F Nitinol stone basket was used for fragments removal. In cases of large stone burden, Double J stent was kept in situ. Double J stent was removed after 4 weeks. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus RIRS

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Stone free state at 3 months; Group 1: 45/55, Group 2: 43/51
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - High, Comments - 7 and 8 participants dropped out overall in the two groups but unsure how many in each subgroup; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Retreatment at Not reported; Group 1: 25/55, Group 2: 3/51
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - High, Comments - 7 and 8 participants dropped out overall in the two groups but unsure how many in each subgroup; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Ancillary procedures at Not reported; Group 1: 9/55, Group 2: 4/51
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - High, Comments - 7 and 8 participants dropped out overall in the two groups but unsure how many in each subgroup; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Adverse events at Define
- Actual outcome for Adults (≥16 years), renal stone <10 mm: UTI at Not reported; Group 1: 0/55, Group 2: 1/51
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - High, Comments - 7 and 8 participants dropped out overall in the two groups but unsure how many in each subgroup; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Ureteral extravasation at Not reported; Group 1: 0/55, Group 2: 0/51
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - High, Comments - 7 and 8 participants dropped out overall in the two groups but unsure how many in each subgroup; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Ureteral perforation at Not reported; Group 1: 0/55, Group 2: 0/51
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - High, Comments - 7 and 8 participants dropped out overall in the two groups but unsure how many in each subgroup;

Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	**Kumar 2015-2131**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=190)
Countries and setting	Conducted in India; Setting: Urology outpatient department
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), ureteric stone 10-20 mm
Subgroup analysis within study	Post-hoc subgroup analysis: Randomised and then stratified
Inclusion criteria	Patients with a single upper ureteral radiopaque calculus less than 20 mm
Exclusion criteria	Patients with a stone larger than 20 mm, bleeding disorders, radiolucent stones, active urinary tract infection, age >60 years and <15 years, severe hydronephrosis, weight >100kg and <40kg, comorbid cardiovascular and respiratory illnesses, pregnancy, fever >37 degrees, serum creatinine level >1.5mg/dL, total leucocyte count >12000/dL, solitary kidney, coexisting ureteral pathology including tumour/stricture, and those who did not give written informed consent
Recruitment/selection of patients	Consecutive patients
Age, gender and ethnicity	Age - Mean (SD): SWL group 37.3 (2.2); URS group 36.3 (2.3). Gender (M:F): 41:37. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Upper ureteric stones
Indirectness of population	No indirectness
Interventions	(n=37) Intervention 1: Shock wave lithotripsy (SWL). SWL was performed as an outpatient procedure using the Dornier Compact Delta. Five grams of eutectic mixture and prilocaine was applied on a 30cm² skin area corresponding to the entry site of the shockwaves, 60 minutes before the procedure. A tablet of diclofenac sodium was given orally at the same time. The shockwave was delivered at a rate of 100 impulses per minute. Three thousand shockwaves were the maximum number of shockwaves to be given per session.

	During each session, the patient was observed for 2 hours and KUB radiography and ultrasonography were used to check stone clearance at 2 weeks. Retreatment SWL was given for incomplete clearance for a maximum of 4 sessions. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=41) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. The URS procedure was performed using a 6/7.5F semi rigid ureteroscope. The holmium laser was used for intracorporeal lithotripsy. The power setting of holmium laser was 0.6-1.2J. The pulse rate was set between 5-15Hz. The ureteral orifice was dilated as needed and in cases of large stone burden, a double J stent was kept in situ. Extravasation of perforation of the ureter also mandated placement of a stent. Stent removal was performed 4 weeks after surgery. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone free state at 3 months; Group 1: 29/37, Group 2: 35/41
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Retreatment at Not reported; Group 1: 29/37, Group 2: 7/41
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Ancillary procedures at Not reported; Group 1: 10/37, Group 2: 12/41
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Adverse events at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: UTI at Not reported; Group 1: 2/37, Group 2: 2/41
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone up-migration at Not reported; Group 1: 0/37, Group 2: 3/41
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	**Kumar 2015-2132**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=195)
Countries and setting	Conducted in India; Setting: A urology outpatient department
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Ultrasound, KUB x-ray and non-contrast CT
Stratum	Adults (≥16 years), renal stone 10-20 mm
Subgroup analysis within study	Post-hoc subgroup analysis
Inclusion criteria	People with single lower caliceal radiopaque calculus <20 mm (including stones <5mm)
Exclusion criteria	Patients with bleeding disorders, active urinary infection, age >60 years and <15 years, weight >100 and <40kg, comorbid cardiovascular and respiratory illnesses, fever >38 degrees C, total leukocyte count >12000/dL, serum creatinine >1.5mg/dL, solitary kidney, coexisting ureteric pathology, including tumor/stricture. pregnancy, moderate and sever hydronephrosis, unfavourable lower caliceal anatomy, radiolucent stones, caliceal diverticulum associated with the targeted stone, and pelvic kidney
Recruitment/selection of patients	Consecutive patients
Age, gender and ethnicity	Age - Mean (SD): SWL group 38.3 (2.2); RIRS group 36.3 (2.3). Gender (M:F): 90:90. Ethnicity: Not reported
Further population details	1. Kidney pole: Lower kidney pole 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=35) Intervention 1: Shock wave lithotripsy (SWL). SWL was performed as an outpatient procedure using the Dornier Compact Delta. 5grams of eutectic mixture of lignocaine and prilocaine was applied on 30cm² skin area corresponding to the entry site of the shock waves, 60 minutes before the procedure. A tablet of diclofenac sodium was given orally at the same time. The rate of shock delivery was 100 impulses per minute. The maximum number of shock waves to be given per session was 3000 shock waves. The patient was observed for 2 hours after each session. Duration Not applicable. Concurrent medication/care: Not

	reported. Indirectness: No indirectness (n=39) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. The procedure was performed using a 6F/7.5F flexible ureteroscope dual channel. Dilation of the ureteral orifice was done whenever required. Ureteral access sheath was used in all cases. The holmium laser was used for intracorporeal lithotripsy. The power setting of the holmium laser was 0.5-1J. The pulse rate was set between 20-40Hz. A 2.2F Nitinol stone basket was used for fragments removal. In cases of large stone burden, Double J stent was kept in situ. Double J stent was removed after 4 weeks. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus RIRS

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Stone free state at 3 months; Group 1: 29/35, Group 2: 35/39
Risk of bias: All domain - High, Selection - High, Blinding - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - High, Comments - 7 and 8 participants dropped out overall in the two groups but unsure how many in each subgroup; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Retreatment at Not reported; Group 1: 29/35, Group 2: 7/39
Risk of bias: All domain - High, Selection - High, Blinding - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - High, Comments - 7 and 8 participants dropped out overall in the two groups but unsure how many in each subgroup; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Ancillary procedures at Not reported; Group 1: 10/35, Group 2: 12/39
Risk of bias: All domain - High, Selection - High, Blinding - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - High, Comments - 7 and 8 participants dropped out overall in the two groups but unsure how many in each subgroup; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Adverse events at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: UTI at Not reported; Group 1: 2/35, Group 2: 2/39
Risk of bias: All domain - High, Selection - High, Blinding - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - High, Comments - 7 and 8 participants dropped out overall in the two groups but unsure how many in each subgroup; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Ureteral extravasation at Not reported; Group 1: 0/35, Group 2: 0/39
Risk of bias: All domain - High, Selection - High, Blinding - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - High, Comments - 7 and 8 participants dropped out overall in the two groups but unsure how many in each subgroup; Indirectness of outcome: No indirectness ;

Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Ureteral perforation at Not reported; Group 1: 0/35, Group 2: 0/39 Risk of bias: All domain - High, Selection - High, Blinding - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - High, Comments - 7 and 8 participants dropped out overall in the two groups but unsure how many in each subgroup; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	Lee 2006141
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=51)
Countries and setting	Conducted in Taiwan; Setting: Not reported
Line of therapy	1st line
Duration of study	Not clear:
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), ureteric stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with solitary, radiopaque upper ureteral stone above the upper border of the L5 vertebral body, 15mm or more in diameter
Exclusion criteria	Age younger than 18 years, pregnancy, uncontrolled urinary tract infection, pyonephrosis, sepsis, renal insufficiency with serum creatinine greater than 3.0mg/dL, history of pelvic surgery or irradiation, and history of SWL, URSL or open ureterolithotomy for treatment of the same side ureteral stone
Recruitment/selection of patients	Consecutive patients
Age, gender and ethnicity	Age - Mean (SD): SWL group 54.2 (16.7); URS group 48.5 (13.3). Gender (M:F): 35:7. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Stone composition (Mixed). 6. Ureteric stone: Upper ureteric stones
Indirectness of population	No indirectness
Interventions	(n=22) Intervention 1: Shock wave lithotripsy (SWL). SWL was performed using the Sieman AG lithostar lithotripter. Intravenous general anaesthesia with 2ml fentanyl and 2mg midazolam was routinely used for treatment. Each patient received 3000 shockwave pulses, and the average energy density setting was 0.42mJ/mm². Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=20) Intervention 2: Ureteroscopy or RIRS - Laser or lithoclast. URSL was performed in a standard fashion using general anaesthesia and an ACMI 6.9F or a Wolf 9.8F ureteroscope. The stones were fragmented with a lithoclast, electrohydraulic or ultrasound lithotripter according to the surgeon's preference. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness

Funding	No funding

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS

Protocol outcome 1: Length of stay at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Length of stay at Not reported; Group 1: mean 1.8 Days (SD 0.4); n=22, Group 2: mean 4.7 Days (SD 2); n=20
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone-free status at After one session; Group 1: 7/22, Group 2: 7/20
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone-free status at After monotherapy; Group 1: 14/22, Group 2: 7/20
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone-free status at After all treatment (including retreatment and ancillary procedures); Group 1: 22/22, Group 2: 15/17
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Retreatment at Not reported; Group 1: 7/22, Group 2: 0/17
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Ancillary procedures at Not reported; Group 1: 5/22, Group 2: 10/17
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 4: Adverse events at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Wound infection at Not reported; Group 1: 0/22, Group 2: 0/20
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Ureteral perforation at Not reported; Group 1: 0/22, Group 2: 5/20
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone upward migration at Not reported; Group 1: 0/22, Group 2: 5/20

Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: UTI at Not reported; Group 1: 1/22, Group 2: 1/20 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Fever at Not reported; Group 1: 1/22, Group 2: 6/20 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Ureteral stricture at Not reported; Group 1: 0/22, Group 2: 1/20 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 5: Length of stay at Define - Actual outcome for Adults (≥16 years), renal stone >20 mm: Length of hospital stay at Not reported; Group 1: mean 1.8 Days (SD 0.4); n=22, Group 2: mean 4.7 Days (SD 2); n=20 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 6: Pain intensity at Define - Actual outcome for Adults (≥16 years), renal stone>20 mm: Pain at 1 day; Group 1: mean 1.86 (SD 0.94); n=22, Group 2: mean 4.35 (SD 2.45); n=20; VAS 0-10 Top=High is poor outcome Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Hospitalisation at Define

Study	Lee 2015138
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=70)
Countries and setting	Conducted in South Korea; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), renal stone >20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Single or multiple renal stones (sum of the maximal length of stones >10mm).
Exclusion criteria	Patients with urogenital anomaly, solitary kidney, age <20 or coagulopathy
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): PCNL group 59.3 (13.3), RIRS group 55.8 (11.2). Gender (M:F): PCNL group 28:7; RIRS group 28:5. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear (Mixed: pelvis 21.4%, upper 2.9%, lower 34.3%, multiple 17.1%). 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=35) Intervention 1: Ureteroscopy or RIRS - Semi-rigid or flexible. Retrograde intrarenal surgery. Under general anaesthesia, patients were placed in the dorsal lithotomy position. Cystoscopic examination was routinely performed and a 0.0035mm guidewire was inserted through the ureteral orifice under videoscopic guidance. A 14/16F or 12/14F ureteral access sheath was placed into the level of the ureteropelvic junction. A 7.5F flexible ureteroscope was passed through the access sheath and placed in the renal pelvis. This stones were fragmented with a laser fibre. Holmium laser power was set to 10W. The repetition rate was 10Hz and 15-20Hz for the fragmentation and dusting mode. Stone fragments were retrieved using a 1.9F stone basket. A 6FR-J stent was routinely placed and usually removed 1-2 weeks postoperatively. A 16F urethral catheter was inserted at the end of the operation. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=35) Intervention 2: Percutaneous nephrolithotomy (PCNL) . Miniaturised percutaneous nephrolithotomy. Under general anaesthesia, patients were placed in the prone position. A percutaneous nephrostomy tube

	was inserted in the lower pole calyx by an urologist or an experienced uroradiologist. Calyceal puncture was carried out using a 22 gauge Skinny Needle under ultrasonography guidance. A 0.035mm guidewire was inserted through the calyceal puncture into the renal pelvis. The skin and fascia were incised and tract dilation was performed with a balloon dilator of up to 18F. A 15F nephroscope was inserted through the sheath and stone fragmentation was accomplished using a holmium YAG laser. Stone fragments were removed using a 4F grasping forceps and a 6F ureteral JJ stent was indwelled. A 16F urethral Foley catheter was placed at the end of the operation. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Academic or government funding (Supported by a grant from the SK Telecom Research Fund)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: RIRS versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Length of stay at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Length of hospital stay at Not reported; Group 1: mean 1.5 Days (SD 0.9); n=33, Group 2: mean 1.6 Days (SD 1.1); n=35
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2; Group 2 Number missing: 0

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Stone-free status at 3 months; Group 1: 32/33, Group 2: 30/35
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2; Group 2 Number missing: 0

Protocol outcome 3: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Ancillary procedures at Not reported; Group 1: 1/33, Group 2: 5/35
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2; Group 2 Number missing: 0

Protocol outcome 4: Adverse events at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Pelvic/ureter perforation at Not reported; Group 1: 1/33, Group 2: 2/35
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2; Group 2 Number missing: 0
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Urinary tract infection at Not reported; Group 1: 1/33, Group 2: 1/35
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2; Group 2 Number missing: 0
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Fever at Not reported; Group 1: 2/33, Group 2: 2/35
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low,

Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2; Group 2 Number missing: 0 Protocol outcome 5: Pain intensity at Define - Actual outcome for Adults (≥16 years), renal stone >20 mm: Pain at 1 day; Group 1: mean 3.1 (SD 2); n=33, Group 2: mean 2.7 (SD 2.1); n=35; VAS 0-10 Top=High is poor outcome Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2; Group 2 Number missing: 0	
Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Hospitalisation at Define

Study	**Li 2017143**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=72)
Countries and setting	Conducted in China; Setting: Xuzhou Central Hospital
Line of therapy	1st line
Duration of study	Intervention + follow up: 1 year
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Stones diagnosed by KUB, ultrasound or CT
Stratum	Adults (≥16 years), renal stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Age ≥18 years and <75 years; simple kidney stones; first treatment
Exclusion criteria	Patients with complex kidney stones, combing ureteral stones, bladder stones, renal tuberculosis, renal tumor, renal dysfunction, acute and chronic nephritis, and nephrotic syndrome; obese patients, patients with severe heart, liver, blood system diseases, and urinary system abnormalities; and pregnant patients, those with poor compliance or incomplete clinical data or those who interrupted treatment
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): URS group 49.7 (10.2); PCNL group 52.3 (11.4). Gender (M:F): 41:31. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Non-obese / short skin-to-stone distance 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable

Extra comments	Stone size, mean (SD; range): PCNL group 15 (5; 11–19), RIRS group 16 (4; 12–19) mm
Indirectness of population	No indirectness
Interventions	(n=39) Intervention 1: Ureteroscopy or RIRS - Semi-rigid or flexible. Ureteroscope lithotripsy - after general anaesthesia, while keeping patients in the lithotomy position, the F8/9.8 wolf flexible ureteroscope was inserted through the urine tract under direct vision. It was followed by the interureteric ridge and the ureterostoma of the affected side was located to insert the rigid ureteroscope into the ureter on the affected side. Subsequently, the ureter was observed and expanded. Retogradely the head or renal pelvis of ureter was indwelled with a guidewire, and the rigid ureteroscope was removed. A channel was established to the renal pelvis though the flexible ureteroscope sheath. The flexible ureteroscope was inserted along with the sheath under direct vision. A holmium laser was used and the lens of the flexible ureteroscope was adjusted to start breaking the stones. After breaking the stones, the F5 double J tube was retained and removed after 2-4 weeks. Duration Not applicable. Concurrent medication/care: After the operation patients were treated with conventional antibiotics for 48 hours. Indirectness: No indirectness (n=33) Intervention 2: Percutaneous nephrolithotomy (PCNL). After general anaesthesia, whilst keeping patients in the prone position, the abdomen was raised to make a low arch of the back at an angle of 30 degrees. A puncture region was made to the funnel shaped fluid collection bag and ultrasound was performed to examine the kidney. The safe guiding wire was implanted and expanded to F16 along the safe guiding wire by fascia dilator, and the peel away sheath was retained. The rigid ureteroscope was inserted into the renal pelvis under the guidance of the guiding wire and a holmium laser was used to break the stones. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: URS versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Stone-free state at 3 months; Group 1: 33/39, Group 2: 21/33
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Recurrence at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Recurrence at 1 year; Group 1: 3/39, Group 2: 4/33

Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 3: Adverse events at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: ureteral mucosa injury, bleeding/ haematoma, infection/renal abscess at Not reported; Group 1: 3/39, Group 2: 9/33 Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Difference for haematuria at baseline; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: ureteral stricture events at Not reported; Group 1: 1/39, Group 2: 0/33 Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Difference for haematuria at baseline; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Mortality at Define; Adverse events at Define; Pain intensity at Define; Length of stay at Define

Study	**Lopes neto 2012148**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=48)
Countries and setting	Conducted in Brazil; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 4 weeks
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Diagnosed with excretory urography or CT
Stratum	Adults (≥16 years), ureteric stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with proximal ureteral stones 10 mm or larger, located between the ureteropelvic junction and the pelvic brim
Exclusion criteria	Pregnancy, concomitant requirement of additional procedures and incomplete follow-up during or after treatment
Recruitment/selection of patients	Not reported

Age, gender and ethnicity	Age - Mean (SD): SWL group 46 (13.5); URS group 49.6 (15.5). Gender (M:F): 17:13. Ethnicity: Ethnicity
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/Hounsfield units: 6. Ureteric stone: Upper ureteric stones
Indirectness of population	No indirectness
Interventions	(n=14) Intervention 1: Shock wave lithotripsy (SWL). In situ SWL was performed with the Dornier Compact Delta S with the patient under intravenous sedation. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=16) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. URS was performed with the patient under spinal or general anaesthesia using 7.5Fr semirigid URS. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS

Protocol outcome 1: Hospitalisation at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Length of hospital stay at Not reported; Group 1: mean 1.9 Days (SD 1.2); n=14, Group 2: mean 27.8 Days (SD 13.4); n=16
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Difference for haematuria at baseline; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone free state at 4 weeks; Group 1: 5/14, Group 2: 10/16
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Difference for haematuria at baseline; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Retreatment at Not reported; Group 1: 12/14, Group 2: 2/16
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Difference for haematuria at baseline; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Ancillary procedure at Not reported; Group 1: 8/14, Group 2: 5/16
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low,

Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Difference for haematuria at baseline; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 4: Adverse events at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: UTI at Not reported; Group 1: 0/14, Group 2: 1/16 Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Difference for haematuria at baseline; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Sepsis at Not reported; Group 1: 0/14, Group 2: 1/16 Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Difference for haematuria at baseline; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Failed technology at Not reported; Group 1: 0/14, Group 2: 1/16 Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Difference for haematuria at baseline; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 5: Pain intensity at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Pain at Not reported; Group 1: mean 1.2 (SD 0.6); n=14, Group 2: mean 1.1 (SD 0.3); n=16; VAS 0-10 Top=High is poor outcome Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Difference for haematuria at baseline; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Length of stay at Define

Study	**Lu 2013150**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=32)
Countries and setting	Conducted in China; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 2 weeks
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: CT scan

Stratum	Adults (≥16 years), renal stone >20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with stones in the renal pelvis of <40 mm in size
Exclusion criteria	CT scan indicating a stone diameter more than 40 mm; lower urinary tract obstruction (including ureteropelvic junction stenosis and benign prostatic hyperplasia); presence of infection; or disturbance of the coagulation system
Recruitment/selection of patients	Patients who were treated at The First Affiliated Hospital of Soochow University (Suzhou City, Jiangsu Province)
Age, gender and ethnicity	Age - Mean (SD): Tubeless group 43.81 (18.89); conventional group 46.25 (22.37). Gender (M:F): 13:19. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=16) Intervention 1: Percutaneous nephrolithotomy (PCNL). Combined subarachnoid anaesthesia and epidural block were used for all patients. Patients were placed in the lithotomy position, and a retrograde catheter (F6 double-J stent in the conventional mPCNL group and an F5 external ureteric catheter in the tubeless mPCNL group) was inserted into the affected ureter with a cystoscope. First, a ureteral stent tube was placed under cystoscope. After removal of the cystoscope, a Foley catheter was inserted through the urethra and into the bladder. The intersection points were between the 12th rib and the posterior axillary line or the scapular line for access. Under the guidance of B-type ultrasonography, an 18G renal aspiration needle was used to access the target renal calyces. The stylet was removed and the presence of out-flowing urine confirmed that the tip of the needle was appropriately located in the urine collection system. A guide wire was inserted through the core needle into the urine collection system, and the core needle was removed. Then, 10F, 12F, 14F, 16F, and 18F fascial dilators were inserted sequentially through the guide wire to dilate the percutaneous renal channel, and then the l8F peel-away sheath was placed. An F8–9.8 ureteroscope was inserted into the urine collection system to observe the location of kidney stones. A lithotripsy system (Holmium laser) was used to pulverize the stones and a pulse-jet water propulsor and lithotomy forceps in the ureteroscope were then used to remove the stones. Then, F16 nephrostomy drainage tubes for conventional mPCNL group were placed through the percutaneous renal working channel for the development of a nephrostomy tract. Duration Not applicable. Concurrent medication/care: Antibiotics were administered for 3–5 days after surgery. Indirectness: No indirectness (n=16) Intervention 2: Percutaneous nephrolithotomy (PCNL) . The same procedure was used as the standard group, except no nephrostomy drainage tubes were placed at the end of the procedure. Duration Not applicable. Concurrent medication/care: Antibiotics were administered for 3–5 days after surgery.

	Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PERCUTANEOUS NEPHROLITHOTOMY (PCNL) STANDARD versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL) TUBELESS

Protocol outcome 1: Hospitalisation at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Length of hospital stay at Not reported; Mean; Standard group 4 (IQR 3-12); tubeless group 3 (IQR 2-7), Units: Days;
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - High, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Stone free state at 2 weeks; Group 1: 13/16, Group 2: 14/16
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Adverse events at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Urinary extravasation at Not reported; Group 1: 0/16, Group 2: 1/16
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Fever at Not reported; Group 1: 2/16, Group 2: 3/16
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	Manzoor 2013152
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=190)
Countries and setting	Conducted in Pakistan; Setting: Institute of Urology and Transplanation
Line of therapy	1st line
Duration of study	Intervention + follow up: 1 week
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Diagnosis was based on history, clinical examination, plain x-ray KUB and ultrasound KUB
Stratum	Adults (≥16 years), ureteric stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients over 16 years of age of either gender with a solitary proximal ureteric stone of 10-15mm size with normal renal function (serum creatinine 0.7-1.5mg/dL)
Exclusion criteria	Patients with renal failure, pregnancy, sepsis, comorbid cardiac or respiratory diseases, coagulation disorder (INR 1-1.4), severe hydronephrosis (renal pelvis >6mm diameter and cortex <10 mm) and multiple ureteric stones
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): 42.54 (14.07). Gender (M:F): 289:109. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Upper ureteric stones
Indirectness of population	No indirectness
Interventions	(n=199) Intervention 1: Shock wave lithotripsy (SWL). SWL was performed using the electromagnetic generator. The stone was targeted with the help of fluoroscopy and 3000 shock waves were given with a rate of 60-90 shock waves per minute. The level of shock wave energy was progressively stepped up until satisfactory stone fragmentation within the comfort of the patients was reached. Fluoroscopy was used to see the cleavage of stone and retargeting if required. The procedure was done as a day procedure. All patients were treated in the supine position and had received analgesia.. Duration Not applicable. Concurrent medication/care: Patients were well hydrated to improve efficacy of SWL. All patients were advised an oral analgesic and selective alpha-1 D adrenergic inhibitor agents on discharge. Indirectness: No indirectness (n=199) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. Ureterorenoscopic manipulation was performed in the operating theatre under full general anaesthesia in the modified lithotomy position with

	ipsilateral leg kept somewhat straight to facilitate the handling of semi-rigid ureteroscope with continuous irrigation using 8 or 8.5Fr semi-rigid ureteroscope. Intracorporeal lithotripsy was performed by pneumatic lithoclast. Fluoroscopy was used if required. A 4.8Fr double J stent was placed to prevent ureteric obstruction if required and Foley catheter was placed. Patients were treated as a day-care procedure until required admission. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone-free status at 1 week; Group 1: 98/199, Group 2: 115/119
Risk of bias: All domain - ; Indirectness of outcome: No indirectness

Protocol outcome 2: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Retreatment at 1 week; Group 1: 80/199, Group 2: 22/199
Risk of bias: All domain - ; Indirectness of outcome: No indirectness
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Ancillary treatment at 1 week; Group 1: 44/199, Group 2: 36/199
Risk of bias: All domain - ; Indirectness of outcome: No indirectness

Protocol outcome 3: Adverse events at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: UTI at 1 week; Group 1: 10/199, Group 2: 10/199
Risk of bias: All domain - ; Indirectness of outcome: No indirectness
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Fever at 1 week; Group 1: 0/199, Group 2: 40/199
Risk of bias: All domain - ; Indirectness of outcome: No indirectness
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone migration at 1 week; Group 1: 0/199, Group 2: 20/199
Risk of bias: All domain - ; Indirectness of outcome: No indirectness

Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	Mehrabi 2016157
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=59)
Countries and setting	Conducted in Iran; Setting: Hospital
Line of therapy	1st line
Duration of study	Intervention + follow up: 2 weeks
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Confirmed by KUB and ultrasonography
Stratum	Adults (≥16 years), ureteric stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with radiopaque upper ureter stones with size of 5-15mm
Exclusion criteria	Patients with uncontrolled coagulopathy and hypertension, urosepsis, azotemia, pregnancy and ASA class 3 or more
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): SWL group 43.7 (15.5), URS group 45.3 (14.5). Gender (M:F): 30:29. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Upper ureteric stones
Indirectness of population	No indirectness
Interventions	(n=32) Intervention 1: Shock wave lithotripsy (SWL). Lithotripsy was done in supine position using Dornier delta 2 machines with shockwaves by standard methods. Lithotripsy was started with 12KW voltages and after 10 minutes increased to 18KW and in maximum it continued to 3500 shockwaves. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=27) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. After anaesthesia, patients were placed in lithotomy position and TUL was conducted with semirigid ureteroscope (wolf 6-8F) and Holmium laser by standard methods. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS	

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone free state at 2 weeks; Group 1: 28/32, Group 2: 23/27 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 2: Adverse events at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Fever at 2 weeks; Group 1: 2/32, Group 2: 0/27 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: UTI at 2 weeks; Group 1: 0/32, Group 2: 1/27 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	Mokhless 2014164
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=60)
Countries and setting	Conducted in Egypt; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Children (<16 years): 10-20mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Renal stones 10-20mm in maximum diameter, no previous stone treatment
Exclusion criteria	Cystinuria, radiolucent stones and renal anomalies
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): 2.4 (1.3). Gender (M:F): 2:1. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear (Mixed: pelvis 53.3%, pelvis + calyx 26.7%, calyx 20%). 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not applicable 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=30) Intervention 1: Shock wave lithotripsy (SWL). SWL was performed using the Modularis Variostar Lithotripter under general anaesthesia while supine. All SWL cases were performed by a single urologist. Each session began at the lower power and gradually escalated in steps every 100 shocks until the power was set to between 14 and 17kV. The rate of shocks delivered was 60-90 per minute. Shocks were given based on stone dissolution. The number of shock waves was limited to 2000 per session. The therapy head of the electromagnetic lithotripter was positioned below the treatment table and conductive gel was applied.. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=30) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. RIRS was performed under general anaesthesia while in the lithotomy position. The procedure began by placing a 0.035inch guidewire through the channel of a 7.5Fr semirigid ureteroscope. Ureteral access was achieved using hydrodilatation assisted by a hand irrigation pump. Neither balloon dilation nor a ureteral access sheath was used. The ureteroscope was introduced under direct vision up to the renal pelvis until the stone was identified. Irrigation was minimal. Fragmentation was performed using a holmium yag laser with 270 and 365um fibres at settings of 0.8J at

	8Hz and 1.0J at 10Hz. When fragmentation was complete or a stone was no longer accessible, another guidewire was placed through the ureteroscope channel. The flexible ureteroscope was introduced and was used to inspect the collecting system, and any stones found were fragmented by the holmium yag laser. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus RIRS Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define - Actual outcome for Children (<16 years): Stone free state at 1 session; Group 1: 21/30, Group 2: 26/30 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Children (<16 years): Clinically insignificant residual fragments at 1 session; Group 1: 0/30, Group 2: 1/30 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Children (<16 years): Clinically significant residual fragments at 1 session; Group 1: 9/30, Group 2: 3/30 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Children (<16 years): Stone free state at 3 months; Group 1: 28/30, Group 2: 29/30 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 2: Use of healthcare services/retreatment at Define - Actual outcome for Adults (≥16 years), ureteric stone 1-2 cm: Retreatment at 1 week; Group 1: 9/30, Group 2: 0/30 Risk of bias: All domain - ; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Adverse events at Define; Pain intensity at Define; Length of stay at Define

Study	Ozturk 2013169
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=150)
Countries and setting	Conducted in Turkey; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), ureteric stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients who had ureteral stones between 10 and 20 mm
Exclusion criteria	Patients under 18 years old with previously managed calculi or multiple stones and/or with solitary kidney or ureteropelvic junction obstruction
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Median (range): SWL group 40.7 (20–78); RIRS group 41.1 (24–58). Gender (M:F): 63:37. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Upper ureteric stones
Indirectness of population	No indirectness
Interventions	(n=52) Intervention 1: Shock wave lithotripsy (SWL). Electrohydraulic extracorporeal lithotripter (Multimed Classic, Elmed, Ankara, Turkey) was used. In each lithotripsy session, 2.500 to 3.500 shocks were given at 14 to 17 kv). Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=48) Intervention 2: Ureteroscopy or RIRS - Laser or lithoclast. Flexible ureterorenoscope (Olympus URFP5, Tokyo, Japan) and holmium laser (Ho:YAG Laser; Dornier MedTech, Munich, Germany) was used. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus RIRS	

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone free state at 3 months; Group 1: 42/52, Group 2: 38/48 Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 2: Adverse events at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Fever at 3 months; Group 1: 0/52, Group 2: 1/48 Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Ureteral laceration at 3 months; Group 1: 0/52, Group 2: 1/48 Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	Pearle 2001174
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=64)
Countries and setting	Conducted in USA; Setting: Not reported
Line of therapy	1st line
Duration of study	Not reported
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), ureteric stone <10 mm: Mean stone size: SWL group 7.4mm; URS group 6.4mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with solitary, radiopaque distal ureteral calculus below the bony pelvis, 15mm or less in diameter
Exclusion criteria	Multiple ureteral calculi, solitary kidney, renal insufficiency, ipsilateral ureteral stricture, plan for simultaneous treatment of ipsilateral renal or contralateral renal, or ureteral calculi, active urinary tract infection, transplant kidney and uncorrected coagulopathy. Women who were fertile and of childbearing age were also excluded
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): SWL group 41.2 (14.9); URS group 41.2 (12.8). Gender (M:F): 51:13. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Lower ureteric stones
Indirectness of population	No indirectness
Interventions	(n=32) Intervention 1: Shock wave lithotripsy (SWL). At all centres shockwave lithotripsy was performed with an unmodified HM3 lithotripter with the patient prone on a modified Stryker frame. In 44% of patients who underwent shockwave lithotripsy the stone could not be adequately visualised in the 2 flouroscopic planes. Consequently, intravenous contrast was administered to opacify the ureter and facilitate stone targeting. No external ureteral catheters were used for contrast injection. A bladder catheter was placed in patients for whom the use of intravenous contrast was anticipated to prevent the opaque bladder from obscuring the ureter. Up to a total of 2400 gated shock waves were routinely administered at a power setting of 15 to 22kV. Procedural time comprised the time from the first shock until completion of therapy. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=32) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. Ureteroscopy was performed with a 6.9F semirigid ureteroscope in all but 2 patients in whom an 11.5F rigid ureteroscope was used. In 44% of

	patients balloon dilation of the ureteral orifice was performed to facilitate ureteroscope passage and/or stone extraction. Stones were extracted in 59% of the patients who underwent ureteroscopy, including basket extraction in 11 and grasper in 8. In 41% of the patients who underwent ureteroscopy the target stone was fragmented in situ with laser including holmium YAG in 12 and pulsed dye in one. Placement of a ureteral stent at the conclusion of the procedure was left to the discretion of the treating surgeon. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Study funded by industry (Financial interest and/or other relationship with Boston Scientific, Circon ACMI, Microvasive and US Surgical; Microvasive and Endocare Inc; Applied Medical Resources, Storz America Inc and US surgical; Applied Medical and Boston Scientific; Thermatrac; Closure, Dexterity Surgical, Ethicon Endo-surgery Inc, Indigo medical Inc, US surgical and USSC; Applied medical resources, Cook Biotech, Cook Urological, Greenwald, Karl Storz, Microvasive OSI and Orthoedic Systems Inc)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS

Protocol outcome 1: Hospitalisation at Define
- Actual outcome for Adults (≥16 years), ureteric stone <10 mm: Rehospitalisation at Not reported; Group 1: 2/32, Group 2: 4/32
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at not reported
- Actual outcome for Adults (≥16 years), ureteric stone <10 mm: Stone free status at 3 months; Group 1: 29/29, Group 2: 29/29
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 3; Group 2 Number missing: 3

Protocol outcome 3: Adverse events at Define
- Actual outcome for Adults (≥16 years), ureteric stone <10 mm: fever at Not reported; Group 1: 0/32, Group 2: 1/32
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study (subsidiary papers)	**Pearle 2008 173**
Study type	RCT (Patient randomised; Parallel)

Number of studies (number of participants)	1 (n=78)
Countries and setting	Conducted in USA; Setting: 19 institutions
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: computerized tomography (CT) and/or excretory urography
Stratum	Adults (≥16 years), renal stone <10 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Adult patients with isolated, 10 mm or less lower pole stones in whom treatment was indicated (pain, infection, haematuria , local obstruction and stone growth)
Exclusion criteria	Concomitant same side non-lower pole stones, ureteral stricture or ureteropelvic junction obstruction, infundibular stenosis or caliceal diverticulum associated with the targeted stone, a transplant, pelvic or solitary kidney, renal insufficiency (serum creatinine greater than 3.0 mg/dl), pregnancy, previous failed treatment, cystinuria, urinary diversion, impassable urethral stricture, planned simultaneous treatment of contralateral stones, active urinary tract infection or an immunocompromised state
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): SWL group 52.5 (12.3); URS group 49.3 (14.2). Gender (M:F): 36:31. Ethnicity: Not reported
Further population details	1. Kidney pole: Lower kidney pole 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=32) Intervention 1: Shock wave lithotripsy (SWL). Nine lithotripters were used across the 19 institutions. Lithotripsy was performed using recognized standards for each machine. The power settings and number of shock waves administered were left to the discretion of the treating physician with the intent of achieving a fragment size of less than 3 mm. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=35) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. A variety of ureteroscopes were used, including 7.5Fr and Flex-X™ (Karl Storz Endoscopy-America, Culver, California), ACMI Dur 8™ and Dur 8-Elite™ (ACMI, Southborough, Massachusetts) and URF-P3 (Olympus, Melville, New York). Dilation of the intramural ureter was performed as needed. Likewise, use of a ureteral access sheath, intact stone retrieval vs intracorporeal lithotripsy and stent placement were left to investigator discretion. Duration Not applicable.

	Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS

Protocol outcome 1: Hospitalisation at Define
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Hospital stay at Not reported; Mean; SWL group, 0 (SD not reported); URS 0.06 (SD not reported);
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone <10 mm: readmission at Not reported; Group 1: 0/32, Group 2: 3/35
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Stone free state at 3 months; Group 1: 17/26, Group 2: 23/32
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 6; Group 2 Number missing: 3

Protocol outcome 3: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Retreatment at Not reported; Group 1: 2/32, Group 2: 2/35
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Ancillary procedure at Not reported; Group 1: 3/32, Group 2: 0/35
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 4: Adverse events at Define
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Failed technology/visualisation at Not reported; Group 1: 1/32, Group 2: 5/35
Risk of bias: All domain - ; Indirectness of outcome: No indirectness
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Ureteral perforation at Not reported; Group 1: 0/32, Group 2: 2/35
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	Qi 2014178
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=104)
Countries and setting	Conducted in China; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 1 month
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), ureteric stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	People with impacted proximal ureteral stones >15 mm. Stones located above the lower border of the fourth lumbar vertebra are defined as proximal ureteral calculi
Exclusion criteria	Ipsilateral renal stone requiring surgery, congenital ureteral or renal anomalies, accompanied by urinary tract infection, sever kyphosis, and scoliosis deformity and coagulopathy
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): URS group 42.5 (10.3); PCNL group 41.1 (12.4). Gender (M:F): 61:43. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Upper ureteric stones
Indirectness of population	No indirectness
Interventions	(n=52) Intervention 1: Ureteroscopy or RIRS - Semi-rigid or flexible. During URS, a holmium YAG laser was used to disintegrate the calculi with an 8F/9.8F semirigid ureteroscope in the lithotomy position. Lithotripsy was done at the site of the impacted calculus. If stones prevented the passage of the guidewire or catheter, fragmentation would have started from the edge of the stone using a ballistic probe that can decrease the mucosa lesion relative to the laser. After the calculus had been dislocated, the anti-retropulsion device bypassed the stone and entrapped it. Lithotripsy was kept on at a more proximal position. If adhesions between stone and mucosa were serious, and the stone could not be dislocated after attempts, lithotripsy should have been started from the centre of the stone using pneumatic lithotripters. The large fragments were removed with the forceps or stone basket. Duration Not applicable. Concurrent medication/care: An antibiotic was given at the time of anaesthesia. Indirectness: No indirectness (n=52) Intervention 2: Percutaneous nephrolithotomy (PCNL) . For PCNL, the access was established

	through the middle or upper calix with the guidance of ultrasonography. Since the channel was dilated to 24F, a 20.8F rigid nephroscope was used for lithotripsy. The combination of an ultrasonic and a pneumatic lithotripter was applied to fragment and clear the stone. A 16F nephrostomy tube was placed in all patients and it was removed at 3-5 days postoperatively. Duration Not applicable. Concurrent medication/care: An antibiotic was given at the time of anaesthesia. Indirectness: No indirectness
Funding	No funding

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: URS versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Hospitalisation at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Length of hospital stay at Not reported; Group 1: mean 1.7 Days (SD 1.3); n=52, Group 2: mean 4.6 Days (SD 2.1); n=52
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone-free state at 1 month; Group 1: 51/52, Group 2: 52/52
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone-free state at 3 days; Group 1: 39/52, Group 2: 50/52
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Adverse events at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Fever at Not reported; Group 1: 8/52, Group 2: 5/52
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Minor ureteral perforation at Not reported; Group 1: 2/52, Group 2: 0/52
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	Rabani 2012179
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=62)
Countries and setting	Conducted in Iran; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 1 month
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: conventional X-ray of the kidneys, ureter, and bladder (KUB) as well as ultrasound or excretory urography (IVP)
Stratum	Adults (≥16 years), ureteric stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with proximal ureteral stones larger than 12 mm
Exclusion criteria	Patients who could not tolerate the lithotomy position, younger than 18 years, had undergone coagulopathy, had concurrent renal and ureteral stones, were pregnant, or had sepsis
Recruitment/selection of patients	Not rpeorted
Age, gender and ethnicity	Age - Mean (range): 39.5 (19-64). Gender (M:F): 40:22. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Upper ureteric stones
Indirectness of population	No indirectness
Interventions	(n=30) Intervention 1: Shock wave lithotripsy (SWL). Patients underwent SWL under intravenous sedation with pethidine as an outpatient procedure. The initial voltage of each shock wave was 13 kV, which was gradually increased to 18 kV. The maximum number of shock waves was limited to 4,500. In unsuccessful cases, repeat SWL or TUL was planned. Lack of success was defined as no change in the stone burden after the first postoperative X-ray and ultrasound one week after the operation, and a successful outcome was defined as a stone-free state one month after the procedure. Asymptomatic residual stones with a size of less than 5 mm were ignored. The lithotripter used in the SWL group was the Dornier compact delta 2 lithotripter. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=32) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. Patients underwent URS with a semi-rigid wolf 8–9. 8F ureteroscope, and TUL was performed in successfully accessible cases. In nonaccessible cases, a 4.8F double-J stent was inserted blindly next to the stone, after unwanted pushed-back stones, or

	for large displaced fragments. Accessibility was defined as being able to reach the stone through the ureteroscope, and a successful outcome was defined as the patient being stone-free on radiography and ultrasound one month after the treatment. The procedure was performed under spinal anaesthesia in group one. The sources of energy in the TUL group were ultrasonic and pneumatic. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS Protocol outcome 1: Length of stay at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Length of hospital stay at Not reported; Group 1: mean 5.97 Hours (SD 3.643); n=30, Group 2: mean 26.5 Hours (SD 9.228); n=32 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone free state at 1 month; Group 1: 19/30, Group 2: 25/32 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 3: Use of healthcare services/retreatment at Define - Actual outcome for Adults (≥16 years) ureteric stone 10-20 mm: Retreatment at Not reported; Group 1: 7/30, Group 2: 7/32 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Adverse events at Define; Pain intensity at Define; Hospitalisation at Define

Study	**Saad 2015183**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=38 (43 stones))
Countries and setting	Conducted in Egypt; Setting: Hospital urology department
Line of therapy	1st line

Duration of study	Intervention + follow up: 1 month
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Non contrast CT
Stratum	Children (<16 years): renal >20mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Age younger than 16 years and presence of renal calculi larger than 20 mm
Exclusion criteria	Uncorrected bleeding diathesis, renal insufficiency, congenital renal anomalies and contraindications to general anaesthesia
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): RIRS group 6.44 (4.84); PCNL group 6.93 (3.55). Gender (M:F): 1.86:1. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/hounsfield units: Stone composition (Calcium oxalate 39.5%, calcium phosphate 16.3%, uric acid 18.6%, cysteine 16.3%, struvite 9.3%). 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=21) Intervention 1: Ureteroscopy or RIRS - Semi-rigid or flexible. RIRS was done with the patient in the lithotomy position under general anaesthesia. Prophylactic antibiotics were administered according to body weight. Ureteroscopy was performed using a 4.5F semirigid ureteroscope. A second guidewire was then introduced. Flexible ureteroscopy using a Flexx catheter was performed using though a 9.5F-11.5F ureteral access sheath to minimize intrarenal pressure during the procedure. On cases of access sheath introduction failure a double-J stent was left for passive dilation of the ureter, with patients being rehospitalised at 10 days for the procedure. Holmium YAG laser was used for stone disintegration at energy of 0.4-0.6 J and pulse rate of 10-15 Hz. Stones were fragmented into powder and smaller pieces without any trial for gravel removal. A 4.8F ureteral stent was left indwelling for 2-4 weeks after intervention. Duration Not applicable. Concurrent medication/care: Not reported (n=22) Intervention 2: Percutaneous nephrolithotomy (PCNL). All procedures were done with the patient in the prone position under general anaesthesia. Contrast material was injected through a ureteral catheter for opacification of the collecting system. Renal puncture was performed under fluoroscopic guidance. Dilation of the tract was done using metal dilators up to 22F. A 17F paediatric nephroscope was used in all cases. Pneumatic lithotripsy was used for stone disintegration. A flexible nephroscope with basket was used for extraction of residual stones at the end of the procedure. Placement of a nephrostomy tube depended on the intraoperative events in each case. A nephrostomy tube was placed if there were intraoperative complications or significant residuals. A 4.8F ureteral stent was left for 2-4 weeks. Duration Not applicable.

	Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: RIRS versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Length of stay at Define
- Actual outcome for Children (<16 years): Length of hospital stay at Not reported; Group 1: mean 1.1 Days (SD 0.52); n=21, Group 2: mean 2.59 Days (SD 1.98); n=22
Risk of bias: All domain – Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Differences in stone composition between groups; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Children (<16 years): Stone-free status at 1 month; Group 1: 15/21, Group 2: 21/22
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Difference in terms of stone burden (number of single and multiple stones in each group); Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Use of healthcare services/retreatment at Define
- Actual outcome for Children (<16 years): Retreatment at Not reported; Group 1: 2/21, Group 2: 1/22
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Differences in stone composition between groups; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 4: Adverse events at Define
- Actual outcome for Children (<16 years): Fever at Not reported; Group 1: 21/4, Group 2: 4/22
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Differences in stone composition between groups; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Children (<16 years): Bleeding at Not reported; Group 1: 0/21, Group 2: 3/22
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Differences in stone composition between groups; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Hospitalisation at Define

Study	Sabnis 2013184
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=70)
Countries and setting	Conducted in India; Setting: A single tertiary care urological hospital in Western India
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), renal stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	A single renal stone or multiple stones in the same line (which can be accessed in a single puncture) <15 mm in size. The stone size was defined as the maximum diameter as determined by non-contrast CT.
Exclusion criteria	Patients undergoing any other surgical procedure during the same admission (e.g. ureteroscopy), multiple stones at different locations, pregnancy, age <18 years, uncorrected coagulopathy and active UTI
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): RIRS group 43.7 (12.1), PCNL group 38.6 (14.6). Gender (M:F): 46:24. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear (Mixed). 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Stone composition (Mean Hounsfield units: PCNL 1313 (203); RIRS 1247 (191)). 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=35) Intervention 1: Percutaneous nephrolithotomy (PCNL). The microperc procedure was performed as follows. Under general anaesthesia, in the lithotomy position, a 7-F ureteric catheter was placed under cystoscopic guidance into the renal pelvis. In the prone position, either the stone-containing calyx or the appropriate calyx leading straight to the pelvic stone was selected for puncture. Calyceal puncture was done using a 16-gauge three-part needle under ultrasonography and/or fluoroscopy guidance. In none of the cases, renal access was achieved under vision using all-seeing option. The bevelled inner needle with stylet was removed, the telescope was inserted through one connector side port and the other side port was used for irrigation (Fig. 2). The 272-mm laser fibre was inserted through the central port and the calculus was completely fragmented using a holmium:YAG laser (LISA Laser, Pleasanton, CA, USA). The operating surgeon controlled the amount of irrigation from the irrigation pump using a foot pedal. A JJ stent was inserted if the

	fragmented stone burden was felt to be significant. If a JJ stent was required, the previously placed ureteric catheter was replaced with a JJ stent over a guidewire in supine position at the end of the procedure. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=35) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. In RIRS, cystoscopy was performed and the ureteric orifice was cannulated with a 150 cm guidewire. The ureter was dilated with fascial dilators and a 12-F ureteric access sheath (Cook Medical Inc., Bloomington, IN, USA) was placed. A 7.5-F Flex X2 (Karl Storz, Tuttlingen, Germany) flexible ureteroscope was used along with a 272-mm laser fibre for laser lithotripsy. If the calculus was in the lower calyx, it was attempted to basket and place it in the upper calyx before fragmentation. If this was not successful, the calculus was fragmented in the lower calyx. Holmium laser power was set in the range 5–15W. If the fragments were large, they were removed with a 1.7-F zero-tipped nitinol stone basket (Cook Medical Inc.). After laser lithotripsy, either a JJ stent or 5-F ureteric catheter was placed. A JJ stent was inserted when (i) any ureteric injury was visualized at the end of the procedure, (ii) the fragmented stone burden was felt to be significant, or (iii) access sheath was in place for >45 min. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PERCUTANEOUS NEPHROLITHOTOMY (PCNL) versus RIRS

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Stone free state at 3 months; Group 1: 34/35, Group 2: 33/35
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Ancillary procedures at Not reported; Group 1: 1/35, Group 2: 1/35
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Retreatment at Not reported; Group 1: 1/35, Group 2: 0/35
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Adverse events at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Pelvic perforation at Not reported; Group 1: 1/35, Group 2: 0/35
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Fever at Not reported; Group 1: 3/35, Group 2: 4/35

Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), renal stone 1-2 cm: Urosepsis at Not reported; Group 1: 0/35, Group 2: 0/35 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 4: Pain intensity at Define - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Pain at 6 hours; Group 1: mean 4.8 (SD 1.6); n=35, Group 2: mean 3.8 (SD 1.1); n=35; VAS 0-10 Top=High is poor outcome Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Pain at 12 hours; Group 1: mean 3.4 (SD 2); n=35, Group 2: mean 2.4 (SD 0.9); n=35; VAS 0-10 Top=High is poor outcome Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Pain at 24 hours; Group 1: mean 1.9 (SD 1.2); n=35, Group 2: mean 1.6 (SD 0.8); n=35; VAS 0-10 Top=High is poor outcome Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Length of stay at Define

Study	**Sakr 2017186**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=150)
Countries and setting	Conducted in Egypt; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 1 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: KUB, pelvi-abdominal ultrasonography and non-contrast pelvi abdominal spiral CT
Stratum	Adults (≥16 years), renal stone >20 mm
Subgroup analysis within study	Not applicable

Inclusion criteria	Patients with 20-30 mm renal stones
Exclusion criteria	Patients with active urinary infection, renal anomalies, and uncorrected coagulopathy as well as stones with the main burden in the upper calyx
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): miPCNL group 43.8 (9.5); standard PCNL group 40.2 (8.3). Gender (M:F): 92:58. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear (Mixed). 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Non-obese / short skin-to-stone distance 4. Pregnant women: Not stated / Unclear 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=75) Intervention 1: Percutaneous nephrolithotomy (PCNL). All patients received spinal anaesthesia. With the patient in the lithotomy position, cystoscopy was performed through which a ureteral catheter was advanced. A Foley's catheter was then placed to which the ureteral catheter was fixed and a retrograde pyelography was done. The patients were then placed in the flank free modified supine position. Skin was punctured at the posterior axillary line and renal access was achieved under fluoroscopic guidance using an 18 gauge renal puncture needle through which a 0.038-inch J tip guidewire was introduced. In the mini PCNL group, the tract was dilated up to 16.5F with a single step metal dilator and a 12 F sized miniature nephroscope was used. Stones were fragmented using pneumatic lithotripter and fragments were retrieved either by grasper or passively by gravity for smaller fragments. An appropriate nephrostomy catheter was inserted at the end of the procedure. Duration Not applicable. Concurrent medication/care: Prophylactic broad spectrum antibiotic was administered at induction of anaesthesia. Indirectness: No indirectness (n=75) Intervention 2: Percutaneous nephrolithotomy (PCNL). All patients received spinal anaesthesia. With the patient in the lithotomy position, cystoscopy was performed through which a ureteral catheter was advanced. A Foley's catheter was then placed to which the ureteral catheter was fixed and a retrograde pyelography was done. The patients were then placed in the flank free modified supine position. Skin was punctured at the posterior axillary line and renal access was achieved under fluoroscopic guidance using an 18 gauge renal puncture needle through which a 0.038-inch J tip guidewire was introduced. In the standard group, the tract was dilated up to 30F with telescoping Alkens metal dilators and a 26F nephroscope was used. Stones were fragmented using pneumatic lithotripter and fragments were retrieved either by grasper or passively by gravity for smaller fragments. An appropriate nephrostomy catheter was inserted at the end of the procedure. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	No funding

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: MINI PERCUTANEOUS NEPHROLITHOTOMY (PCNL) versus STANDARD PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Length of stay at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Length of hospital stay at Not reported; Mean; Mini group, 4.3; Standard group 4.5, Units: Days;
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Stone free state at 1 month; Group 1: 72/75, Group 2: 73/75
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Retreatment at Not reported; Group 1: 3/75, Group 2: 2/75
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Ancillary procedures at Not reported; Group 1: 4/75, Group 2: 3/75
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 4: Adverse events at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Bleeding at Not reported; Group 1: 1/75, Group 2: 8/75
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Fever at Not reported; Group 1: 8/75, Group 2: 5/75
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Perforation of renal pelvis at Not reported; Group 1: 2/75, Group 2: 1/75
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 5: Pain intensity at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Pain at 1 day; Group 1: mean 3.2 (SD 0.6); n=75, Group 2: mean 3.3 (SD 0.8); n=75; VAS 0-10 Top=High is poor outcome
Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low,

Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Hospitalisation at Define

Study	Salem 2009-1187
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	2 (n=200)
Countries and setting	Conducted in Egypt; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), ureteric stone <10 mm
Subgroup analysis within study	Unclear
Inclusion criteria	Solitary unilateral radio-opaque calculi and a functioning kidney. The other kidney should be functioning and nonobstructive
Exclusion criteria	Pregnancy, paediatric group, multiple, bilateral and radiolucent stones, non-functioning kidney, associated renal stones requiring therapy or lower ureteric stones in the ipsilateral side, stones >20mm in size, uremia, sepsis, ureteral abnormalities, coagulative disorders, and body habitus precluding either technique
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (range): SWL 42.8 (37-60); URS 41.2 (36-50). Gender (M:F): 78:32. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Upper ureteric stones
Indirectness of population	No indirectness
Interventions	(n=58) Intervention 1: Shock wave lithotripsy (SWL). SWL was done without stenting as a primary therapy under iv sedation, with shock wave voltage ranging between 13 and 18kV and maximum number limited to 3000 shock waves. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=52) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. URS was done as a primary therapy under spinal or general anaesthesia using 8.5-11 F semirigid, with diameter graduated from its tip till its base. The procedure started by cystoscopy with retrograde pyelography, placement of 0.038 inch floppy tip guidewire past the stone to maintain access. Dilatation was limited to the intramural part in 30% of cases. Intracorporeal lithotripsy was used to fragment the stones which were then extracted by forceps. At the end, ureteric catheter or double J was left in patients with large stone burden and/or extravasation. Duration Not

	applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), ureteric stone <10 mm: Stone-free status at 2 weeks; Group 1: 46/58, Group 2: 52/52
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), ureteric stone <10 mm: Retreatment at 3 months; Group 1: 10/58, Group 2: 0/52
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone <10 mm: Ancillary procedure at 2 weeks; Group 1: 2/58, Group 2: 0/52
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Adverse events at Define; Pain intensity at Define; Length of stay at Define

Study	Salem 2009-2187
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=200)
Countries and setting	Conducted in Egypt; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), ureteric stone 10-20 mm
Subgroup analysis within study	Unclear
Inclusion criteria	Solitary unilateral radio-opaque calculi and a functioning kidney. The other kidney should be functioning and nonobstructive
Exclusion criteria	Pregnancy, pediatric group, multiple, bilateral and radiolucent stones, nonfunctioning kidney, associated renal stones requiring therapy or lower ureteric stones in the ipsilateral side, stones >20mm in size, uremia, sepsis, ureteral abnormalities, coagulative disorders, and body habitus precluding either technique
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (range): URS group 36.7 (20-48); SWL group 35.4 (37-55). Gender (M:F): 57:33. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Upper ureteric stones
Indirectness of population	No indirectness
Interventions	(n=42) Intervention 1: Shock wave lithotripsy (SWL). SWL was done without stenting as a primary therapy under iv sedation, with shock wave voltage ranging between 13 and 18kV and maximum number limited to 3000 shock waves. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=48) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. URS was done as a primary therapy under spinal or general anaesthesia using 8.5-11 F semirigid, with diameter graduated from its tip till its base. The procedure started by cystoscopy with retrograde pyelography, placement of 0.038 inch floppy tip guidewire past the stone to maintain access. Dilatation was limited to the intramural part in 30% of cases. Intracorporeal lithotripsy was used to fragment the stones which were then extracted by forceps. At the end, ureteric catheter or double J was left in patients with large stone burden and/or extravasation. Duration Not

	applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone free state at 2 weeks; Group 1: 25/42, Group 2: 44/48
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Retreatment at 3 months; Group 1: 12/42, Group 2: 0/48
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Ancillary procedures at 3 months; Group 1: 5/42, Group 2: 4/48
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Adverse events at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Extravasation at Not reported; Group 1: 0/42, Group 2: 4/48
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Fever at Not reported; Group 1: 2/42, Group 2: 0/48
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 4: Hospitalisation at Define
- Actual outcome for Adults (≥16 years) ureteric stone 10-20 mm: Readmission at Not reported; Group 1: 2/100, Group 2: 0/100
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	Samad 2012188
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=54 (60 renal units))
Countries and setting	Conducted in Pakistan; Setting: The Kidney Centre, Karachi
Line of therapy	1st line
Duration of study	Not clear:
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Intravenous pyelogram
Stratum	Children (<16 years)
Subgroup analysis within study	Not applicable
Inclusion criteria	Children ages 14 years and below undergoing percutaneous nephrolithotomy (PCNL) with stone size larger than 15 mm, no perforation or tear in pelvicalyceal system during procedure, absence of anatomical obstruction e.g. pelviureteric junction obstruction (PUJO), single puncture for achieving access tract, absence of significant bleeding during the procedure, no other procedure performed under same anaesthesia and no previous surgery or minimally invasive procedure on the ipsilateral kidney
Exclusion criteria	Not reported
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): Tubeless group 40.6 (11.9); standard group 46.1 (18.4). Gender (M:F): 31:23. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not applicable 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=30) Intervention 1: Percutaneous nephrolithotomy (PCNL). Under general anaesthesia, the child was placed in the lithotomy position, a ureteric catheter was passed up to the kidney(s), the contrast was infused and anatomy of the pelvicalyceal system was visualized using fluoroscopic guidance. A Foley catheter was passed, and the patient was turned to the prone position. Percutaneous access was gained with a 17F nephroscope after serial dilatation with semi-rigid fascial dilators. Stone(s) were fragmented using a pneumatic lithoclast and an attempt to achieve complete clearance was made. A 16F Foley catheter with its balloon port cut was inserted and anchored with a deep mattress suture using 2/0 nylon. Patients were discharged after the removal of the ureteric catheter, Foley catheter and nephrostomy tube. . Duration Not applicable. Concurrent medication/care: Additional intramuscular pethidine was prescribed on an SOS basis, and total amount in mg was calculated until the time of discharge. . Indirectness: No indirectness

	(n=30) Intervention 2: Percutaneous nephrolithotomy (PCNL). In tubeless group, after the removal of nephroscope, a deep mattress suture was applied with a covering waterproof dressing. Children were discharged after the removal of the ureteric and Foley catheters, once the dressing was found to be dry. Duration Not applicable. Concurrent medication/care: Additional intramuscular pethidine was prescribed on an SOS basis, and total amount in mg was calculated until the time of discharge. . Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PERCUTANEOUS NEPHROLITHOTOMY (PCNL) STANDARD versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL) TUBELESS

Protocol outcome 1: Hospitalisation at Define
- Actual outcome for Children (<16 years): Length of hospital stay at Not reported; Group 1: mean 2.4 Days (SD 1.3); n=30, Group 2: mean 1.6 Days (SD 0.7); n=30
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Stone size; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Children (<16 years): Stone free state at Not reported; Group 1: 26/30, Group 2: 28/30
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Very high, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Stone size; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Use of healthcare services/retreatment at Define
- Actual outcome for Children (<16 years): Ancillary procedures at Not reported; Group 1: 4/30, Group 2: 2/30
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Stone size; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 4: Adverse events at Define
- Actual outcome for Children (<16 years): UTI at Not reported; Group 1: 2/30, Group 2: 5/30
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Stone size; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Children (<16 years): Fever at Not reported; Group 1: 3/30, Group 2: 4/30
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Stone size; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	**Sarica 2017189**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=65)
Countries and setting	Conducted in Turkey; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 4 weeks
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Non contrast CT and KUB, plain xray, ultrasound or urography where necessary
Stratum	Adults (≥16 years), ureteric stone <10 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with acute colic pain due to a single obstructing opaque upper ureteral stone (5 to 10 mm)
Exclusion criteria	Patients with multiple stones, previous stone surgery including stent placement and auxiliary procedures, congenital anomalies, active urinary tract infection, pregnancy or renal insufficiency
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): 40.50 (1.73). Gender (M:F): 47:18. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Stone composition (Hounsfield units: SWL group 707.5 (46.72); URS group 821.3 (57.82)). 6. Ureteric stone: Upper ureteric stones
Indirectness of population	No indirectness
Interventions	(n=34) Intervention 1: Shock wave lithotripsy (SWL). SWL was performed with an electromagnetic lithotriptor (Compact Sigma, Dornier MedTech, Wessling, Germany) under analgesia. Semirigid ureteroscopy was performed with 8 Fr ureteroscope (Karl Storz, Tuttlingen, Germany) under general anaesthesia.. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=31) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. URS. No further details reported.

	Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS

Protocol outcome 1: Quality of life at Define
- Actual outcome for Adults (≥16 years), ureteric stone <10 mm: EQ-5D index at 4 weeks; Group 1: mean 0.77 (SD 0.02); n=34, Group 2: mean 0.87 (SD 0.01); n=31; EQ5d index 0-1 Top=High is good outcome
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone <10 mm: EQ-5D VAS at 4 weeks; Group 1: mean 73.17 (SD 1.72); n=34, Group 2: mean 84.67 (SD 1.49); n=31; EQ-5D VAS 0-100 Top=High is good outcome
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), ureteric stone <10 mm: Stone free state at 4 weeks; Group 1: 25/34, Group 2: 26/31
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), ureteric stone <10 mm: Retreatment at 4 weeks; Group 1: 0/34, Group 2: 5/31
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone <10 mm: Ancillary procedures at 4 weeks; Group 1: 9/34, Group 2: 0/31
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 4: Pain intensity at Define
- Actual outcome for Adults (≥16 years), ureteric stone <10 mm: Pain at 4 weeks; Group 1: mean 5.7 (SD 0.38); n=34, Group 2: mean 4.1 (SD 0.55); n=31; VAS 0-10 Top=High is poor outcome
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Adverse events at Define; Length of stay at Define

Study	Sebaey 2016193
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=80)
Countries and setting	Conducted in Egypt; Setting: Not reported
Line of therapy	1st line
Duration of study	Not clear:
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Adults (≥16 years), renal stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with a solitary radio-opaque renal stone, and candidates for PCNL
Exclusion criteria	Patients with multiple stones, previous surgery, endoscopic manoeuvres or SWL in the same kidney, congenital anomalies, coagulopathy, or renal insufficiency
Recruitment/selection of patients	Selected from the outpatient clinic of the Urology Department at Benha University Hospital, Egypt
Age, gender and ethnicity	Age - Mean (SD): Tubeless group 40.6 (11.9); standard group 46.1 (18.4). Gender (M:F): 58:22. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear (Mixed: renal pelvis 21.3%, lower calyx 62.5%, middle calyx 12.5%, upper calyx 3.8%). 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=40) Intervention 1: Percutaneous nephrolithotomy (PCNL). All procedures were performed with the patient supine under general anaesthesia. Cystoscopy was used to insert a 6-F open-tip ureteric catheter; a percutaneous puncture of the desired calyx was made under fluoroscopic guidance using an 18-G puncture needle after the injection of contrast media into the ureteric catheter to identify the pelvicalyceal system. Once the position of the needle was confirmed in the desired calyx a 0.09-cm (0.03500) J-tip guidewire was inserted into the collecting system or down the ureter under image control, the needle was then retracted and a 14-F Teflon dilator was inserted over the guidewire in a screw manner. A 14-F Amplatz sheath was inserted over the dilator and then the dilator was removed leaving the sheath in place. Using a 9.5-F Karl Storz semi-rigid 6□ short ureteroscope, the stone was identified and disintegrated by pneumatic lithotripsy. The fragments were removed with stone forceps or Zero TipTM baskets. At the end of the procedure, the pelvicalyceal system was examined, both endoscopically and radiographically, for any residual fragments or perforations. In the standard PCNL group, a 14-F nephrostomy tube was inserted and fixed to the skin and

	clamped for 4 hours. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=40) Intervention 2: Percutaneous nephrolithotomy (PCNL). The procedure was the same as in the standard group. In the tubeless mini PCNL patients, at the end of the procedure the site of the tract was closed using deep 1/0 suture.. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	No funding
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PERCUTANEOUS NEPHROLITHOTOMY (PCNL) STANDARD versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL) TUBELESS Protocol outcome 1: Hospitalisation at Define - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Length of hospital stay at Not reported; Group 1: mean 1.07 Days (SD 0.27); n=40, Group 2: mean 1.1 Days (SD 0.3); n=40 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Stone free state at Not reported; Group 1: 33/40, Group 2: 37/40 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Adverse events at Define; Pain intensity at Define; Length of stay at Define

Study	**Sen 2017{#1506}**
Study type	Non-randomised study
Number of studies (number of participants)	1 (n=48)
Countries and setting	Conducted in Turkey; Setting: Not reported
Line of therapy	Unclear

Duration of study	Other: Patients who underwent RIRS or MPCNL between January 2015 and April 2016 were analysed retrospectively.
Method of assessment of guideline condition	Unclear method of assessment/diagnosis: Not reported
Stratum	Children (<16 years): Children, renal 10-20mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Not reported
Exclusion criteria	Not reported
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): MPCNL group: 4 (2.3 years); RIRS group: 10.9 (3 years). Gender (M:F): Not reported. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not applicable 5. Stone composition/hounsfield units: Not stated / Unclear 6. Uteric stone: Not applicable
Extra comments	Paediatric patients who underwent RIRS or MPCNL for paediatric kidney stone disease between January 2015 and April 2016. Children of school age underwent RIRS in the presence of retro-colon and abnormal rotation of the kidney, whereas MPCNL was used in preschool children in whom renal access sheath entry was considered to be inadequate
Indirectness of population	No indirectness
Interventions	(n=23) Intervention 1: Ureteroscopy or RIRS - Semi-rigid or flexible. A 0.035-inch safety guide was placed in the renal pelvis, accompanied by cytoscopy or rigid ureterorenoscopy (URS) and under the fluoroscopic or direct visual guidance, in the lithotomy position. The ureteral sheath (9.5/11.5F, 35cm, Boston Scientific Natick, MA, USA) was advanced through this guidewire under fluoroscopic guidance. The stone was accessed at its site through a flexible URS (Olympus URF-P6, Singapore), and fragmented using a Ho:YAG laser (StoneLight Laser THerapy System). No routine basket extraction was performed for residual fragments. At the discretion of the surgeon, a JJ stent was applied at the end of the operation and extracted within approximately 10-14 days . Duration Not reported. Concurrent medication/care: All procedures were performed under general anaesthesia. Indirectness: No indirectness (n=25) Intervention 2: Percutaneous nephrolithotomy (PCNL) . In the lithotomy position, a 3F ureteralcytoscope-guided catheter was advanced to the renal pelvis through the ureteral orifice. A 16-gauge all-seeing needle (PolyDiagnost, Germany) under fluoroscopic guidance was inserted into the stone-containing calyx or pelvis, in the prone position. A three-path connector was attached to the proximal end. One of the lateral channels of the connector was used as a telescope and the other for the irrigation. In addition, a laser fiber was directed from the central channel. The holmium: yttrium aluminium garnet

	(Ho:YAG) laser (AMS StoneLight Holmium Laser System, Brookfield, WI, USA) was used as the lithotripsy tool. The ureteral catheter was removed within 12-24 hours following the fragmentation of the stones. The stone particles were then left to pass spontaneously. Duration Not reported. Concurrent medication/care: All procedures were performed under general anaesthesia. Indirectness: No indirectness
Funding	No funding

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SEMI-RIGID OR FLEXIBLE versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Length of stay at Define
- Actual outcome for Children (<16 years): Length of stay at Days; Group 1: mean 2.2 days (SD 0.4); n=23, Group 2: mean 2.1 days (SD 0.6); n=25
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - Very high, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Children of school age underwent RIRS in the presence of retro-colon and abnormal rotation of the kidney, whereas MPCNL was used in preschool children in whom renal access sheath entry was considered to be inadequate; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: New stone formation/incidence of stones/recurrence rate at Define
- Actual outcome for Children (<16 years): Stone-free state at 2 weeks; Group 1: 19/23, Group 2: 21/25
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - Very high, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Children of school age underwent RIRS in the presence of retro-colon and abnormal rotation of the kidney, whereas MPCNL was used in preschool children in whom renal access sheath entry was considered to be inadequate; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Adverse events at Define
- Actual outcome for Children (<16 years): Minor adverse events (fever) at Not reported; Group 1: 4/23, Group 2: 3/25
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - Very high, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Children of school age underwent RIRS in the presence of retro-colon and abnormal rotation of the kidney, whereas MPCNL was used in preschool children in whom renal access sheath entry was considered to be inadequate; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Children (<16 years): Major adverse events (sepsis) at Not reported; Group 1: 1/23, Group 2: 0/25
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - Very high, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Children of school age underwent RIRS in the presence of retro-colon and abnormal rotation of the kidney, whereas MPCNL was used in preschool children in whom renal access sheath entry was considered to be inadequate; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; Treatment success (stone free state, clinically insignificant residual fragments) at Define; Use of healthcare services/retreatment rate at Define; Kidney function at Define; Recurrence rate at Define; Mortality at Define; Pain intensity at Define; Hospitalisation at Define

Study	**Sener 2014197**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=140)
Countries and setting	Conducted in Turkey; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: X-ray, urinary ultrasound (USG), and intravenous urography (IVU)
Stratum	Adults (≥16 years), renal stone <10 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with single lower pole stones <10 mm
Exclusion criteria	Patients with a history of previous ipsilateral kidney surgery, solitary kidney, acute urinary tract infections, anatomic variations, and steep infindibulopelvic angle (<30 degrees)
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): SWL group 42.9 (5.6); URS group 45.4 (6.4). Gender (M:F): 72:68. Ethnicity: Not reported
Further population details	1. Kidney pole: Lower kidney pole 2. Neuropathic/ cerebral-palsy /immobility: Not applicable 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=70) Intervention 1: Shock wave lithotripsy (SWL). SWL was performed on an outpatient basis. Electrohydraulic extracorporeal lithotripter (Multimed Classic; Elmed, Ankara, TURKEY) was used for SWL (In each lithotripsy session, 2,500–3,000 shocks were given at 14–17 kV.), and flexible ureterorenoscope (Flex-X, Karl Storz, Tuttlingen, Germany) and Holmium laser (Ho YAG Laser; Dornier MedTech; Munich, Germany), for flexible ureterorenoscopy. At the most, patients in SWL group underwent three courses of SWL therapy. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=70) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. For F-URS, preoperative stenting was

	not performed. An access sheath of 11–13F was placed in the operation. The stones were placed on to the upper pole or renal pelvis and disintegrated there. With the achievement of stone sizes smaller than 3 mm, the operation was ended. After the procedure, a JJ stent was not placed unless a complication occurred.. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Stone free state at 3 months; Group 1: 64/70, Group 2: 70/70
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Ancillary procedures at Not reported; Group 1: 6/70, Group 2: 0/70
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Adverse events at Define
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Fever at Not reported; Group 1: 0/70, Group 2: 2/70
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone <10 mm: UTI at Not reported; Group 1: 0/70, Group 2: 1/70
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	Sener 2015196
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=150)
Countries and setting	Conducted in Turkey; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 12 months
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), renal stone <10 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Asymptomatic single lower pole stones <10mm
Exclusion criteria	Patients with semiopaque or nonopaque stones, anomalous kidneys, ureteropelvic junction obstruction, a history of open or percutaneous interventions to the ipsilateral kidney, a solitary kidney, steep infundibulopelvic angle, and a dilated pelvicalyceal system
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): URS 36.84 (11.70); SWL 34.5 (11.04); observation 32.52 (13.29). Gender (M:F): 101:49. Ethnicity: Not reported
Further population details	1. Kidney pole: Lower kidney pole 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/Hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=50) Intervention 1: Shock wave lithotripsy (SWL). SWL was performed as an outpatient procedure, without general or regional anaesthesia by the same experienced urologist. An electrohydraulic extracorporeal lithotripter was used for SWL (in each lithotripsy session 2500-3000 shocks were given at 14-17kV). Patients in the SWL group underwent three courses at the most of SWL therapy. The patients were evaluated for fragmentation by KUB radiography 1 week after the SWL session. . Duration Not applicable. Concurrent medication/care: Not reported (n=50) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. Flexible ureterorenoscope and holmium laser were used for flexible ureterorenoscopy. In the F-URS group preoperative stenting was not performed. An access sheath of 11-13Fr was surgically placed. The stones were placed onto the upper pole or renal pelvis and disintegrated there. The operation was ended when the biggest stone was <3mm. After the procedure a JJ stent was not placed unless a complication occurred. . Duration Not applicable. Concurrent

	medication/care: Not reported. Indirectness: No indirectness (n=50) Intervention 3: Non-surgical / conservative management. Observation. Development of symptoms such as ureteral or calyceal obstruction, UTI or haematuria during follow up or stone growth was described as disease progression. Intractable pain or pain causing impairment of quality of life was also an indication for active intervention. These patients were referred for SWL, URS or PCNL after prompt medical treatment. Duration Not applicable. Concurrent medication/care: Not reported (n=100) Intervention 4: Ureteroscopy or RIRS - Semi-rigid or flexible. Surgical management: SWL or URS as described above. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Stone-free state at 3 months; Group 1: 46/50, Group 2: 46/50
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Ancillary procedures at Not reported; Group 1: 3/50, Group 2: 4/50
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Retreatment at Not reported; Group 1: 20/50, Group 2: 0/50
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Adverse events at Define
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Fever at Not reported; Group 1: 0/50, Group 2: 3/50
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone <10 mm: UTI at Not reported; Group 1: 0/50, Group 2: 1/50
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Ureteral laceration at Not reported; Group 1: 0/50, Group 2: 1/50

Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SURGICAL MANAGEMENT versus NON-SURGICAL / CONSERVATIVE MANAGEMENT

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Stone-free state at 3 months; Group 1: 92/100, Group 2: 1/50
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), renal stone <10 mm: Ancillary procedures at Not reported; Group 1: 7/100, Group 2: 6/50
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	**Singh 2014203**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=70)
Countries and setting	Conducted in India; Setting:
Line of therapy	1st line
Duration of study	Intervention + follow up: 1 month
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: ultrasonography, x-ray KUB, intravenous urography
Stratum	Adults (≥16 years), renal stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with an isolated IC radio-opaque stone between 10 and 20mm

Exclusion criteria	Patients with non-IC calculi, radiolucent calculi, distal obstruction (ureteric, ureteropelvic junction, or infundibular stenosis), stone in calyceal diverticulum, congenital anomalies (ectopic, duplex, and horseshoe), obesity (BMI >29), pregnancy, active UTI, serum creatinine >3mg/dL and solitary kidney
Age, gender and ethnicity	Age - Mean (SD): SWL group 34.5 (4.35); RIRS group 37.65 (11.8). Gender (M:F): 42:28. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Non-obese / short skin-to-stone distance 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=35) Intervention 1: Shock wave lithotripsy (SWL). SWL was done under intravenous sedation by Dornier compact alpha lithotripter as an outpatient procedure. A total of 3500-4500 shocks were given per session. the whole procedure of SWL was monitored by a urologist. As a protocol, treatment started with a frequency of 60 shocks/min and energy level of 1, which increased to next energy level after every 200 shocks up to a maximum of level 4. Frequency was increased (to a maximum of level 120) according to patient tolerance once a reasonable fragmentation was seen. To ensure a good fragmentation a minimum of 3500 shocks were used in each sitting. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=35) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. RIRS was done using a 7.5 F flexible ureterorenoscope under combined spinal and epidural anaesthesia. An access sheath was used in all cases. Stone were relocated to a more favourable location in the pelvis or upper pole by basketing to allow for better visualisation during lithotripsy. For lithotripsy, holmium YAG laser was used at a setting of 8-12 W. If the stone was big and not basketable, it was fragmented in situ in few pieces and repositioned into upper calyx or pelvis for further fragmentation. After stone fragmentation, basket retrieval of large stone fragments was done under direct visualisation. At the end of surgery, a 6F double J stent was placed routinely. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	No funding (No relevant financial interests)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus RIRS

Protocol outcome 1: Length of stay at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Length of stay at Not reported; Group 1: mean 5.8 Hours (SD 3.3); n=35, Group 2: mean 48 Hours (SD 15.3); n=35
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Stone free state at 1 month; Group 1: 17/35, Group 2: 29/35
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Retreatment at Not reported; Group 1: 23/35, Group 2: 2/35
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Ancillary procedure at Not reported; Group 1: 16/35, Group 2: 3/35
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 4: Adverse events at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Sepsis at Not reported; Group 1: 2/35, Group 2: 1/35
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: ureteric perforation at Not reported; Group 1: 0/35, Group 2: 1/35
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 5: Pain intensity at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Pain at 1 day; Group 1: mean 2.4 (SD 0.64); n=35, Group 2: mean 4.34 (SD 0.45); n=35; VAS 0-10 Top=High is poor outcome
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Hospitalisation at Define

Study	Sio 2008205
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=75)
Countries and setting	Conducted in Italy; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 1 month
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Renal ultrasonography (US), kidney-ureters-bladder (KUB) plain radiography, and pyelography
Stratum	Adults (≥16 years), renal stone >20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Single or multiple renal stones (pelvic-caliceal) treatable with a single percutaneous access, stone diameter >2.5 cm, body mass index (BMI) <30 kg/m2; and no contraindications to perform the operation in the prone position
Exclusion criteria	Presence of stones in more than one calyx, complete staghorn stones, and coexisting renal anomalies
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (range): Supine group 38 (25–72); prone group 41 (28–69). Gender (M:F): 33:42. Ethnicity:
Further population details	1. Kidney pole: Not stated / Unclear 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Non-obese / short skin-to-stone distance 4. Pregnant women: Not stated / Unclear 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=39) Intervention 1: Percutaneous nephrolithotomy (PCNL). Patients were placed in a modified supine position with either a 3-l water bag under the flank, or a smaller cushion, according to patient body mass. All procedures were carried out under general anaesthesia. With the patient in the supine position, a flexible cystoscopy was performed, a 5F ureteral catheter was introduced, and a retrograde ureteropyelography was done. This catheter was fixed with tape to a 14F Foley catheter, which was placed at the end of this step. In both groups, the skin was punctured by the urologist on or slightly medial to the posterior axillary line. Renal access was achieved under fluoroscopic guidance after opacification and dilation of the pelvicaliceal system through the ureteral catheter. An anterior calyx was punctured just when the stone was in an anterior branch of the calyx. An attempt, even if not always successful, was made to introduce the wire down the ureter. Coaxial dilators of the Alken type were used for tract dilation. At the end of progressive telescopic dilation, a 30-Ch Amplatz sheath was positioned, allowing the introduction of a 26F nephroscope. Stones were fragmented with an ultrasonic lithotripsy device (Calcuson, Karl Storz), which allowed for suction of smaller fragments. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness

	(n=36) Intervention 2: Percutaneous nephrolithotomy (PCNL) . Patients were turned to the prone position. The same procedure as in the supine group was used. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) SUPINE versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL) PRONE

Protocol outcome 1: Hospitalisation at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Length of hospital stay at Not reported; Mean; Supine group 4.3 (2.2-8.4); prone group 4.1 (2.4-7.8), Units: Days;
Risk of bias: All domain - High, Selection - Very high, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Stone free state at 1 month; Group 1: 35/39, Group 2: 33/36
Risk of bias: All domain - High, Selection - Very high, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Ancillary procedures at Not reported; Group 1: 4/39, Group 2: 2/36
Risk of bias: All domain - High, Selection - Very high, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Adverse events at Define; Pain intensity at Define; Length of stay at Define

Study (subsidiary papers)	**Verze 2010-1219**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=273)
Countries and setting	Conducted in Italy; Setting: Not reported
Line of therapy	1st line

Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Plain film
Stratum	Adults (≥16 years), ureteric stone <10 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with solitary, unilateral, radiopaque, distal ureteric stones with a stone size of 5–15 mm shown by IVU and requiring active intervention
Exclusion criteria	Obesity, pregnancy, paediatric group, solitary kidney, excretory system malformations, ipsilateral ureteric stricture, active UTI, uncorrected coagulation disorders, transplanted kidney, previous stone manipulation and previous ureteric surgery
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (range): SWL group 50.5 (18-80); URS group 49.4 (21-81). Gender (M:F): 138:135. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Non-obese / short skin-to-stone distance 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Lower ureteric stones
Indirectness of population	No indirectness
Interventions	(n=69) Intervention 1: Shock wave lithotripsy (SWL). ESWL procedures were performed by experienced urologists using the Modulith SLX-MX (Storz Medical, Switzerland) electromagnetic lithotripter. Patients were positioned prone and stones were localized with fluoroscopic guidance. Duration Not applicable. Concurrent medication/care: Patients in both groups received prophylactic antibiotics at the end of the procedure. Indirectness: No indirectness (n=66) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. URS procedures were performed by experienced urologists using a Storz semi-rigid ureteroscope with a diameter of 7.5–9.5 F after dilatation of the ureteric orifice if needed. Stones were fragmented with the Swiss Lithoclast Master lithotripter (EMS, Switzerland) and/or extracted via baskets or forceps. The placement of an ureteric double-pigtail stent at the end of the URS was left to the discretion of the treating surgeon. Duration Not applicable. Concurrent medication/care: Patients in both groups received prophylactic antibiotics at the end of the procedure. Indirectness: No indirectness
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS	

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define - Actual outcome for Adults (≥16 years), ureteric stone <10 mm: Stone free state at 3 months; Group 1: 66/69, Group 2: 63/66 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 2: Use of healthcare services/retreatment at Define - Actual outcome for Adults (≥16 years), ureteric stone <10 mm: Retreatment at 3 months; Group 1: 8/69, Group 2: 3/66 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone <10 mm: Ancillary procedures at 3 months; Group 1: 2/69, Group 2: 16/66 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Adverse events at Define; Pain intensity at Define; Length of stay at Define

Study	**Verze 2010-2219**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=273)
Countries and setting	Conducted in Italy; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Plain film
Stratum	Adults (≥16 years), ureteric stone 10-20 mm
Subgroup analysis within study	Post-hoc subgroup analysis
Inclusion criteria	Patients with solitary, unilateral, radiopaque, distal ureteric stones with a stone size of 5–15 mm shown by IVU and requiring active intervention
Exclusion criteria	Obesity, pregnancy, paediatric group, solitary kidney, excretory system malformations, ipsilateral ureteric stricture, active UTI, uncorrected coagulation disorders, transplanted kidney, previous stone manipulation and previous ureteric surgery

Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (range): SWL group 50.5 (18-80); URS group 49.4 (21-81). Gender (M:F): 138:135. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Non-obese / short skin-to-stone distance 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Lower ureteric stones
Indirectness of population	No indirectness
Interventions	(n=68) Intervention 1: Shock wave lithotripsy (SWL). ESWL procedures were performed by experienced urologists using the Modulith SLX-MX (Storz Medical, Switzerland) electromagnetic lithotripter. Patients were positioned prone and stones were localized with fluoroscopic guidance. Duration Not applicable. Concurrent medication/care: Patients in both groups received prophylactic antibiotics at the end of the procedure. Indirectness: No indirectness (n=70) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. URS procedures were performed by experienced urologists using a Storz semi-rigid ureteroscope with a diameter of 7.5–9.5 F after dilatation of the ureteric orifice if needed. Stones were fragmented with the Swiss Lithoclast Master lithotripter (EMS, Switzerland) and/or extracted via baskets or forceps. The placement of an ureteric double-pigtail stent at the end of the URS was left to the discretion of the treating surgeon. Duration Not applicable. Concurrent medication/care: Patients in both groups received prophylactic antibiotics at the end of the procedure. Indirectness: No indirectness (n=137) Intervention 3: Shock wave lithotripsy (SWL). As described previously. Duration Not applicable. Concurrent medication/care: As described previously. Indirectness: No indirectness (n=136) Intervention 4: Ureteroscopy or RIRS - Semi-rigid or flexible. As previously described. Duration Not applicable. Concurrent medication/care: As previously described. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone free state at 3 months; Group 1: 61/68, Group 2: 66/70
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Use of healthcare services/retreatment at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Retreatment at 3 months; Group 1: 49/68, Group 2: 7/70 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Ancillary procedure at 3 months; Group 1: 12/68, Group 2: 8/70 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 3: Adverse events at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Obstructive pyelonephritis at Not reported; Group 1: 14/137, Group 2: 0/136 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Fever at Not reported; Group 1: 0/137, Group 2: 15/136 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Haemorrhage at Not reported; Group 1: 0/137, Group 2: 7/136 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Ureteric perforation at Not reported; Group 1: 0/137, Group 2: 1/136 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	**Wankhade 2014226**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=156)
Countries and setting	Conducted in India; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Unclear method of assessment/diagnosis

Stratum	Adults (≥16 years), renal stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	11-15 mm lower caliceal calculi
Exclusion criteria	Not reported
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Range: 15-62. Gender (M:F): Not reported. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=78) Intervention 1: Shock wave lithotripsy (SWL). SWL was conducted on Dorniel compact alfa. The frequency was used between 60-80 and intensity between 3-4. All procedures were conducted by a single operator on the same machine. The stenting was done whenever necessary and maximum 3-4 sittings were done. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=78) Intervention 2: Percutaneous nephrolithotomy (PCNL) . PCNL was performed in all cases under regional anaesthesia, fluoroscopy control. Alken dilators were used and 22, 24 and 26Fr Amplaz Sheath were used as necessary. All cases were performed by single endourologist. In all patients Nephrostomy [12 or 14 Fr Nelatone catheter was kept post-operative for 24 hours. DJ stent was kept when necessary. Ureteric catheter was kept when DJ stent was not used. Pneumatic lithoclast was used for fragmentation and Alligator or tripronge forceps were used for retrieval of fragments. Duration Not reported. Concurrent medication/care: Post-operatively analgesics, antibiotics were used as routine.. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Stone free state at 3 months; Group 1: 53/78, Group 2: 76/78
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Ancillary procedure at Not reported; Group 1: 12/78, Group 2: 0/78

Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 3: Adverse events at Define - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Mortality at Not reported; Group 1: 0/78, Group 2: 0/78 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Sepsis at Not reported; Group 1: 0/78, Group 2: 0/78 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	**Wang 2013224**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=122)
Countries and setting	Conducted in China; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 1 month
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: All patients were definitively diagnosed preoperatively by plain film X-rays, intravenous pyelogram, ultrasonography or CT plain scan
Stratum	Adults (≥16 years), renal stone >20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients were included if they had kidney stones of diameter >20 mm or upper ureter stones of diameter >15 mm and had not previously undergone nephrostomy; and if they did not have serious cardiovascular or cerebrovascular disease or a hemorrhagic tendency.
Exclusion criteria	Not reported
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (range): Supine group 44 (30-69); prone group 42 (22-70). Gender (M:F): 62:60. Ethnicity: Not reported

Further population details	1. Kidney pole: Not stated / Unclear 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	No indirectness
Interventions	(n=62) Intervention 1: Percutaneous nephrolithotomy (PCNL). The entire procedure was performed with the patient under general anaesthesia on the UROSCOP Access. Patients randomized to the prone position group were placed in the lithotomic position, and retrograde ureteric catheterization was performed. All other procedures were completed in the prone position. A cushion was placed under the belly to reduce the possibility of pleural damage. Using a combination of ultrasound (Aloka 5 multicolour ultra-sound instrument with transducer frequency 3.5 MHz, Japan) and fluoroscopic (Siemens, Germany) guidance, an 18-G coaxial needle (Cook Inc., USA) was inserted into the desired calyx, and a working channel to Fr16 was established using the fascial dilators (Cook Inc., USA). An Fr9 ureteroscope (Olympus, Japan) was placed directly into the kidney through the established tract to confirm successful creation of the channel. After the ureteroscope was withdrawn, an X-Force N30 nephrostomy balloon dilation catheter (BCR Inc., USA) was inserted. An Fr24 Amplatz sheath was placed in the proper position, allowing the introduction of an Fr20 nephroscope (Storz, Germany). A cybersonics double-catheter system (Cybersonics Inc. USA) was used to fragment and remove the stone. At the end of the procedure, a clamped Fr20 Foley catheter was inserted to act as a nephrostomy tube and kept open for 24 hours. If there was no extravasation, the tube was removed four days after surgery. A double J tube was routinely inserted into the ureter and removed about 1 month later in the out-patient clinic. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=60) Intervention 2: Percutaneous nephrolithotomy (PCNL). Patients randomized to the modified supine position group were placed in a supine position with the flank raised and slightly rotated by a single 3-liter water bag. The patient's ipsilateral flank was elevated approximately 30° relative to the operating room table. All other procedures were identical to those performed in the prone position. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PERCUTANEOUS NEPHROLITHOTOMY (PCNL) PRONE POSITION versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL) SUPINE POSITION

Protocol outcome 1: Hospitalisation at Define
- Actual outcome for Adults (≥16 years), renal stone >20 mm: Length of hospital stay at Not reported; Mean; Prone group 8.2 (6-11); supine group 8.4 (6-12) , Units: days;
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low,

Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 2: Treatment success (stone free state, clinically insignificant residual fragments) at Define - Actual outcome for Adults (≥16 years), renal stone >20 mm: Stone free state at 1 month; Group 1: 55/62, Group 2: 44/60 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 3: Use of healthcare services/retreatment at Define - Actual outcome for Adults (≥16 years), renal stone >20 mm: Retreatment at Not reported; Group 1: 0/62, Group 2: 6/60 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), renal stone >20 mm: Ancillary procedures at Not reported; Group 1: 4/62, Group 2: 5/60 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 4: Recurrence at Define - Actual outcome for Adults (≥16 years), renal stone >20 mm: Recurrence at Not reported; Group 1: 0/62, Group 2: 0/60 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 5: Adverse events at Define - Actual outcome for Adults (≥16 years), renal stone >20 mm: Fever at Not reported; Group 1: 5/62, Group 2: 6/60 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), renal stone >20 mm: Clinically insignificant bleeding at Not reported; Group 1: 11/62, Group 2: 8/60 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	Wang 2016222
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=126)
Countries and setting	Conducted in Taiwan; Setting: Emergency room
Line of therapy	1st line
Duration of study	Not clear:
Method of assessment of guideline condition	Unclear method of assessment/diagnosis
Stratum	Adults (≥16 years), ureteric stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	A WBC of 10,000mm³ or greater and/or temperature 38 degrees or greater.
Exclusion criteria	Urethral or ureteral stricture, urinary diversion, pregnancy, solitary kidney, severe sepsis, septic shock, and unwillingness or impossibility to commit to the study follow-up protocol
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): URS group 57.52 (11.93); PCN group 58.21 (10.89). Gender (M:F): 53:54. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Not stated / Unclear (Mixed: upper 57%, middle 14.9%, lower 28%).
Indirectness of population	No indirectness
Interventions	(n=63) Intervention 1: Ureteroscopy or RIRS - Semi-rigid or flexible. Patients were placed in the asymmetric lithotomy position under laryngeal mask general anaesthesia. All the procedures were performed by semirigid ureteroscopes combined with the lithoclast to disintegrate the stones. The ureteroscope proceeded under direct vision without active dilation. For prevention of stone migration, the stone occlusion device bypassed the stone and entrapped the stone. Lithotripsy was done by hitting the stone in the centre and breaking it into pieces as small as possible. When fragment size was small enough, fragments were retrieved from the ureter under direct vision with an ureteroscopic grasper. A double J stent was placed routinely and left for 2 weeks. Duration Not applicable. Concurrent medication/care: All patients were initially given parenteral antibiotics. Oral ketorolac 10mg three times a day to minimise urinary tract symptoms was needed, and patients were allowed use sublingual buprenorphine 0.2mg on demand. . Indirectness: No indirectness

	(n=63) Intervention 2: Percutaneous nephrolithotomy (PCNL). PCNL was performed in the angiography suite by a radiologist using sonographic guided with the patient under anaesthesia. No further details reported. Duration Not applicable. Concurrent medication/care: All patients were initially given parenteral antibiotics. Oral ketorolac 10mg three times a day to minimise urinary tract symptoms was needed, and patients were allowed use sublingual buprenorphine 0.2mg on demand. Indirectness: No indirectness
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: URS versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL) Protocol outcome 1: Length of stay at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Length of hospital stay at Not reported; Group 1: mean 8.24 Days (SD 2.77); n=54, Group 2: mean 10.25 Days (SD 3.53); n=53 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10; Group 2 Number missing: 9 Protocol outcome 2: Use of healthcare services/retreatment at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Ancillary procedures at Not reported; Group 1: 1/54, Group 2: 2/53 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10; Group 2 Number missing: 9 Protocol outcome 3: Mortality at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Mortality at Not reported; Group 1: 0/54, Group 2: 0/53 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10; Group 2 Number missing: 9	
Protocol outcomes not reported by the study	Quality of life at Define; Treatment success (stone free state, clinically insignificant residual fragments) at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Adverse events at Define; Pain intensity at Define; Hospitalisation at Define

Study	**Wang 2017225**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=100)
Countries and setting	Conducted in China; Setting: Department of urology
Line of therapy	1st line

Duration of study	Intervention + follow up: 12 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: KUB abdominal plain film
Stratum	Adults (≥16 years), ureteric stone 10-20 mm: Mean (SD) stone size: URS group 16.8(2.1) mm; PSCL group 19.3 (1.8) mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with a single upper ureteral stone (located below the ureteropelvic junction to the superior aspect of sacroiliac joint); the stone was >15 mm along its longest diameter as revealed by kidney-ureter-bladder (KUB) abdominal plain film
Exclusion criteria	patients with a history of any intervention operation on the corresponding ureter, radiolucent stones, active infection, or urinary tract abnormalities, coagulopathy, or pregnancy, as well as those patients requiring simultaneous treatment of a kidney stone
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): URS group: 41 (14); PCNL group 41 (15). Gender (M:F): 59/41. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Not applicable 6. Uteric stone: Upper ureteric stones
Indirectness of population	No indirectness
Interventions	(n=50) Intervention 1: Ureteroscopy or RIRS - Semi-rigid or flexible. The patient was under spinal or general anesthesia and placed in the lithotomy position. An 8 to 9.8 F rigid ureteroscope (Richard Wolf GmbH, Knittlingen, Germany) was used for uteroscopy and access was provided by retrograde insertion of a 0.038-in. floppy tip guide wire over which the ureteroscope was introduced into the ureter without dilating the ureteral orifice. The stones were fragmented with a holmium YAG laser through the ureteroscope. A double-J stent was placed in cases with large residual stones, significant mucosal edema, stone impaction, or probable ureteral trauma. The stent was removed when the patient was stone-free on follow-up evaluation as an outpatient. Duration Not applicable. Concurrent medication/care: A sensitive antibiotic was given to the patients with positive cultures to control the infection before surgical intervention. Indirectness: No indirectness (n=50) Intervention 2: Percutaneous nephrolithotomy (PCNL). Under general anesthesia, the patient was placed in the lithotomy position and an external 5 Fr or 6 Fr ureteral catheter was inserted to the target ureter under direct ureteroscopic vision. Then the patient was rotated to the prone position with a pack under the ipsilateral hemi-pelvis. An ultrasound-guided percutaneous puncture was made by the urologist with an

	18-gauge puncture needle being pushed into the designated calyx. A flexible guide wire was then inserted through the calyceal puncture into the renal pelvis and across the ureteropelvic junction into the ureter. An 8 Fr fasical dilator was employed initially, and the calibre was increased gradually by progressive 2 Fr fascial dilators along the guide wire, until the percutaneous nephrostomy tract was dilated to 18 Fr. A matched peel-away sheath was inserted into the renal collecting system. All the stones were fragmented with a Swiss lithoclast used as the sole device for using a 2.4 F (0.8-mm thick), 668-mm-long probe and stone debris were flushed out by a water flow produced by an endoscopic perfusion pump (EMS - Electro medical Systems S.A., Nyon, Switzerland). At the end of the procedure, a 5 Fr double-J stent was indwelled via the percutaneous access with the assistance of the guide wire. All the percutaneous tracts were inserted with a 16 Fr silastic nephrostomy tube. Duration Not applicable. Concurrent medication/care: A sensitive antibiotic was given to the patients with positive cultures to control the infection before surgical intervention. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: URS versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: New stone formation/incidence of stones/recurrence rate at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: stone free at 1 month; Group 1: 33/46, Group 2: 48/50
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Use of healthcare services/retreatment rate at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: ancillary procedures at 3 days; Group 1: 15/46, Group 2: 3/50
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: length of stay at 1 month; Group 1: mean 2.5 days (SD 1.3); n=46, Group 2: mean 6.8 days (SD 2.6); n=50
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Adverse events at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: minor adverse events at 1 month; Group 1: 3/46, Group 2: 7/50
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: major adverse events at 1 month; Group 1: 5/46, Group 2: 0/50
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low,

Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; Treatment success (stone free state, clinically insignificant residual fragments) at Define; Kidney function at Define; Recurrence rate at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	**Wazir 2015227**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=224)
Countries and setting	Conducted in Pakistan; Setting: Institute of kidney diseases
Line of therapy	1st line
Duration of study	Intervention + follow up: 2 weeks
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Complete clinical evaluation (history, examination, urin culture, xray KUB, ultrasound KUB and excretory urography)
Stratum	Adults (≥16 years), ureteric stone <10 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Distal ureteric stones between 6-12mm in size
Exclusion criteria	Patients with renal insufficiency, ipsilateral ureteric stricture, active urinary tract infection, and obesity (BMI >29)
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): SWL group 46 (14.6); URS group 48.7 (16.2). Gender (M:F): 154:70. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Non-obese / short skin-to-stone distance 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Lower ureteric stones
Indirectness of population	No indirectness
Interventions	(n=112) Intervention 1: Ureteroscopy or RIRS - Semi-rigid or flexible. Patients underwent URS with ICL using an 8Fr semi-rigid ureteroscope with a 4Fr working channel and a conventional pneumatic lithotripter with 1mm metallic probe under spinal or general anaesthesia. A 6.5Fr DJ stent was placed postoperatively in all cases. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness

	(n=112) Intervention 2: Shock wave lithotripsy (SWL). Patients underwent ESWL on the day of admission after giving an intramuscular diclofenac sodium injection and in prone position using an electromagnetic lithotripter under fluoroscopic or ultrasound guidance. The shockwave energy was progressively increased until satisfactory fragmentation. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: URS versus SHOCK WAVE LITHOTRIPSY (SWL) Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define - Actual outcome for Adults (≥16 years), ureteric stone <10 mm: Stone free state at 2 weeks; Group 1: 101/112, Group 2: 75/112 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Adverse events at Define; Pain intensity at Define; Length of stay at Define

Study	**Yang 2012237**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=182)
Countries and setting	Conducted in China; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 3-12 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: B-scan ultrasonography, IVU or CT
Stratum	Adults (≥16 years), ureteric stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Ureteral stone at the proximal segment of the ureter above the level of L4. Stones were impacted (either the stone had been in the same position for >2 months or an IVU contrast agent could not pass the stone with at least a moderate degree of hydronephrosis and with ectasis of the renal pelvis >4cm)

Exclusion criteria	Coagulopathy, serious heart disease or pulmonary insufficiency, severe kyphosis and scoliosis deformity, extreme obesity, active infection, urinary tract abnormalities, a simultaneous kidney stone requiring surgery, and pregnancy
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): MPCNL group 45.2 (14.7), URS group 46.4 (15.1). Gender (M:F): 107:75. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not applicable 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Upper ureteric stones
Indirectness of population	No indirectness
Interventions	(n=91) Intervention 1: Ureteroscopy or RIRS - Semi-rigid or flexible. All surgery was performed with the patient under epidural or general anaesthesia. The patient was first placed in the lithotomy and then prone position. Transurethral ureteroscopy using a holmium laser. An 8F-9.8F rigid ureteroscope was inserted into the ureter, and the stone was then broken using the holmium laser into gravel <4mm. For the stone gravel refluxed to the kidney by saline infusion and lithotripsy with a size >4mm, those patients were treated with SWL 3-7 days post operatively. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=91) Intervention 2: Percutaneous nephrolithotomy (PCNL) . All surgery was performed with the patient under epidural or general anaesthesia. The patient was first placed in the lithotomy and then prone position. Ultrasound guided percutaneous punctures were made with an 18 gauge coaxial needle into the targeted calix. The puncture point was in the 12th rib infracostal margin, between the posterior axillary line and scapula line. A guidewire was inserted and fixed and the puncture needle was removed. Dilation of the percutaneous tract was performed serially over the guidewire with a fascial dilator to 16F. A patented sheath with a 16F inner diameter was placed at the percutaneous access port and was connected to a vacuum aspiration machine. A small diameter nephroscope was inserted through the sheath to observe the stone. A holmium laser was used to break the stones and the vacuum suctioning device was used to clear the gravel. A 6F double J stent was placed and the patented sheath was removed. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Academic or government funding (Supported by major scientific and technological project funds from the Jiangxi Provincial Health Department, China)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: URS versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define

- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone-free at 1 month; Group 1: 81/91, Group 2: 91/91 Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 2: Use of healthcare services/retreatment at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Ancillary procedures at Not reported; Group 1: 23/91, Group 2: 0/91 Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - Used a random number table to divide participants into two groups, according to the admission sequence of participants; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 3: Adverse events at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Fever at 1 month; Group 1: 14/91, Group 2: 5/91 Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - Used a random number table to divide participants into two groups, according to the admission sequence of participants; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: ureteral stricture at 1 month; Group 1: 2/91, Group 2: 0/91 Risk of bias: All domain - High, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - Used a random number table to divide participants into two groups, according to the admission sequence of participants; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	Yuruk 2010241
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=99)
Countries and setting	Conducted in Turkey; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 12 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Excretory urography and TcDMSA renal cortical scintigraphy
Stratum	Adults (≥16 years), renal stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with asymptomatic lower caliceal calculi 20mm or less in greatest diameter
Exclusion criteria	Patients with radiolucent calculi, high serum creatinine, solitary kidney, recurrent urinary tract infections, additional renal anomalies, previous renal parenchymal scarring and a dilated pelvicaliceal system
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): SWL group 44.5 (9.4); PCNL group 44.1 (12.3); observation group 44 (12.2). Gender (M:F): 50:44. Ethnicity: Not reported
Further population details	1. Kidney pole: Lower kidney pole 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Not applicable
Indirectness of population	Serious indirectness: May include some stones <10mm
Interventions	(n=33) Intervention 1: Shock wave lithotripsy (SWL). SWL was done without anaesthesia using a compact electromagnetic lithotripter. Therapy was usually started at low 14kV power and gradually increased to 24kV. A total of 3000 shocks per session were delivered or until complete stone fragmentation occurred. Patients were evaluated 1 week after session 1 by x-ray of the kidneys, ureters and bladder. If there was no stone disintegration after 3 SWL sessions, the case was considered a failure. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=33) Intervention 2: Percutaneous nephrolithotomy (PCNL) . PCNL was done beginning with cystoscopy and ureteral catheter insertion. The patient was then placed prone. Percutaneous access was achieved using C arm fluoroscopy. After caliceal puncture the tract was dilated with a high pressure NephroMax balloon dilator and a 30Fr Amplatz sheath was placed. Nephroscopy was performed with a rigid 26Fr nephroscope. Stones were fragmented using a combined pneumatic and ultrasonic lithotripter. Stone clearance and collecting system integrity were confirmed intraoperatively by antegrade nephrostography. A

	14Fr nephrostomy tube was placed at the end of the case as indicated.. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=33) Intervention 3: Non-surgical / conservative management. Observation. Symptoms related to ureteral caliceal obstruction, stone growth, recurrent urinary infections and haematuria were defined as disease progression. Patients were referred for SWL, PNL or flexible URS after prompt medical treatment. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Stone free status at 3 months; Group 1: 17/31, Group 2: 30/31
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2; Group 2 Number missing: 2

Protocol outcome 2: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Retreatment at Not reported; Group 1: 21/31, Group 2: 0/31
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2; Group 2 Number missing: 2
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Ancillary procedures at Not reported; Group 1: 3/31, Group 2: 0/31
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2; Group 2 Number missing: 2

Protocol outcome 3: Adverse events at Define
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Fever at Not reported; Group 1: 0/31, Group 2: 1/31
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2; Group 2 Number missing: 2
- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Bleeding necessitating blood transfusion at Not reported; Group 1: 0/31, Group 2: 1/31
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2; Group 2 Number missing: 2

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus NON-SURGICAL / CONSERVATIVE MANAGEMENT

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define

- Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Stone free status at 3 months; Group 1: 17/31, Group 2: 0/32 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2; Group 2 Number missing: 1 Protocol outcome 2: Use of healthcare services/retreatment at Define - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Ancillary procedures at Not reported; Group 1: 3/31, Group 2: 7/32 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2; Group 2 Number missing: 1 RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PERCUTANEOUS NEPHROLITHOTOMY (PCNL) versus NON-SURGICAL / CONSERVATIVE MANAGEMENT Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Stone free status at 3 months; Group 1: 30/31, Group 2: 0/32 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2; Group 2 Number missing: 1 Protocol outcome 2: Use of healthcare services/retreatment at Define - Actual outcome for Adults (≥16 years), renal stone 10-20 mm: Ancillary procedures at Not reported; Group 1: 0/31, Group 2: 7/32 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2; Group 2 Number missing: 1	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	**Zeng 2002244**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=390)
Countries and setting	Conducted in China; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 28 days
Method of assessment of guideline condition	Unclear method of assessment/diagnosis

Stratum	Adults (≥16 years), ureteric stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Not reported
Exclusion criteria	Not reported
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Other: Median: SWL group 51; URS group 40. Gender (M:F): 235:155. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Lower ureteric stones
Indirectness of population	No indirectness
Interventions	(n=210) Intervention 1: Shock wave lithotripsy (SWL). The HB-ESWL-V lithotripter was applied. After the patients were pronated or laid at a major postero-oblique position, the stones were targeted at the second focus of the ellipsoid body as shown by the cross cursor on the monitor. As a routine, each patient was given fluid irrigation intravenously and injected pethidine 100mg. The discharge voltage was set at 8.3 to 15.0kV and stroke times at 1500-3000 for each single episode of treatment. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=180) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. For the URS group, the patients, lying at a lithotomy position, were anaesthetised epidurally. Wolf 7.5-9.0Fr ureteroscopy was inserted into the bladder and guided upward the affected ureter. At sight of the stone, the target was fragmented with JML-93 pneumatic lithotripter. A double J tube was then placed and removed 3-7 days later. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone free state at 28 days; Group 1: 164/210, Group 2: 168/180
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Age; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Retreatment at Not reported; Group 1: 25/210, Group 2: 4/180
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low,

Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Age; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 3: Adverse events at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Infection at Not reported; Group 1: 4/210, Group 2: 2/180 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Age; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Ureteral perforation at Not reported; Group 1: 0/210, Group 2: 6/180 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Age; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Ureteral stricture at Not reported; Group 1: 8/210, Group 2: 4/180 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Age; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

Study	**Zeng 2012{#281}**
Study type	Non-randomised study
Number of studies (number of participants)	1 (n=46)
Countries and setting	Conducted in China; Setting: MPCNL was performed at the Department of Urology of the First Affiliated Hospital of Guangzhou Medical College and SWL was performed at the Department of Urology of the Xinhua Hospital of Shanghai Jiaotong University
Line of therapy	Unclear
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Unclear method of assessment/diagnosis: Not reported
Stratum	Children (<16 years): Children, renal >20mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Not reported
Exclusion criteria	Not reported
Recruitment/selection of patients	Not reported

Age, gender and ethnicity	Age - Mean (SD): MPCNL group: 23.08 (9.56 months); SWL group: 23.5 (6.64 months) . Gender (M:F): Define. Ethnicity: Not reported
Further population details	1. Kidney pole: Not stated / Unclear 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not applicable 5. Stone composition/hounsfield units: Not stated / Unclear 6. Uteric stone: Not stated / Unclear
Extra comments	Infants <3 years of age with renal stones sizing 15-25mm. Serious indirectness for the difference in setting in which MPCNL and SWL were performed
Indirectness of population	Serious indirectness
Interventions	(n=22) Intervention 1: Shock wave lithotripsy (SWL). SWL was performed with the Dornier Compact Delta-lithotripter under ultrasonic guidance. The patient was placed in the supine position. The number of shock waves per SWL session varied from 300 to 1800 (mean 956) at a rate of 60 shock waves/min. The electric discharge voltage was escalated from 8 kV to 11-12 kV. No ureteral catheterization was needed either before or after the procedure. A plain abdominal radiograph was performed to evaluate stone-free status at 1 week postoperatively. In infants with inadequate stone disintegration, a repeated SWL was performed after 2 weeks. Duration 3 months. Concurrent medication/care: All operations were performed under general anaesthesia. Prophylactic antibiotics were administered to all patients.. Indirectness: Serious indirectness; Indirectness comment: SWL and MPCNL performed in different settings (n=24) Intervention 2: Percutaneous nephrolithotomy (PCNL) . The patient was first placed in the lithotomy position. A 4F or 5F ureteral catheter was inserted into the ureter with the assistance of a flexible 0.035-in. Zebra guide wire (Boston Scientific Corporation) under direct ureteroscopic vision. Then the patient was turned to the prone position. A percutaneous access was established under fluoroscopic guidance using the "bull's eye technique". After the access was serially dilated to 14F, 16F or 18F, a matched peel-away sheath (Cook Inc.) was inserted into the renal collecting system. The stones were fragmented with a pneumatic lithotripter (Jielun Medical Corporation, Guangzhou, China) under an 8F/9.8F semi-rigid ureteroscope (Richard Wolf GmbH, German). Large fragments were extracted by forceps, whereas smaller fragments were flushed out by a forceful pulse flow produced by an endoscopic perfusion pump (Jielun Medical Corporation, Guangzhou, China) with a pressure at 58-68 mmHg. At the end of the procedure residual stones were determined fluoroscopically. A paediatric JJ ureteral stent was inserted via an antegrade percutaneous access, and a 14F-18F silastic nephrostomy tube was inserted for drainage. A plain abdominal radiograph was performed on postoperative days 1 or 2 to evaluate residual fragments. A second-look MPCNL was performed to remove clinically significant residual fragments at 3-5 days after the first operation when necessary. The nephrostomy tube was removed 4 days later if no fever, urine leakage, and bleeding from the tube was observed. The double-J ureteral stent was removed 4 weeks after the procedure. Duration 3 months. Concurrent medication/care: All operations were performed under general anaesthesia. Prophylactic antibiotics were administered to all patients.. Indirectness: Serious indirectness;

	Indirectness comment: SWL and MPCNL performed in different settings
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Protocol outcome 1: Length of stay at Define
- Actual outcome for Children (<16 years): Length of stay (days) at 3 months; Group 1: mean 6.64 days (SD 2.28); n=22, Group 2: mean 14.13 days (SD 5.8); n=24
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - Very high, Outcome reporting - Low, Measurement - Low; Indirectness of outcome: Serious indirectness, Comments: SWL and MPCNL performed in different settings; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: New stone formation/incidence of stones/recurrence rate at Define
- Actual outcome for Children (<16 years): Stone-free status at 3 months; Group 1: 19/22, Group 2: 24/24
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - Very high, Outcome reporting - Low, Measurement - Low; Indirectness of outcome: Serious indirectness, Comments: SWL and MPCNL performed in different settings; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Use of healthcare services/retreatment rate at Define
- Actual outcome for Children (<16 years): Retreatment at 3-5 days after the first MPCNL and 2 weeks after the first SWL; Group 1: 11/22, Group 2: 3/24; Comments: Retreatment assessed and performed at different time-points postoperatively for SWL and MPCNL
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - Very high, Outcome reporting - Low, Measurement - High; Indirectness of outcome: Serious indirectness, Comments: SWL and MPCNL performed in different settings; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 4: Adverse events at Define
- Actual outcome for Children (<16 years): Minor adverse events at Not reported; Group 1: 4/22, Group 2: 4/24
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - Very high, Outcome reporting - Low, Measurement - Low; Indirectness of outcome: Serious indirectness, Comments: SWL and MPCNL performed in different settings; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; Treatment success (stone free state, clinically insignificant residual fragments) at Define; Kidney function at Define; Recurrence rate at Define; Mortality at Define; Pain intensity at Define; Hospitalisation at Define

Study	Zhang 2009246
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=314)
Countries and setting	Conducted in China; Setting: Not reported
Line of therapy	1st line
Duration of study	Intervention + follow up: 4 weeks
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Plain abdominal X-rays, urinary ultrasonography and with helical computed tomography when necessary
Stratum	Adults (≥16 years), ureteric stone <10 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with distal ureteral stones
Exclusion criteria	History of a urinary system stone, previous surgery on urinary tract, multiple stone, nonopaque stone, urinary tract infection, severe hydronephrosis, a solitary kidney, diseases such as diabetes, peptic ulcers, hypotension or hypertension treated with alpha adrenoceptor blocker or calcium antagonists, severe obesity, kidney failures, or pregnancy
Recruitment/selection of patients	Patients were enrolled from Provincial Hospital Affiliated to Shandong University
Age, gender and ethnicity	Age - Mean (SD): Nifedipine 36.3 (9.7); tamsulosin group, 34.6 (11.4); SWL group 36.6 (11.1). Gender (M:F): 199:94. Ethnicity: Not reported
Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Non-pregnant 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Lower ureteric stones
Indirectness of population	No indirectness
Interventions	(n=199) Intervention 1: Non-surgical / conservative management. Patients in group A received nifedipine (30 mg, orally, tid), and patients in group B were given tamsulosin 0.4 mg/d (OMNIC 0.4). Duration Not reported. Concurrent medication/care: All patients received the conventional treatment with 2500 ml hydration daily and levofloxacin (0.1 g orally, twice a day) for the first 7 days. Indirectness: No indirectness (n=104) Intervention 2: Shock wave lithotripsy (SWL). In Group C, the patients were treated a single session of ESWL with the Dornier Compact Delta Lithotripter (Dornier MedTech System GmbH, Wessling, Germany).. Duration Not reported. Concurrent medication/care: All patients received the conventional treatment with 2500 ml hydration daily and levofloxacin (0.1 g orally, twice a day) for the first 7 days. Indirectness: No indirectness

Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: NON-SURGICAL / CONSERVATIVE MANAGEMENT versus SHOCK WAVE LITHOTRIPSY (SWL) Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define - Actual outcome for Adults (≥16 years), ureteric stone <10 mm: Stone free state at 1 month; Group 1: 141/199, Group 2: 91/104 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 9; Group 2 Number missing: 2	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Use of healthcare services/retreatment at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Adverse events at Define; Pain intensity at Define; Length of stay at Define

Study	**Zhang 2011245**
Study type	RCT (randomised; Parallel)
Number of studies (number of participants)	1 (n=526)
Countries and setting	Conducted in China; Setting: Hospital
Line of therapy	1st line
Duration of study	Intervention + follow up: 2 weeks
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Ultrasound and intravenous pyelography or unenhanced CT
Stratum	Adults (≥16 years), ureteric stone 10-20 mm
Subgroup analysis within study	Not applicable
Inclusion criteria	Ureteral calculi that filed to pass spontaneously after 4 weeks with our without medical expulsive therapy, recurrent renal colic and obstructive uropathy
Exclusion criteria	Ureteral abnormalities, coagulative disorders and body habitus precluding either modality
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (range): URS group 50 (17-81); SWL group 49 (18-81). Gender (M:F): 368:158. Ethnicity: Not reported

Further population details	1. Kidney pole: Not applicable 2. Neuropathic/ cerebral-palsy /immobility: Not stated / Unclear 3. Obesity /skin-to-stone distance: Not stated / Unclear 4. Pregnant women: Not stated / Unclear 5. Stone composition/hounsfield units: Not stated / Unclear 6. Ureteric stone: Not stated / Unclear (Mixed).
Indirectness of population	No indirectness
Interventions	(n=257) Intervention 1: Shock wave lithotripsy (SWL). In situ was done under intramuscular sedation 30 minutes before treatment using the Dornier Compact S lithotripter. An average of 2900 shock waves were delivered at a rate of 60-90 shocks per minute. The shock wave voltage ranged between grade 7 and 9, with the maximum number limited to 3500 shocks. Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness (n=269) Intervention 2: Ureteroscopy or RIRS - Semi-rigid or flexible. URL was performed under spinal anaesthesia with a 8.5-9.5Fr semirigid ureteroscope in combination with holmium YAG laser intracorporeal lithotripsy. Contingency antibiotics were routinely used 30 minutes before procedure. Cystoscopy was performed first in order to place guide wire past the urethral orifice to maintain ureteroscopic access. The stone was broken under direct visualisation using laser (6-10Hz, 0.8-1.2J). The fragment was broken down to <3mm in order to be facilitated to pass spontaneously. Double J stent was universally left for 2-4 weeks after URL and was removed by cystoscopy. . Duration Not applicable. Concurrent medication/care: Not reported. Indirectness: No indirectness
Funding	Other (The authors were supported by Science and Technology Commission and the Bureau of Social Development of Pudong New Area in Shanghai China)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SHOCK WAVE LITHOTRIPSY (SWL) versus URS

Protocol outcome 1: Treatment success (stone free state, clinically insignificant residual fragments) at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Stone free state at 2 weeks; Group 1: 227/257, Group 2: 250/269
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Use of healthcare services/retreatment at Define
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Retreatment at Not reported; Group 1: 20/257, Group 2: 0/269
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Ancillary procedures at Not reported; Group 1: 4/257, Group 2: 16/269
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 3: Adverse events at Define - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Failed technology at Not reported; Group 1: 0/257, Group 2: 3/269 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: perforation at Not reported; Group 1: 0/257, Group 2: 3/269 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Extravasation at Not reported; Group 1: 0/257, Group 2: 2/269 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Adults (≥16 years), ureteric stone 10-20 mm: Fever at Not reported; Group 1: 6/257, Group 2: 2/269 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; Hospitalisation at Define; New stone formation/incidence of stones/recurrence at Define; Kidney function at Define; Recurrence at Define; Mortality at Define; Pain intensity at Define; Length of stay at Define

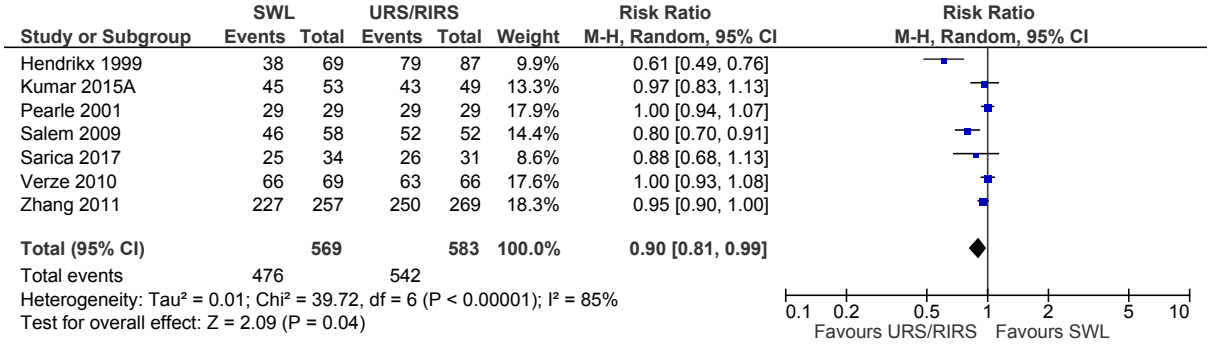
Appendix E: Forest plots

E.1 Between surgery comparisons

E.1.1 Adult, Ureteric, <10mm

E.1.1.1 SWL versus URS

Figure 2: Stone free state



Time-point: Hendrikx 1999, 3 months; Kumar 2015A, 3 months; Pearle 2001, 3 months; Salem 2009, 2 weeks; Sarica 2017, 4 weeks; Verze 2010, 3 months; Zhang 2011, 2 weeks

Figure 3: Retreatment

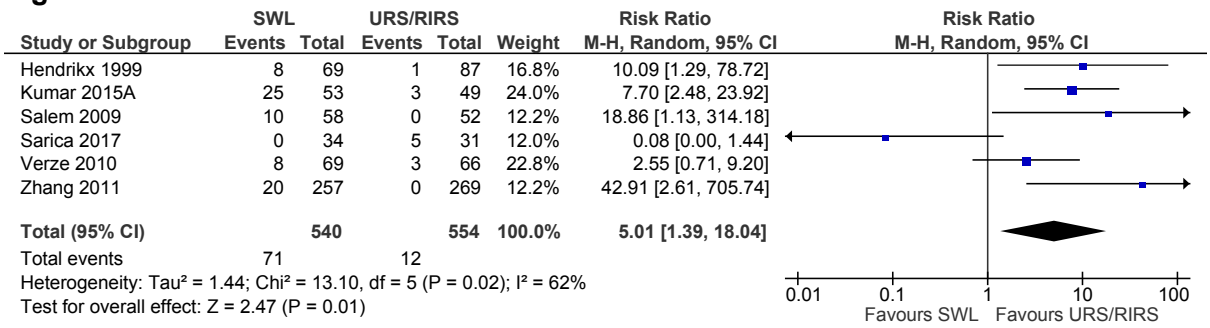


Figure 4: Ancillary procedures

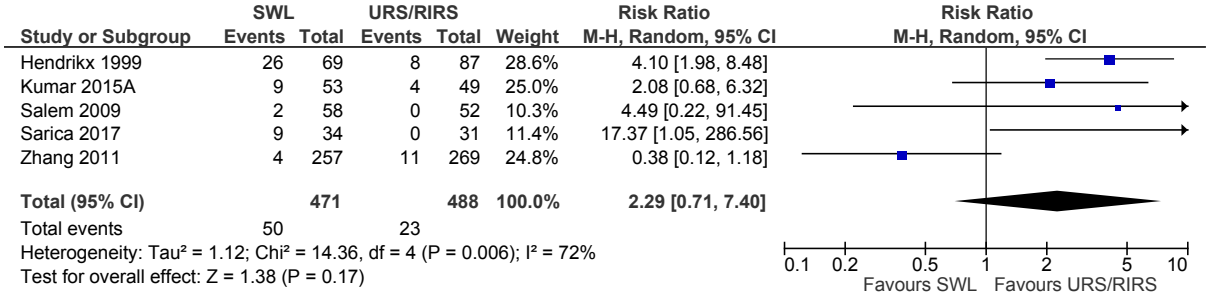
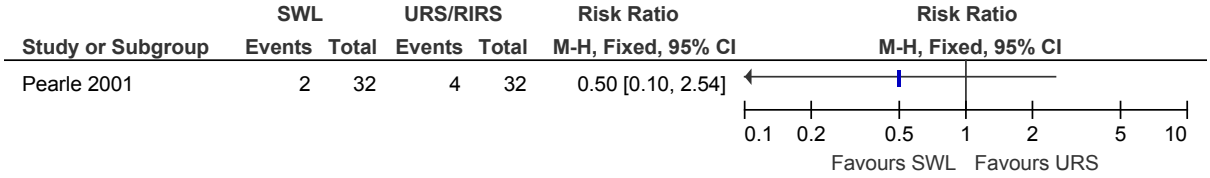
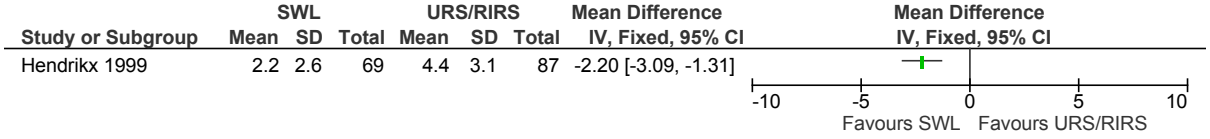


Figure 5: Readmission to hospital



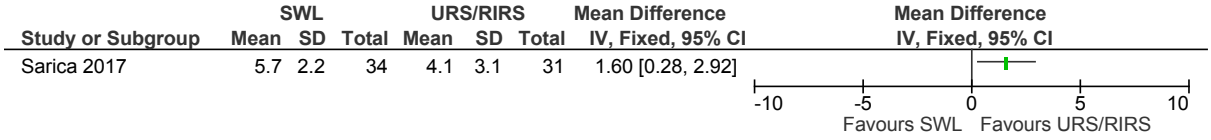
1

Figure 6: Length of hospital stay (days)



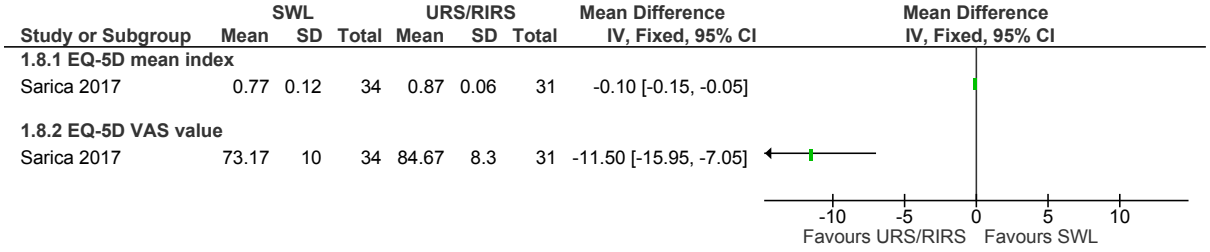
2

Figure 7: Pain (VAS, 0-10; 4 weeks)



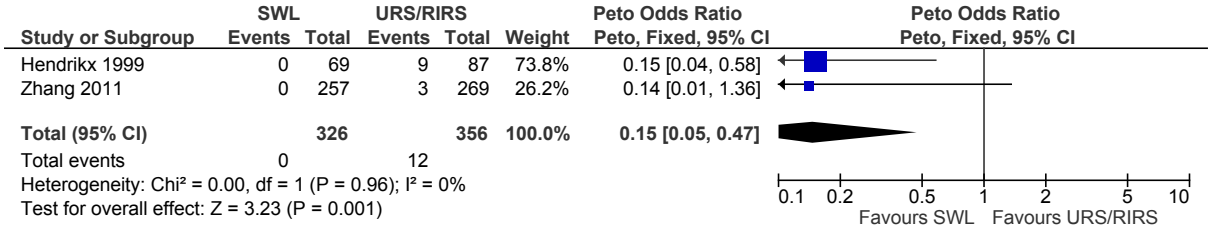
3

Figure 8: Quality of Life (EQ-5D mean index, 0-1; EQ-5D VAS, 0-100; 4 weeks)



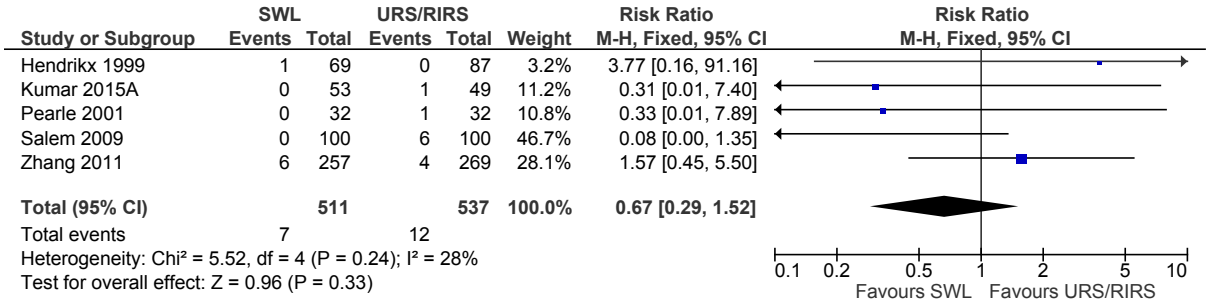
4

Figure 9: Major adverse events



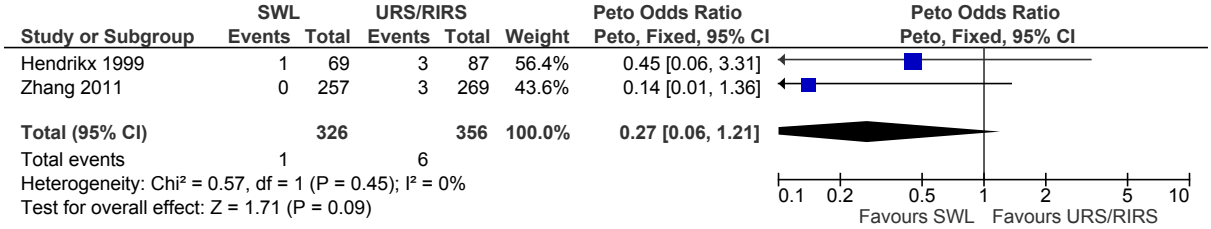
5

Figure 10: Minor adverse events



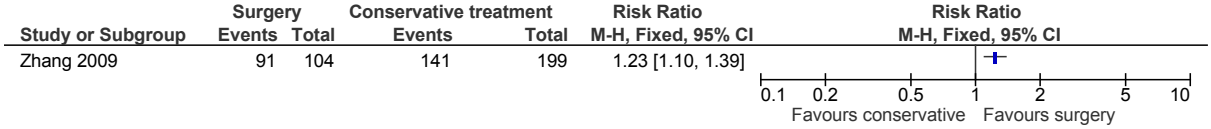
1

Figure 11: Failed technology



2 **E.1.1.2 Surgery (URS, SWL or PCNL) versus non-surgical treatment**

Figure 12: Stone free state



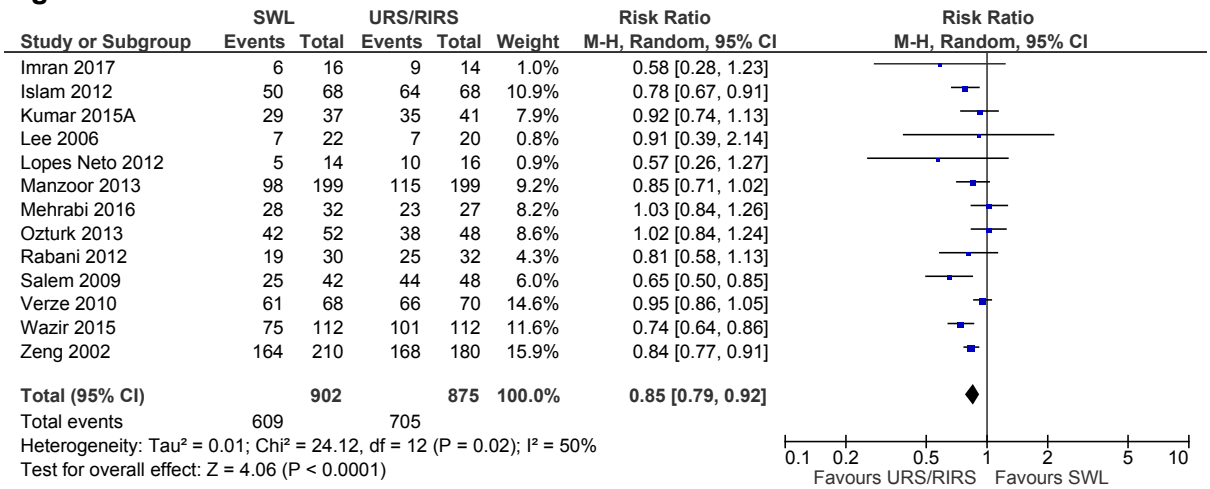
Zhang 2009: surgery = SWL; conservative treatment = 97 nifedipine, 102 tamsulosin

Time point: 4 months

3 **E.1.2 Adult, ureteric, 10-20mm**

4 **E.1.2.1 SWL versus URS**

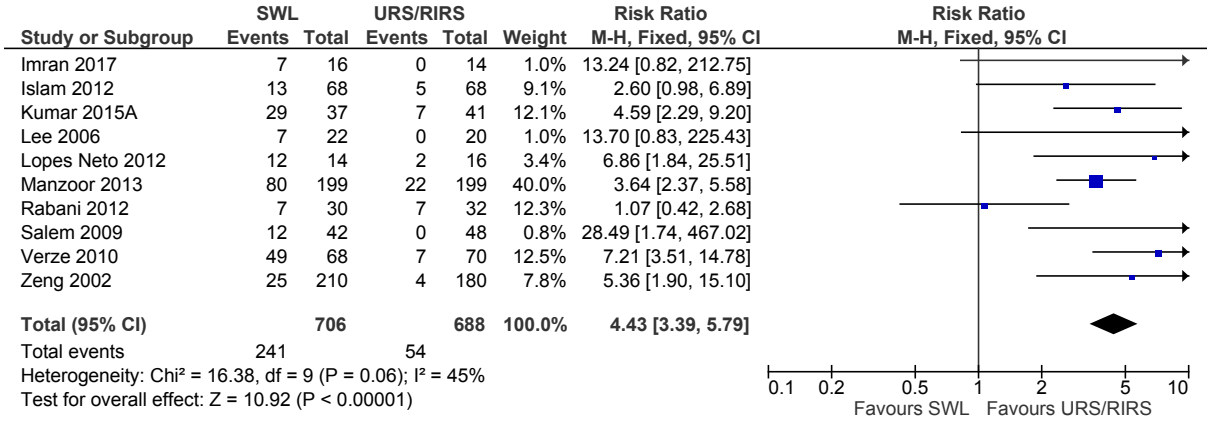
Figure 13: Stone free state



Time-point: Imran 2017, 4 weeks; Islam 2012, 3 months; Kumar 2015A, 3 months; Lee 2006, 1 session; Lopes Neto 2012, 4 weeks; Manzoor 2013, 1 week; Mehrabi 2016, 2 weeks; Ozturk 2013, 3 months; Rabani 2012, 4 weeks; Salem 2009, 2 weeks; Verze 2010, 3 months; Wazir 2015, 2 weeks; Zeng 2002, 4 weeks

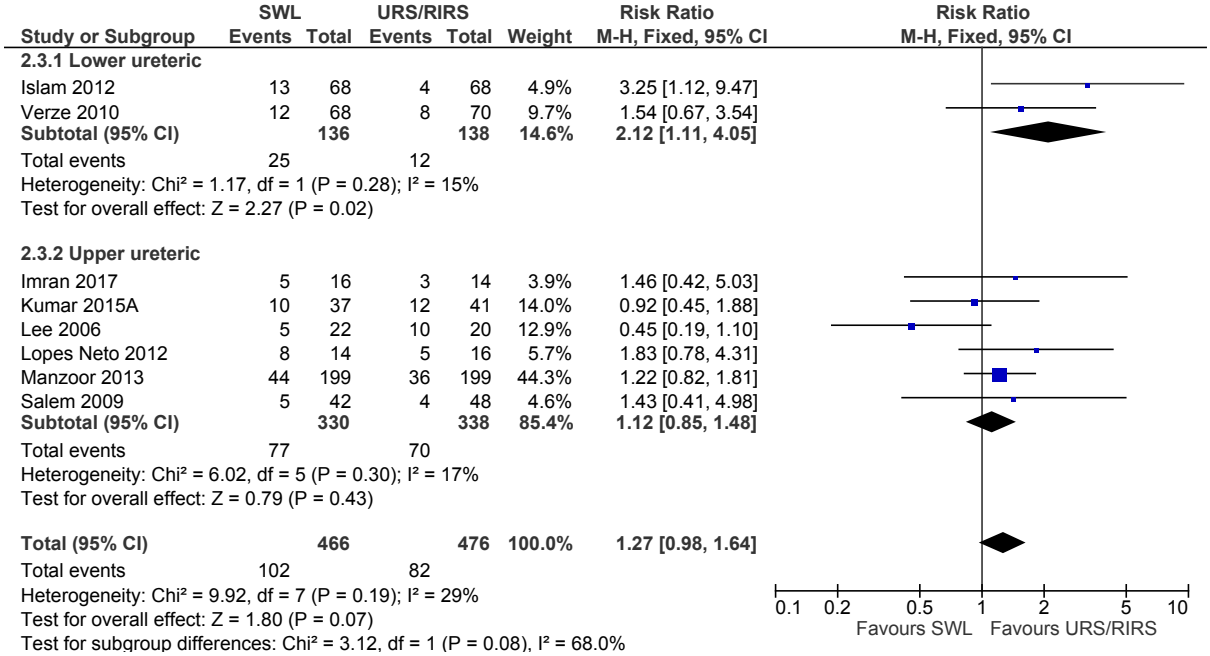
1

Figure 14: Retreatment



2

Figure 15: Ancillary procedures



3

Figure 16: Readmission to hospital

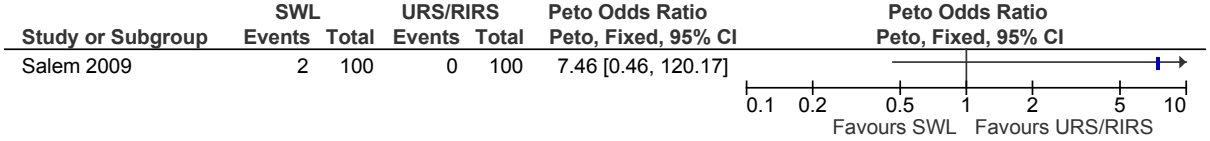


Figure 17: Length of hospital stay (hours)

Study or Subgroup	SWL Mean	SWL SD	SWL Total	URS/RIRS Mean	URS/RIRS SD	URS/RIRS Total	Weight	Mean Difference IV, Random, 95% CI
Imran 2017	1.4	0.46	16	22.1	4.9	14	33.5%	-20.70 [-23.28, -18.12]
Lee 2006	43.2	9.6	22	112.8	48	20	7.8%	-69.60 [-91.02, -48.18]
Lopes Neto 2012	1.9	1.2	14	27.8	13.4	16	26.4%	-25.90 [-32.50, -19.30]
Rabani 2012	5.97	3.64	30	26.5	9.23	32	32.3%	-20.53 [-23.98, -17.08]
Total (95% CI)			**82**			**82**	**100.0%**	**-25.84 [-32.64, -19.05]**

Heterogeneity: Tau² = 34.12; Chi² = 21.76, df = 3 (P < 0.0001); I² = 86%
Test for overall effect: Z = 7.46 (P < 0.00001)

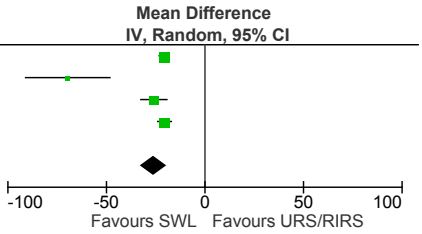


Figure 18: Pain (VAS, 0-10)

Study or Subgroup	SWL Mean	SWL SD	SWL Total	URS/RIRS Mean	URS/RIRS SD	URS/RIRS Total	Weight	Mean Difference IV, Random, 95% CI
Imran 2017	1.5	0.8	16	1.6	0.98	14	34.6%	-0.10 [-0.75, 0.55]
Lee 2006	1.86	0.94	22	4.35	2.45	20	27.9%	-2.49 [-3.63, -1.35]
Lopes Neto 2012	1.2	0.6	14	1.1	0.3	16	37.6%	0.10 [-0.25, 0.45]
Total (95% CI)			**52**			**50**	**100.0%**	**-0.69 [-1.82, 0.44]**

Heterogeneity: Tau² = 0.85; Chi² = 18.05, df = 2 (P = 0.0001); I² = 89%
Test for overall effect: Z = 1.20 (P = 0.23)

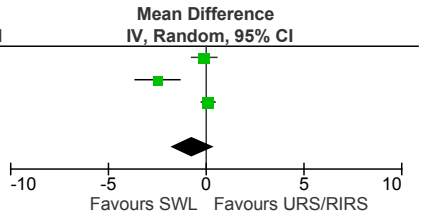


Figure 19: Major adverse events

Study or Subgroup	SWL Events	SWL Total	URS/RIRS Events	URS/RIRS Total	Weight	Risk Ratio M-H, Random, 95% CI
Islam 2012	0	68	2	68	13.4%	0.20 [0.01, 4.09]
Lee 2006	0	22	6	20	14.4%	0.07 [0.00, 1.17]
Lopes Neto 2012	0	14	1	16	12.8%	0.38 [0.02, 8.59]
Ozturk 2013	0	52	1	48	12.6%	0.31 [0.01, 7.39]
Verze 2010	14	137	1	136	19.4%	13.90 [1.85, 104.23]
Zeng 2002	8	210	10	180	27.4%	0.69 [0.28, 1.70]
Total (95% CI)		**503**		**468**	**100.0%**	**0.63 [0.14, 2.74]**
Total events	22		21			

Heterogeneity: Tau² = 1.84; Chi² = 12.51, df = 5 (P = 0.03); I² = 60%
Test for overall effect: Z = 0.62 (P = 0.54)

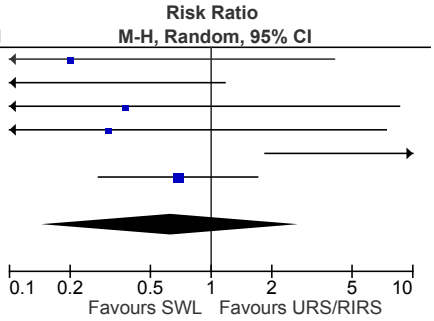


Figure 20: Minor adverse events

Study or Subgroup	SWL Events	SWL Total	URS/RIRS Events	URS/RIRS Total	Weight	Risk Ratio M-H, Random, 95% CI
Imran 2017	1	16	2	14	8.0%	0.44 [0.04, 4.32]
Islam 2012	5	68	4	68	14.3%	1.25 [0.35, 4.46]
Kumar 2015A	2	37	2	41	9.9%	1.11 [0.16, 7.48]
Lee 2006	2	22	7	20	13.0%	0.26 [0.06, 1.11]
Lopes Neto 2012	0	14	1	16	5.2%	0.38 [0.02, 8.59]
Manzoor 2013	10	199	50	199	19.3%	0.20 [0.10, 0.38]
Mehrabi 2016	2	32	1	27	7.8%	1.69 [0.16, 17.61]
Ozturk 2013	0	52	1	48	5.0%	0.31 [0.01, 7.39]
Verze 2010	0	137	27	136	6.1%	0.02 [0.00, 0.29]
Zeng 2002	4	210	2	180	11.3%	1.71 [0.32, 9.25]
Total (95% CI)		**787**		**749**	**100.0%**	**0.47 [0.21, 1.05]**
Total events	26		97			

Heterogeneity: Tau² = 0.78; Chi² = 19.24, df = 9 (P = 0.02); I² = 53%
Test for overall effect: Z = 1.84 (P = 0.07)

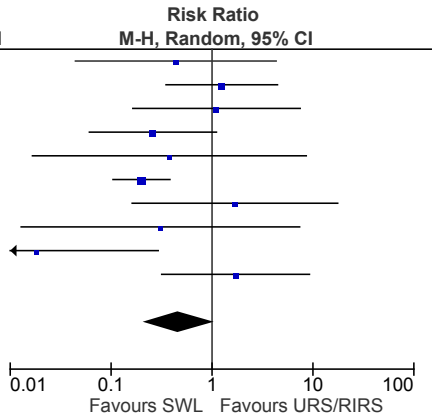
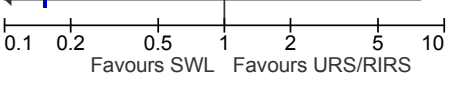


Figure 21: Failed technology

Study or Subgroup	SWL Events	SWL Total	URS/RIRS Events	URS/RIRS Total	Peto Odds Ratio Peto, Fixed, 95% CI
Lopes Neto 2012	0	14	1	16	0.15 [0.00, 7.80]

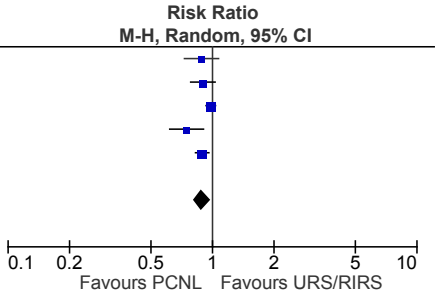


E.1.3 URS versus PCNL

Figure 22: Stone free state

Study or Subgroup	URS/SIRS Events	URS/SIRS Total	PCNL Events	PCNL Total	Weight	Risk Ratio M-H, Random, 95% CI
Basiri 2008	38	50	43	50	14.4%	0.88 [0.73, 1.07]
Gu 2013	26	29	30	30	19.1%	0.90 [0.78, 1.03]
Qi 2014	51	52	52	52	26.9%	0.98 [0.93, 1.03]
Wang 2017	33	46	48	50	14.5%	0.75 [0.62, 0.90]
Yang 2012	81	91	91	91	25.1%	0.89 [0.83, 0.96]
Total (95% CI)		**268**		**273**	**100.0%**	**0.89 [0.80, 0.99]**
Total events	229		264			

Heterogeneity: Tau² = 0.01; Chi² = 18.15, df = 4 (P = 0.001); I² = 78%
Test for overall effect: Z = 2.19 (P = 0.03)



Time-point: 3-4 weeks

Figure 23: Retreatment

Study or Subgroup	URS/SIRS Events	URS/SIRS Total	PCNL Events	PCNL Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Basiri 2008	11	50	7	50	100.0%	1.57 [0.66, 3.72]
Gu 2013	0	29	0	30		Not estimable
Total (95% CI)		**79**		**80**	**100.0%**	**1.57 [0.66, 3.72]**
Total events	11		7			

Heterogeneity: Not applicable
Test for overall effect: Z = 1.03 (P = 0.30)

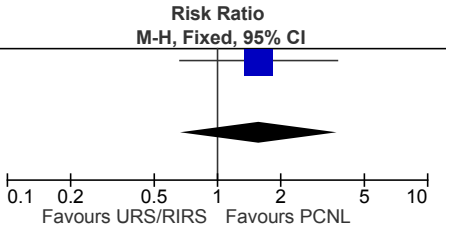


Figure 24: Ancillary procedure

Study or Subgroup	URS/RIRS Events	URS/RIRS Total	PCNL Events	PCNL Total	Weight	Risk Ratio M-H, Random, 95% CI
Gu 2013	23	29	6	30	39.8%	3.97 [1.89, 8.31]
Wang 2016	1	54	2	53	15.8%	0.49 [0.05, 5.25]
Wang 2017	15	46	3	50	31.9%	5.43 [1.68, 17.57]
Yang 2012	23	91	0	91	12.6%	47.00 [2.90, 762.30]
Total (95% CI)		**220**		**224**	**100.0%**	**4.30 [1.36, 13.61]**
Total events	62		11			

Heterogeneity: Tau² = 0.73; Chi² = 7.16, df = 3 (P = 0.07); I² = 58%
Test for overall effect: Z = 2.48 (P = 0.01)

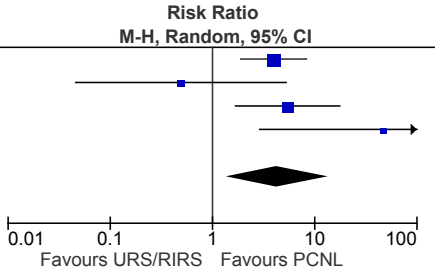


Figure 25: Length of hospital stay (days)

Study or Subgroup	URS/RIRS Mean	URS/RIRS SD	URS/RIRS Total	PCNL Mean	PCNL SD	PCNL Total	Weight	Mean Difference IV, Random, 95% CI
Basiri 2008	0.53	0.12	50	4.4	1.4	50	24.4%	-3.87 [-4.26, -3.48]
Gu 2013	1.9	1.3	29	4.6	1.8	30	19.7%	-2.70 [-3.50, -1.90]
Qi 2014	1.7	1.3	52	4.6	2.1	52	21.3%	-2.90 [-3.57, -2.23]
Wang 2016	8.24	2.77	54	10.25	3.53	53	15.0%	-2.01 [-3.21, -0.81]
Wang 2017	2.5	1.3	50	6.8	2.6	50	19.6%	-4.30 [-5.11, -3.49]
Total (95% CI)			**235**			**235**	**100.0%**	**-3.24 [-3.95, -2.53]**

Heterogeneity: Tau² = 0.50; Chi² = 20.06, df = 4 (P = 0.0005); I² = 80%
Test for overall effect: Z = 8.93 (P < 0.00001)

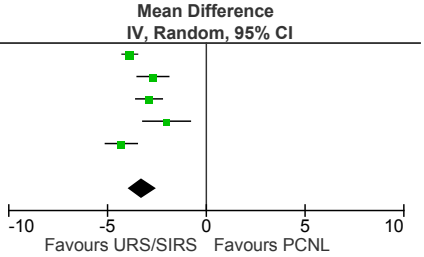


Figure 26: Major adverse events

Study or Subgroup	URS/RIRS Events	URS/RIRS Total	PCNL Events	PCNL Total	Weight	Peto Odds Ratio Peto, Fixed, 95% CI
Gu 2013	1	29	0	30	12.9%	7.65 [0.15, 385.67]
Wang 2016	0	54	0	53		Not estimable
Wang 2017	5	46	0	50	61.5%	8.83 [1.47, 53.06]
Yang 2012	2	91	0	91	25.6%	7.47 [0.46, 120.37]
Total (95% CI)		**220**		**224**	**100.0%**	**8.31 [2.04, 33.90]**
Total events	8		0			

Heterogeneity: Chi² = 0.01, df = 2 (P = 0.99); I² = 0%
Test for overall effect: Z = 2.95 (P = 0.003)

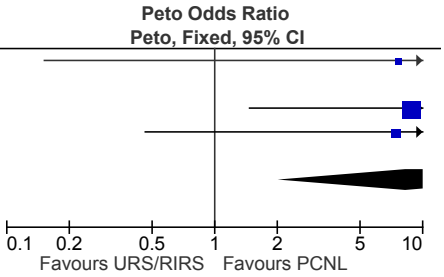
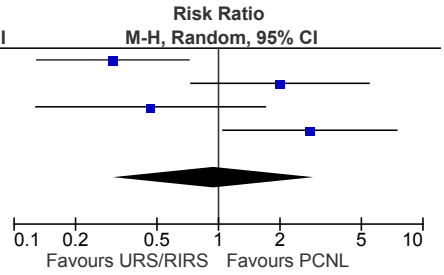


Figure 27: Minor adverse events

Study or Subgroup	URS/RIRS Events	URS/RIRS Total	PCNL Events	PCNL Total	Weight	Risk Ratio M-H, Random, 95% CI
Gu 2013	5	29	17	30	26.8%	0.30 [0.13, 0.72]
Qi 2014	10	52	5	52	25.3%	2.00 [0.73, 5.45]
Wang 2017	3	46	7	50	22.4%	0.47 [0.13, 1.70]
Yang 2012	14	91	5	91	25.6%	2.80 [1.05, 7.45]
Total (95% CI)		**218**		**223**	**100.0%**	**0.95 [0.31, 2.94]**
Total events	32		34			

Heterogeneity: Tau² = 1.05; Chi² = 14.77, df = 3 (P = 0.002); I² = 80%
Test for overall effect: Z = 0.09 (P = 0.93)

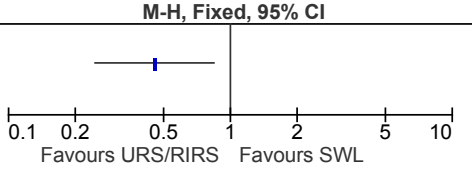


E.1.4 Children, ureteric, <10mm

E.1.4.1 SWL versus URS

Figure 28: Stone-free state

Study or Subgroup	SWL Events	SWL Total	URS Events	URS Total	Risk Ratio M-H, Fixed, 95% CI
4.1.1 6-8 months					
De Dominicis 2005	6	14	16	17	0.46 [0.25, 0.84]



Time-point: mean 6-8 months

Figure 29: Retreatment rate

Study or Subgroup	SWL Events	SWL Total	URS Events	URS Total	Peto Odds Ratio Peto, Fixed, 95% CI
De Dominicis 2005	8	14	0	17	17.96 [3.66, 88.10]

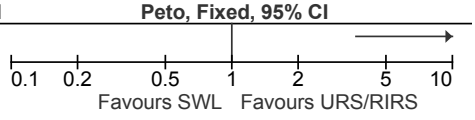
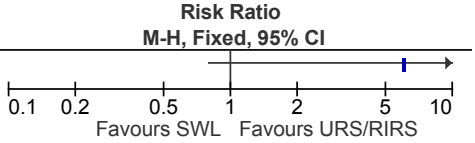


Figure 30: Ancillary procedures

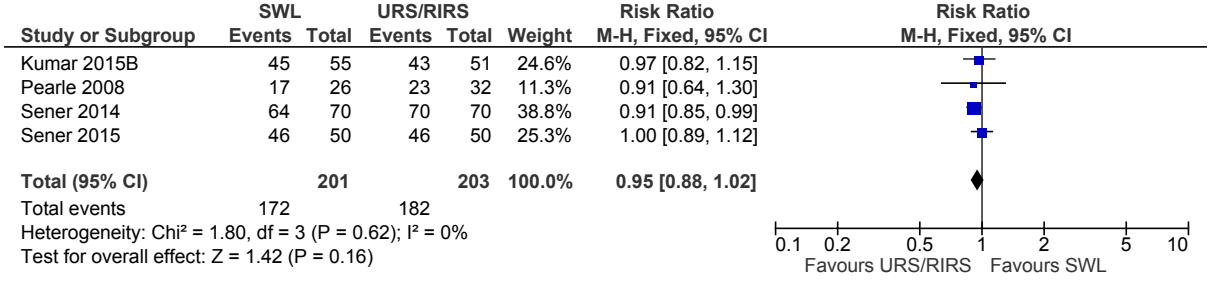
Study or Subgroup	SWL Events	SWL Total	URS Events	URS Total	Risk Ratio M-H, Fixed, 95% CI
De Dominicis 2005	5	14	1	17	6.07 [0.80, 46.10]



E.1.5 Adult, renal, <10mm

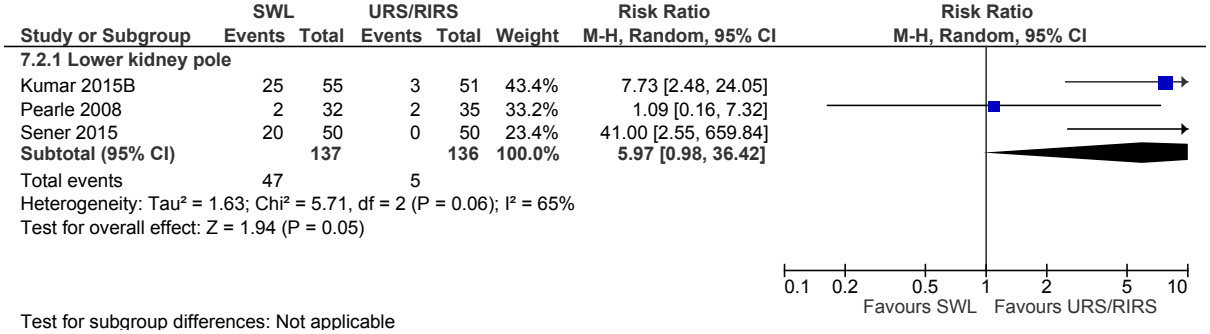
E.1.5.1 SWL versus URS

Figure 31: Stone-free state



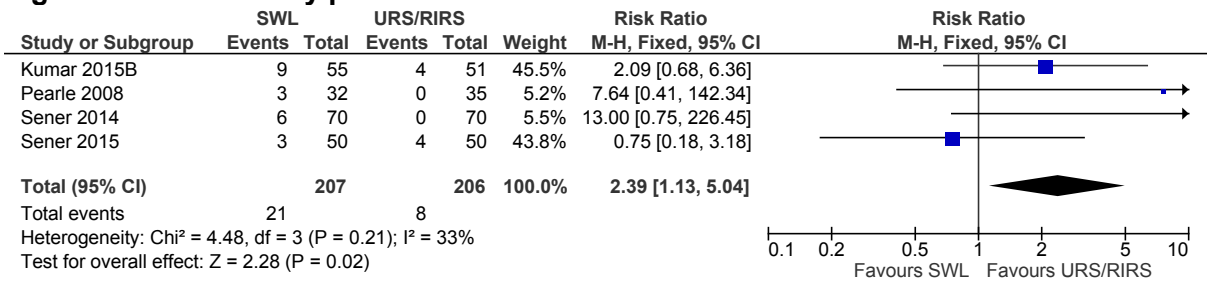
Time-point: 3 months
Sener 2015: asymptomatic population

Figure 32: Retreatment



Sener 2015: asymptomatic population

Figure 33: Ancillary procedures



Sener 2015: asymptomatic population

Figure 34: Readmission

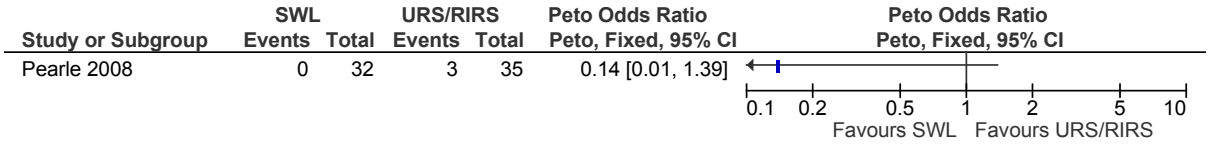
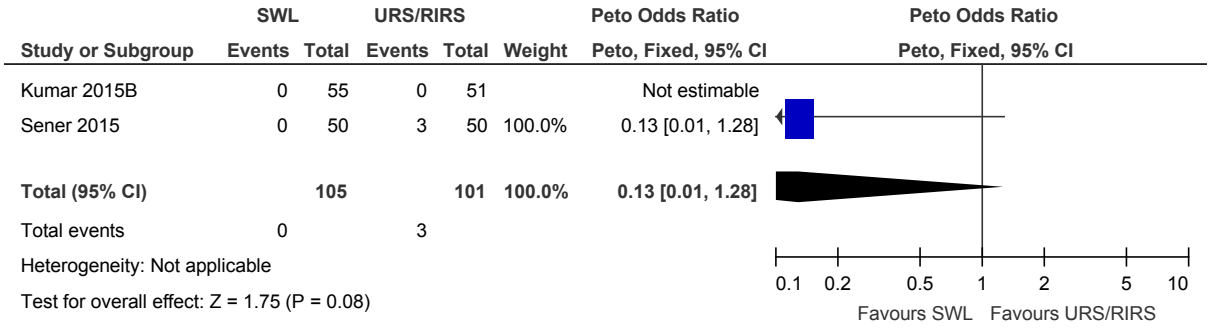


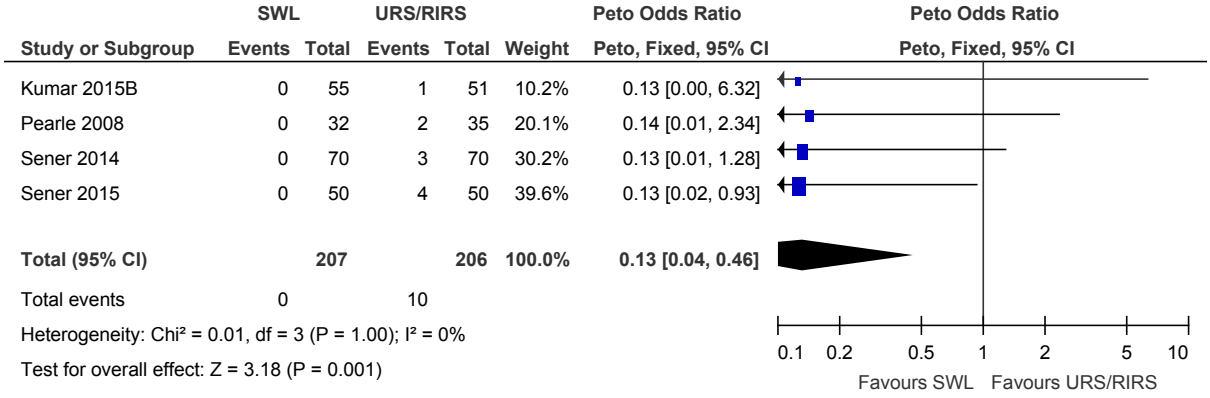
Figure 35: Major adverse events



Sener 2015: asymptomatic population

1

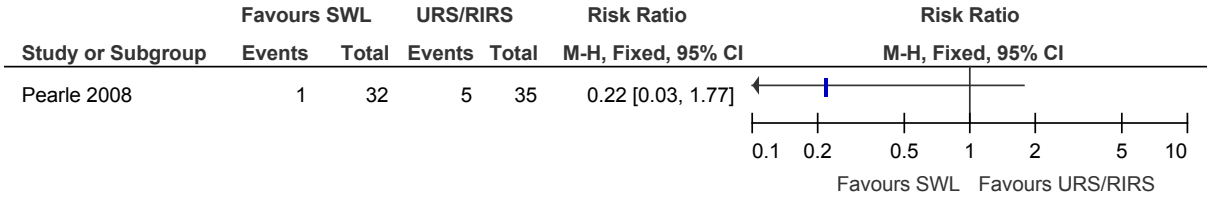
Figure 36: Minor adverse events



Sener 2015: asymptomatic population

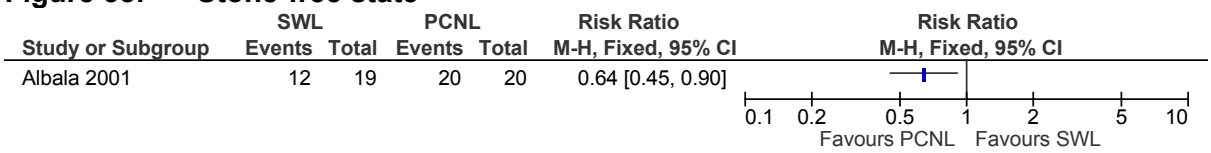
2

Figure 37: Failed technology



3 E.1.5.2 SWL versus PCNL

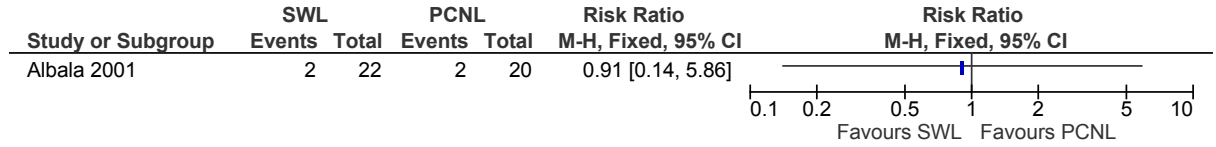
Figure 38: Stone-free state



Time-point: 3 months

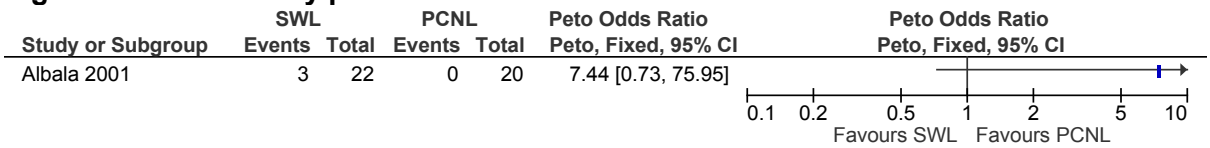
4

Figure 39: Retreatment



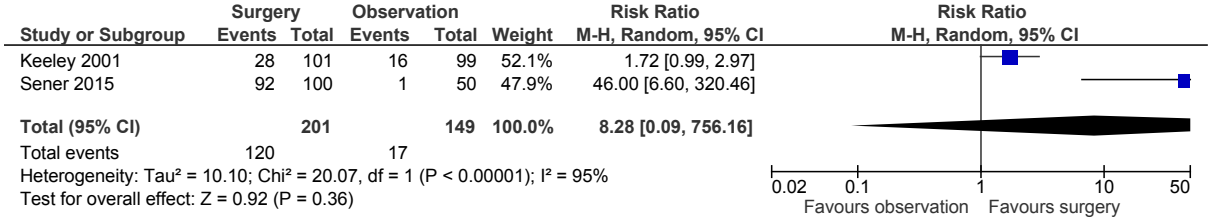
1

Figure 40: Ancillary procedures



2 ### E.1.5.3 Surgery (URS, SWL or PCNL) versus non-surgical treatment

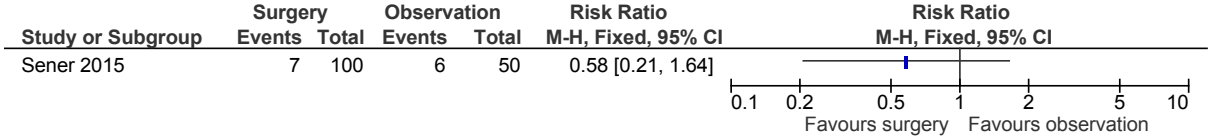
Figure 41: Stone-free state



Keeley 2001: surgery = SWL; Sener 2015: surgery = 50 SWL, 50 URS
Time-point: Keeley 2001. Mean 2.2 years; Sener 2015, 3 months
Population: asymptomatic

3

Figure 42: Ancillary procedures

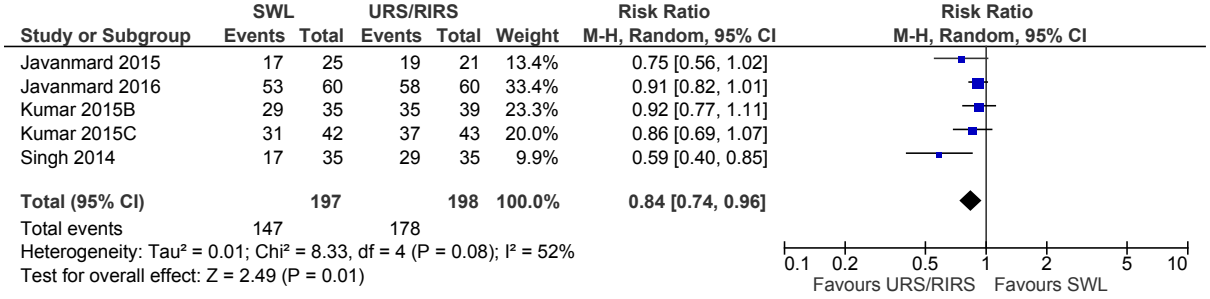


Surgery: 50 SWL, 50 URS; population: asymptomatic

4 ## E.1.6 Adult, renal, 10-20mm

5 ### E.1.6.1 SWL versus URS

Figure 43: Stone-free state



Time-point: Javanmard 2015, 3 months; Javanmard 2016, 3 months; Kumar 2015B, 3 months; Kumar 2015C, 3 months; Singh 2014, 4 weeks

6

Figure 44: Retreatment

Study or Subgroup	SWL Events	SWL Total	URS/RIRS Events	URS/RIRS Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Javanmard 2015	11	25	2	21	12.2%	4.62 [1.15, 18.56]
Javanmard 2016	15	60	6	60	33.7%	2.50 [1.04, 6.01]
Kumar 2015 C	27	42	1	43	5.6%	27.64 [3.93, 194.31]
Kumar 2015B	29	35	7	39	37.2%	4.62 [2.32, 9.18]
Singh 2014	23	35	2	35	11.2%	11.50 [2.93, 45.11]
Total (95% CI)		**197**		**198**	**100.0%**	**5.96 [3.77, 9.42]**
Total events	105		18			

Heterogeneity: Chi² = 7.69, df = 4 (P = 0.10); I² = 48%
Test for overall effect: Z = 7.63 (P < 0.00001)

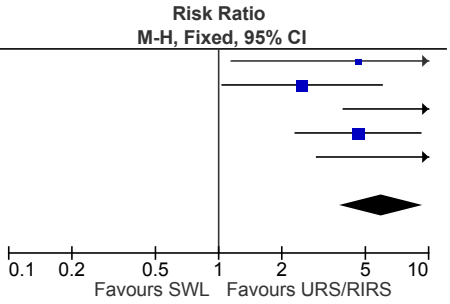


Figure 45: Ancillary procedures

Study or Subgroup	SWL Events	SWL Total	URS/RIRS Events	URS/RIRS Total	Weight	Risk Ratio M-H, Random, 95% CI
8.3.1 Lower pole kidney						
Kumar 2015B	10	35	12	39	38.8%	0.93 [0.46, 1.88]
Kumar 2015C	8	42	4	43	30.8%	2.05 [0.67, 6.29]
Singh 2014	16	35	3	35	30.4%	5.33 [1.70, 16.69]
Subtotal (95% CI)		**112**		**117**	**100.0%**	**2.02 [0.69, 5.85]**
Total events	34		19			

Heterogeneity: Tau² = 0.63; Chi² = 7.11, df = 2 (P = 0.03); I² = 72%
Test for overall effect: Z = 1.29 (P = 0.20)

Test for subgroup differences: Not applicable

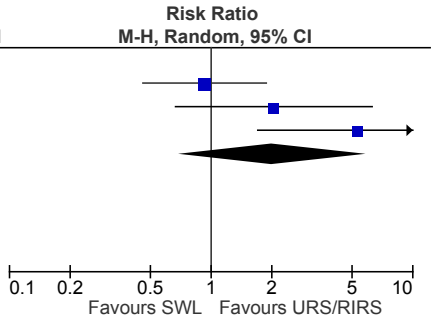


Figure 46: Length of hospital stay (hours)

Study or Subgroup	SWL Mean	SWL SD	SWL Total	URS/RIRS Mean	URS/RIRS SD	URS/RIRS Total	Weight	Mean Difference IV, Random, 95% CI
Javanmard 2016	6.7	1.3	60	18.9	4.3	60	50.4%	-12.20 [-13.34, -11.06]
Singh 2014	5.8	3.3	35	48	15.3	35	49.6%	-42.20 [-47.39, -37.01]
Total (95% CI)			**95**			**95**	**100.0%**	**-27.09 [-56.49, 2.31]**

Heterogeneity: Tau² = 446.33; Chi² = 122.69, df = 1 (P < 0.00001); I² = 99%
Test for overall effect: Z = 1.81 (P = 0.07)

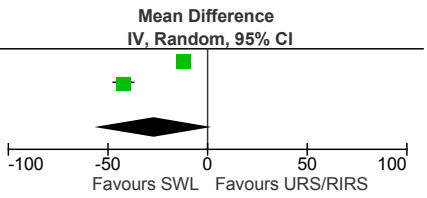


Figure 47: Pain (VAS, 0-10; 1 day)

Study or Subgroup	Favours SWL Mean	Favours SWL SD	Favours SWL Total	URS/RIRS Mean	URS/RIRS SD	URS/RIRS Total	Weight	Mean Difference IV, Random, 95% CI
Javanmard 2016	5.2	2.8	60	3.1	2.7	60	49.3%	2.10 [1.12, 3.08]
Singh 2014	2.4	0.64	35	4.34	0.45	35	50.7%	-1.94 [-2.20, -1.68]
Total (95% CI)			**95**			**95**	**100.0%**	**0.05 [-3.91, 4.01]**

Heterogeneity: Tau² = 8.03; Chi² = 60.53, df = 1 (P < 0.00001); I² = 98%
Test for overall effect: Z = 0.03 (P = 0.98)

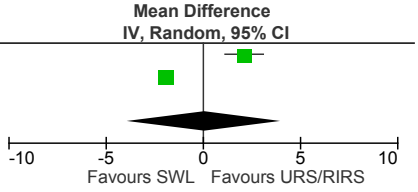
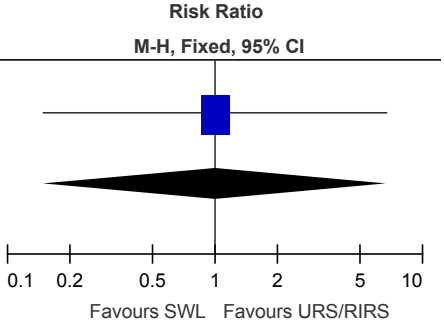


Figure 48: Major adverse events

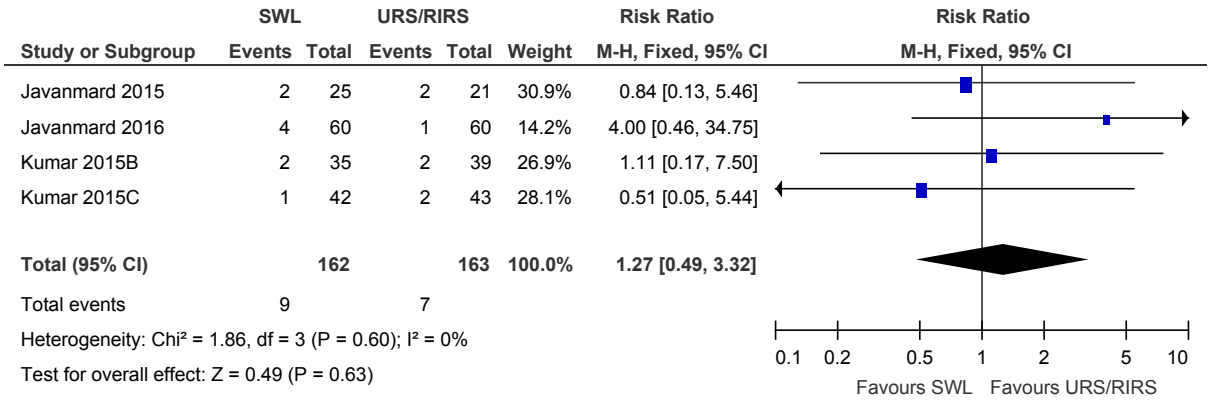
Study or Subgroup	SWL Events	SWL Total	URS/RIRS Events	URS/RIRS Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Kumar 2015B	0	35	0	39		Not estimable
Singh 2014	2	35	2	35	100.0%	1.00 [0.15, 6.71]
Total (95% CI)		**70**		**74**	**100.0%**	**1.00 [0.15, 6.71]**
Total events	2		2			

Heterogeneity: Not applicable
Test for overall effect: Z = 0.00 (P = 1.00)



1

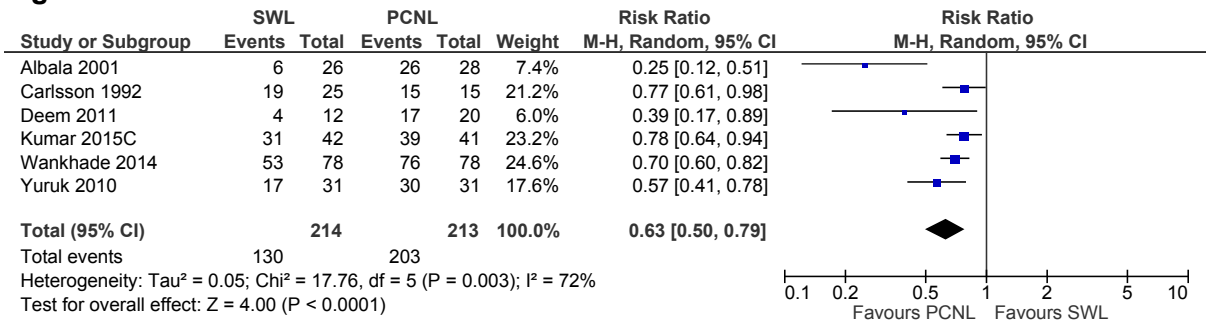
Figure 49: Minor adverse events



2 **E.1.6.2 SWL versus PCNL**

3

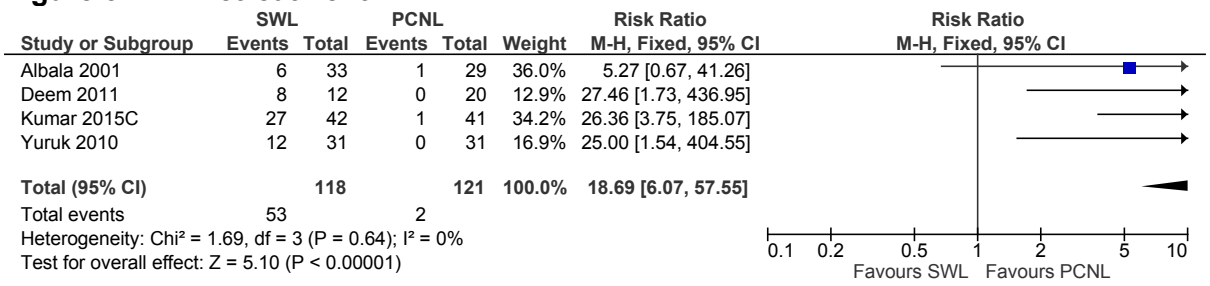
Figure 50: Stone-free state



Time-point: Albala 2001, 3 months; Carlsson 1992, 4 weeks; Deem 2011, 3 months, Kumar 2015C, 3 months; Wankhade 2014, 3 months; Yuruk 2010, 3 months
Yuruk 2010: asymptomatic population

4

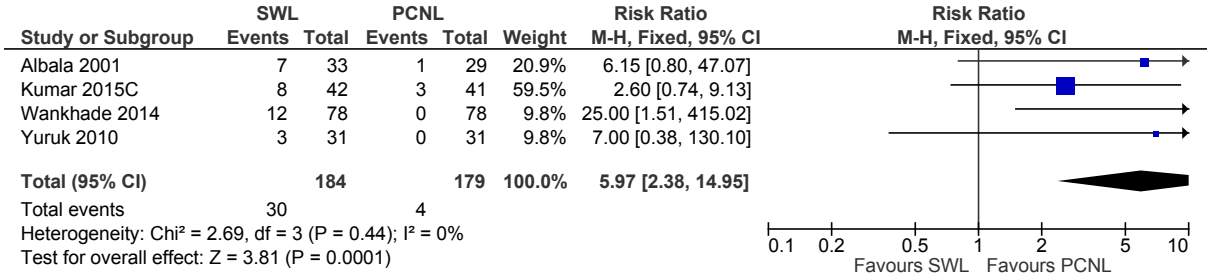
Figure 51: Retreatment



Yuruk 2010: asymptomatic population

5

Figure 52: Ancillary procedures



Yuruk 2010: asymptomatic population

Figure 53: Length of hospital stay

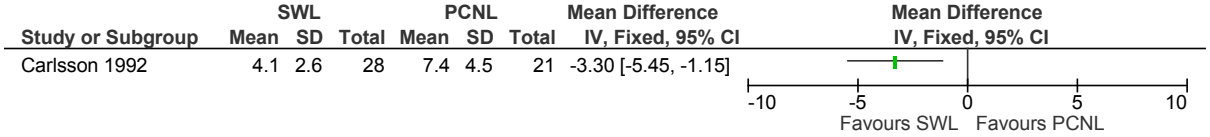


Figure 54: Major adverse events

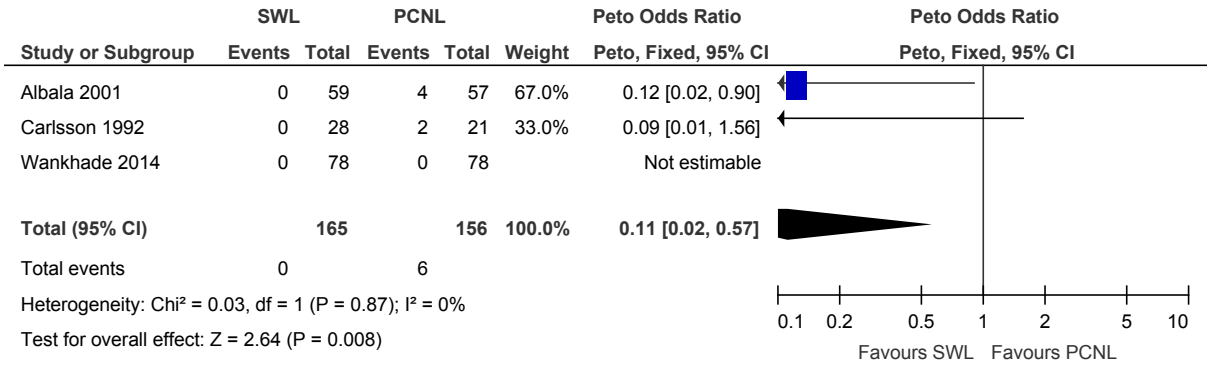
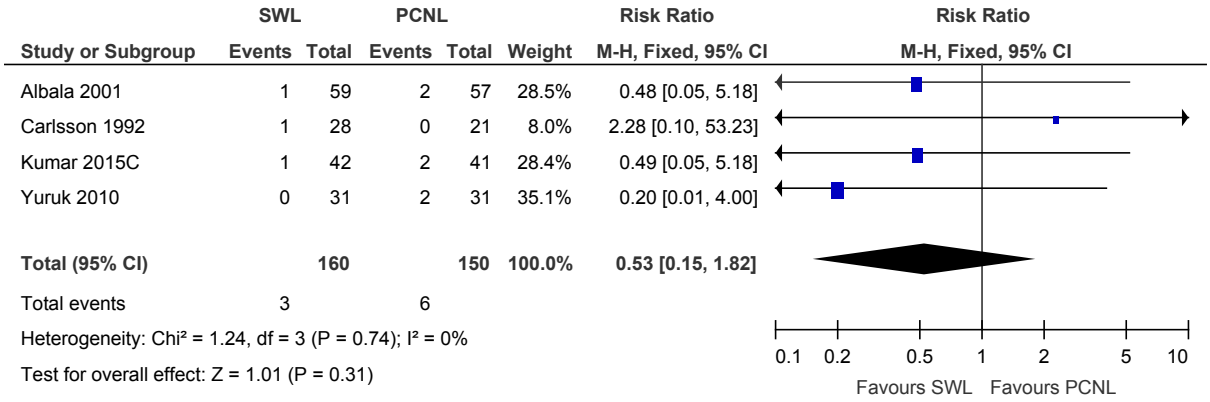
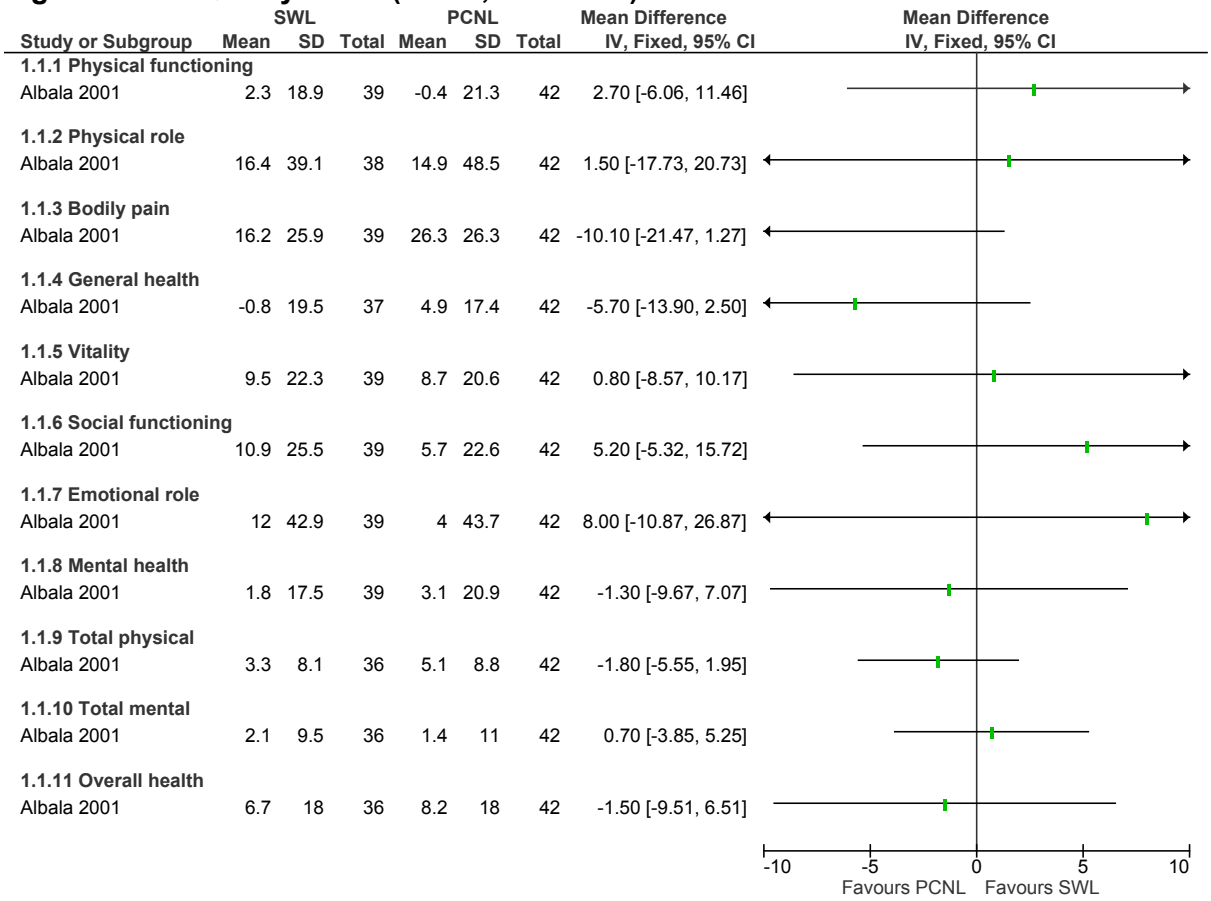


Figure 55: Minor adverse events



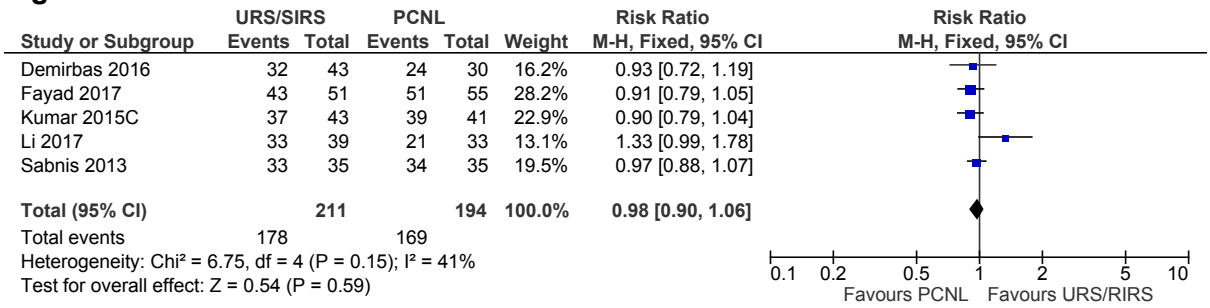
Yuruk 2010: asymptomatic population

Figure 56: Quality of life (SF-36; 3 months)



E.1.6.3 URS versus PCNL

Figure 57: Stone free state



Time-point: Demirbas 2016, 1 month; Fayad 2017, Kumar 2015C, Li 2017, Sabnis 2013, 3 months

Figure 58: Retreatment

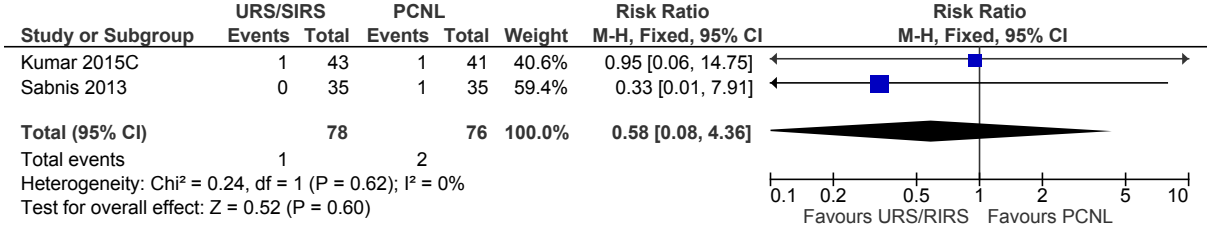


Figure 59: Recurrence

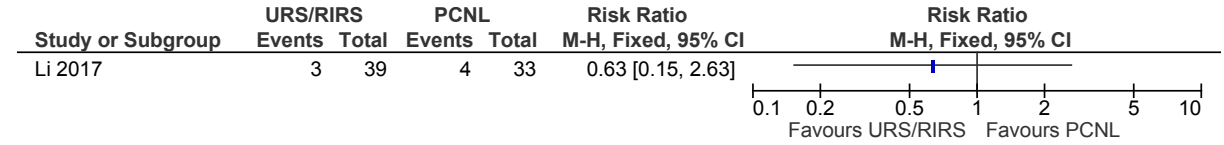


Figure 60: Ancillary procedure

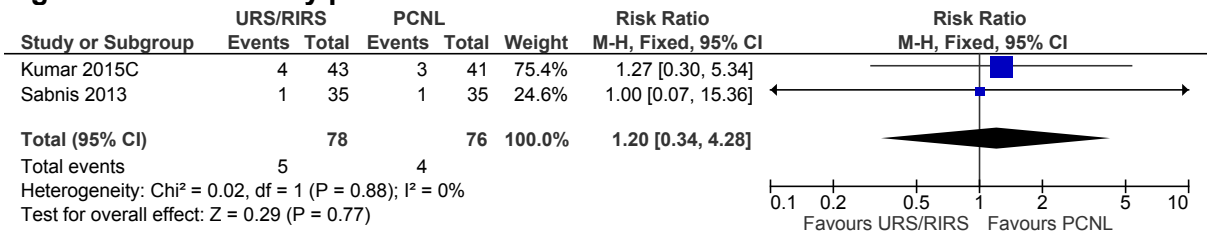


Figure 61: Length of hospital stay (days)

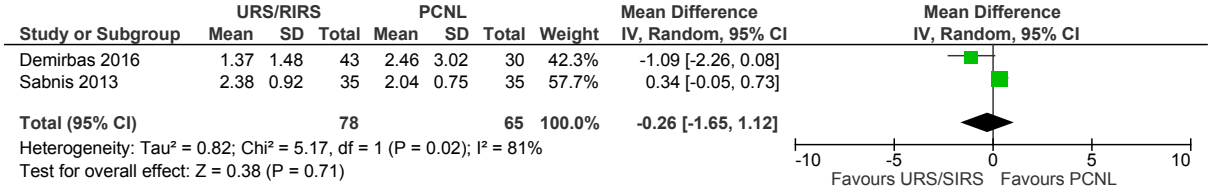


Figure 62: Pain (VAS, 1-10; 6 hours postoperatively)

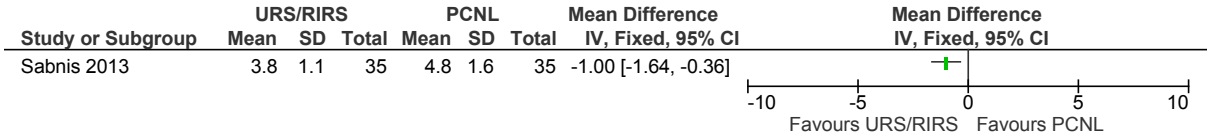


Figure 63: Major adverse events

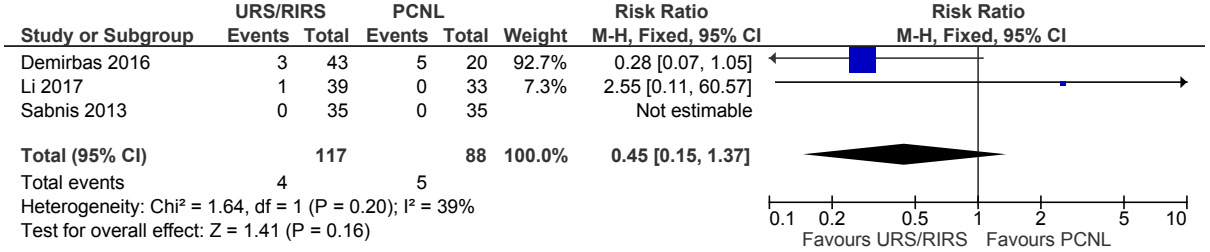
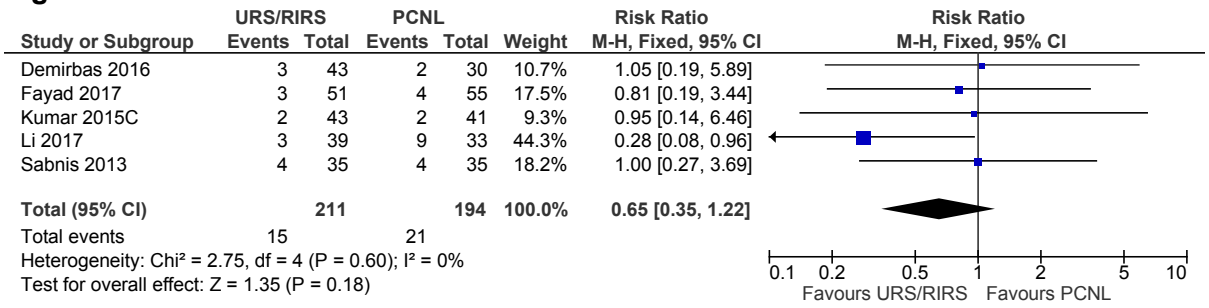
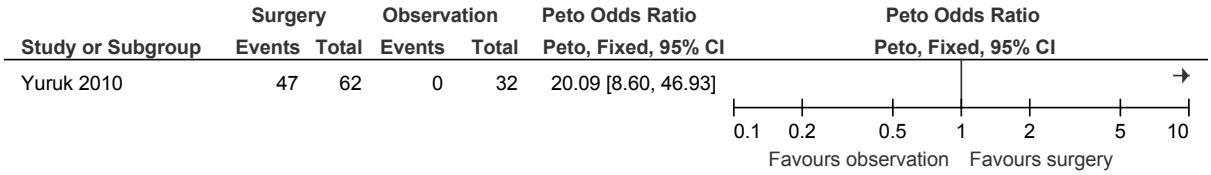


Figure 64: Minor adverse events



1 E.1.6.4 Surgery (URS, SWL or PCNL) versus non-surgical treatment

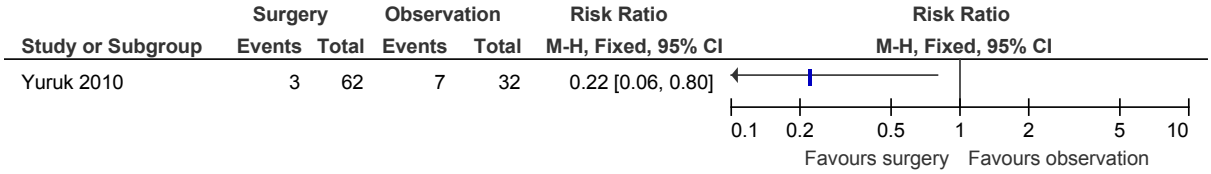
Figure 65: Stone-free state



Surgery group: 31 received PCNL, 31 received SWL; asymptomatic population
Time-point: 3 months

2

Figure 66: Ancillary procedures

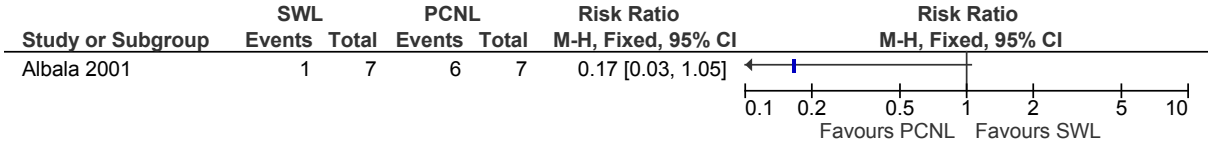


Surgery group: 31 received PCNL, 31 received SWL; asymptomatic population

3 E.1.7 Adult, renal, >20mm

4 E.1.7.1 SWL versus PCNL

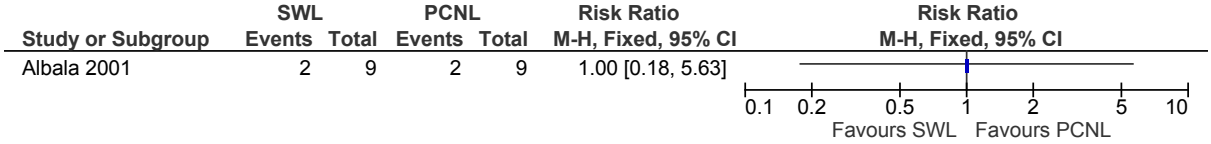
Figure 67: Stone-free state



Time-point: 3 months

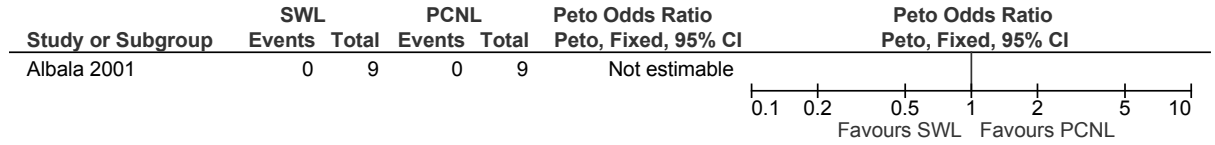
5

Figure 68: Retreatment



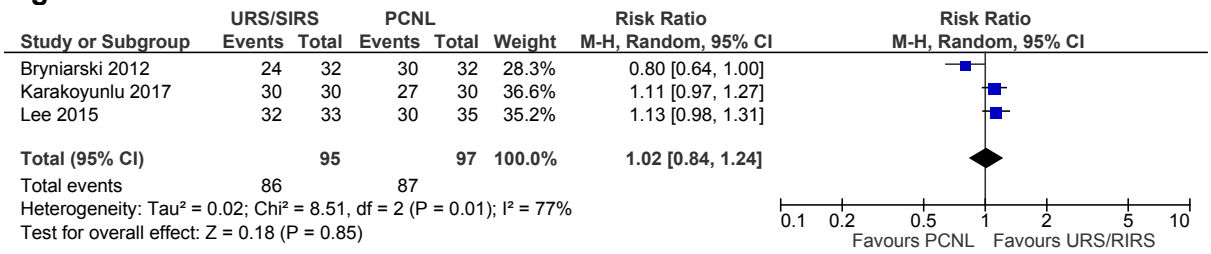
6

Figure 69: Ancillary procedures



E.1.7.2 URS versus PCNL

Figure 70: Stone-free state



Time-point: Bryniarski 2012, 3 weeks; Karakoyunlu 2017, at discharge; Lee 2015; 3 months

Figure 71: Retreatment

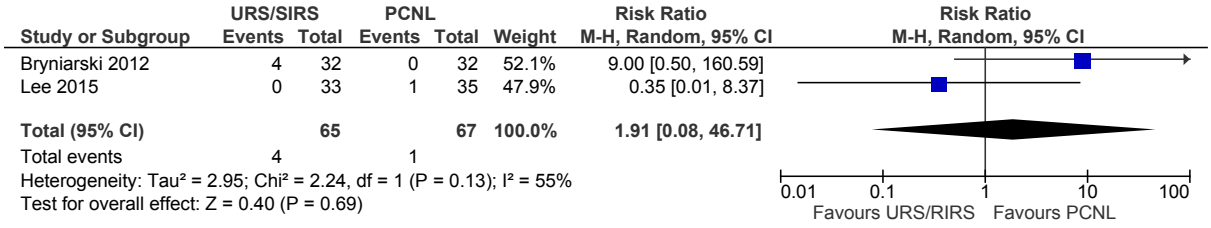


Figure 72: Ancillary procedure

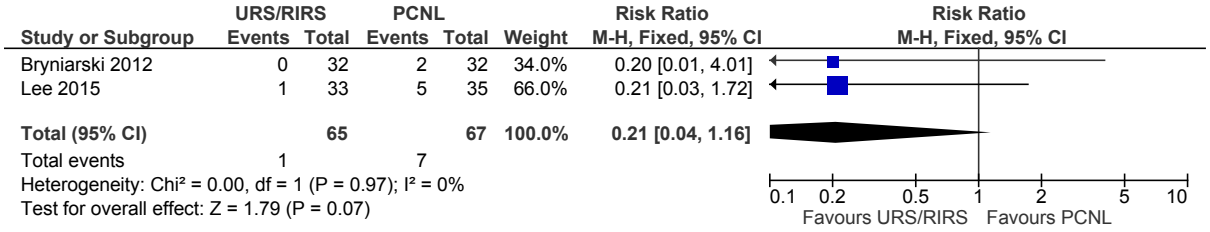


Figure 73: Length of hospital stay (days)

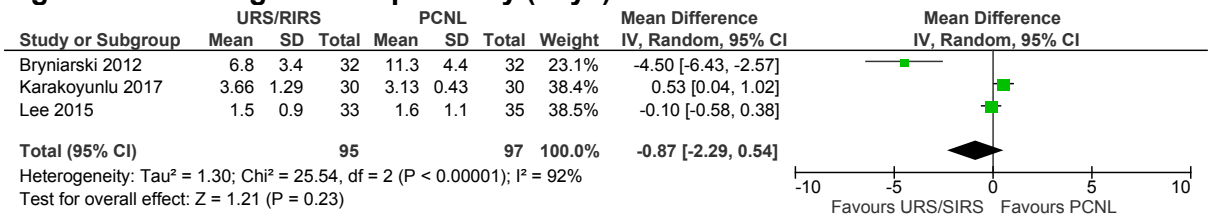
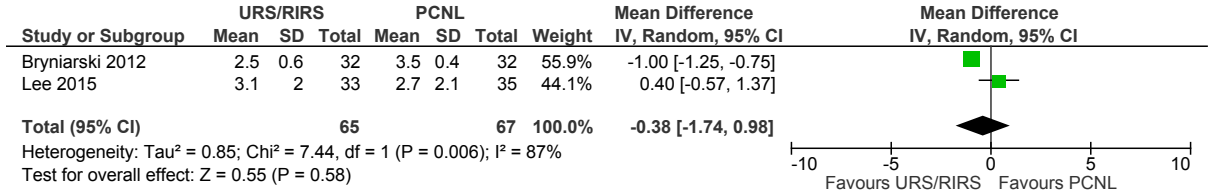
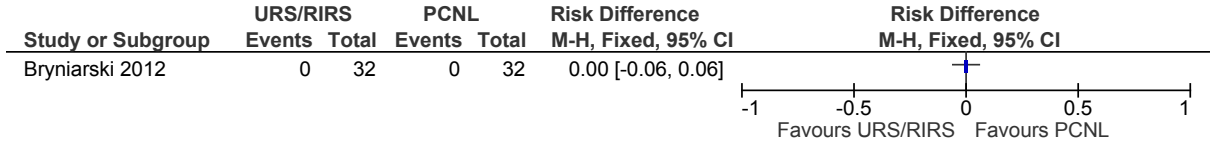


Figure 74: Pain (VAS; 1 day)



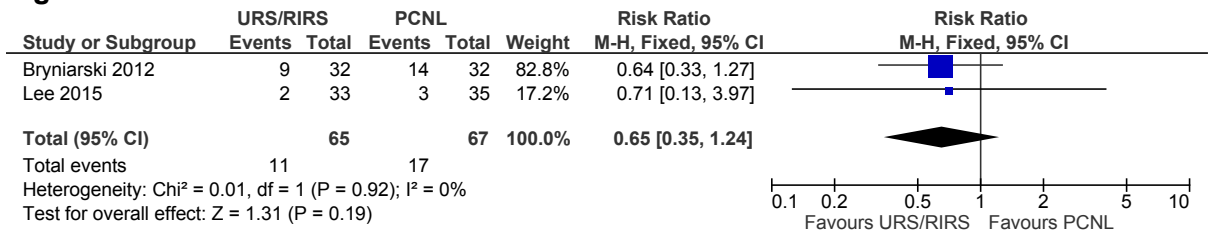
1

Figure 75: Major adverse events



2

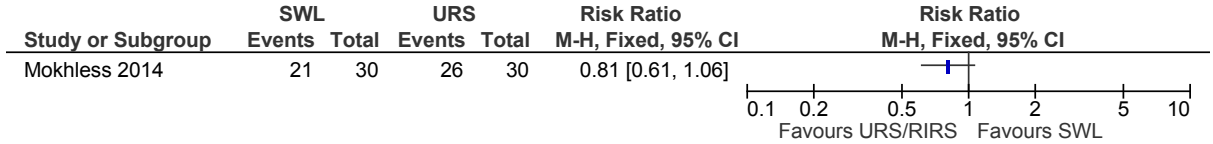
Figure 76: Minor adverse events



E.1.8 Children, renal 10-20mm

E.1.8.1 SWL versus URS

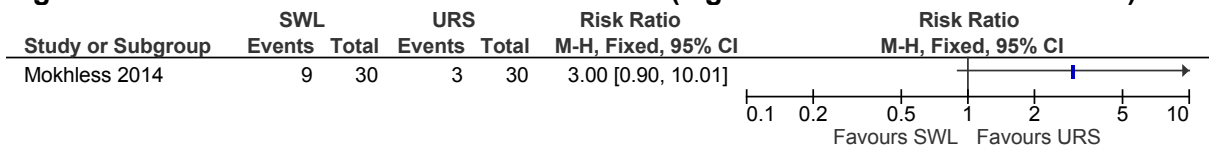
Figure 77: Stone-free state



Time-point: 3 months

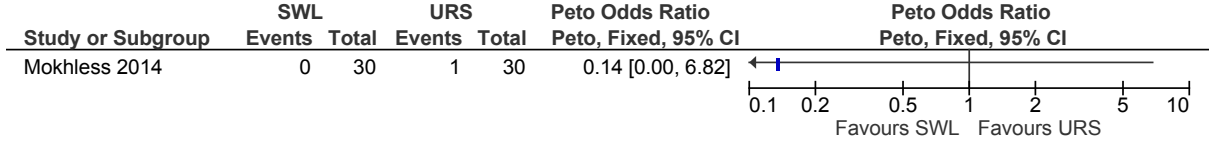
6

Figure 78: Residual stones – after 1 session (significant residual stone >3mm)



7

Figure 79: Residual stones – after 1 session (insignificant residual stone <3mm)



8

Figure 80: Retreatment

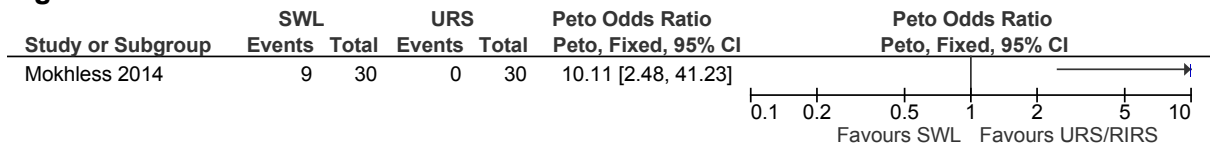
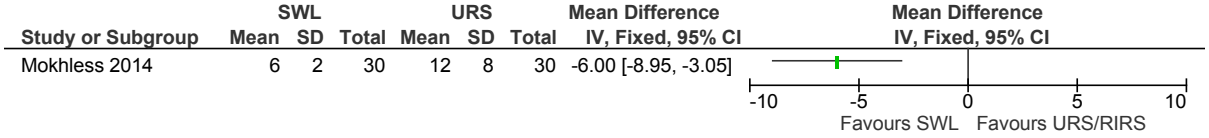
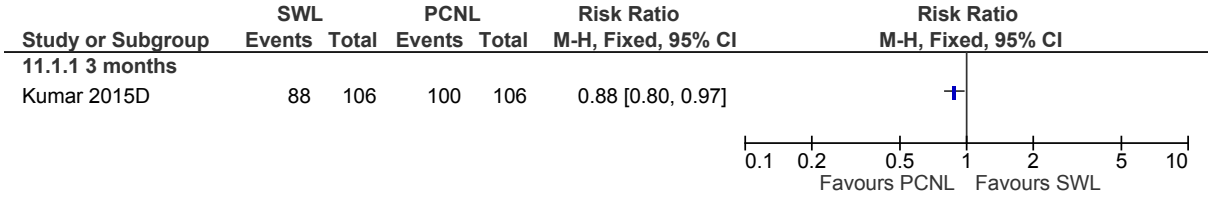


Figure 81: Length of hospital stay (hours)



E.1.8.2 SWL versus PCNL

Figure 82: Stone-free state



Time-point: 3 months

Figure 83: Retreatment

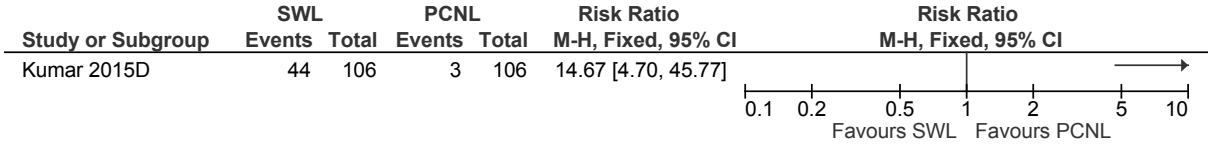


Figure 84: Ancillary procedures

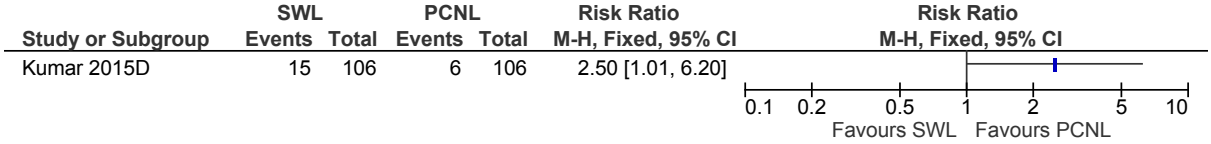


Figure 85: Major adverse events

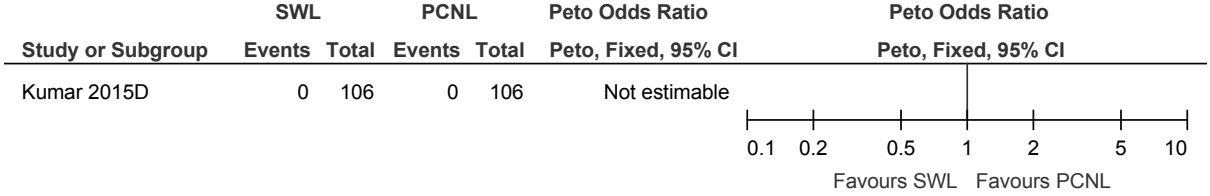
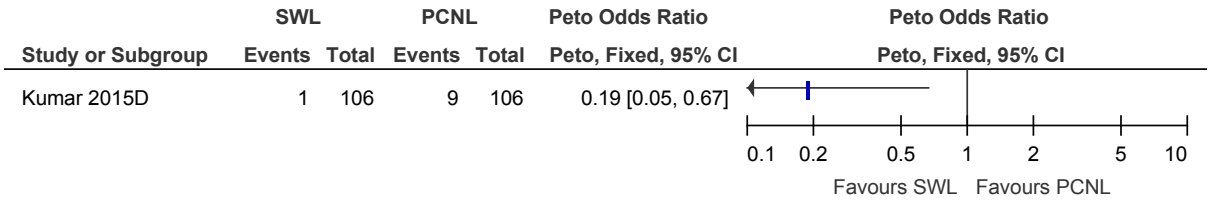
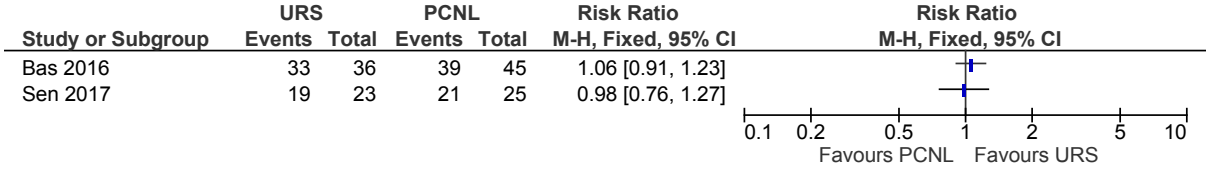


Figure 86: Minor adverse events



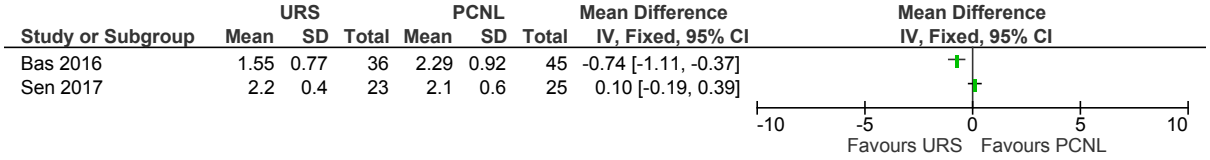
1 **E.1.8.3 URS vs PCNL (non-randomised studies)**

Figure 87: Stone-free state



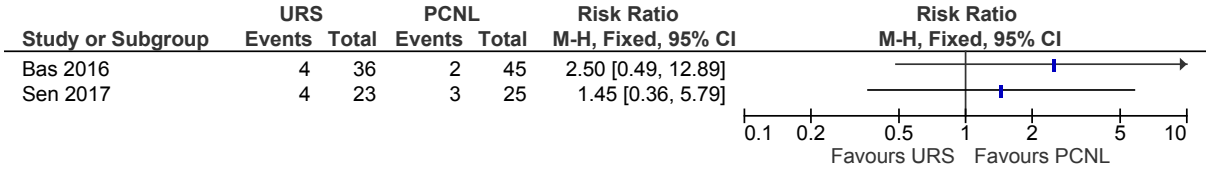
2

Figure 88: Length of stay



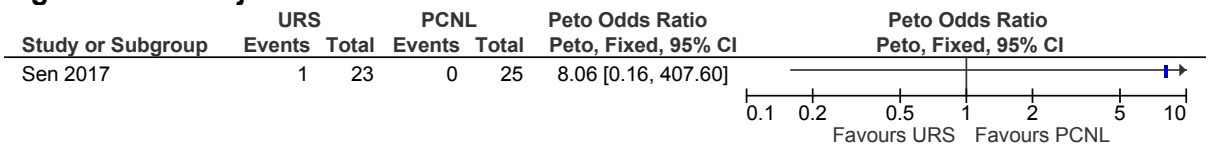
3

Figure 89: Minor adverse events



4

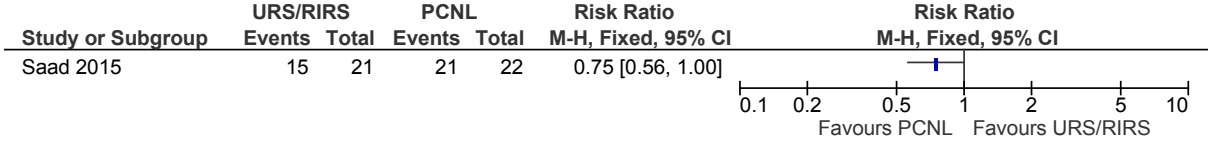
Figure 90: Major adverse events



5 **E.1.9 Children, renal, >20mm**

6 **E.1.9.1 URS versus PCNL**

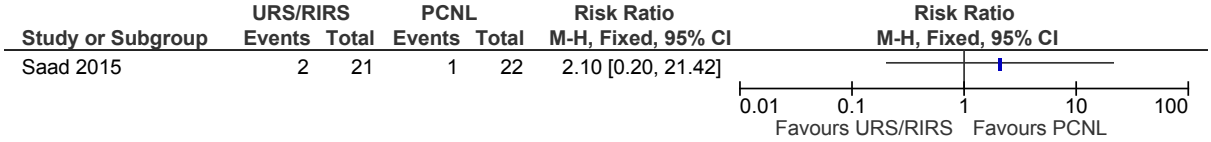
Figure 91: Stone free state (by renal unit)



Time-point: 1 month

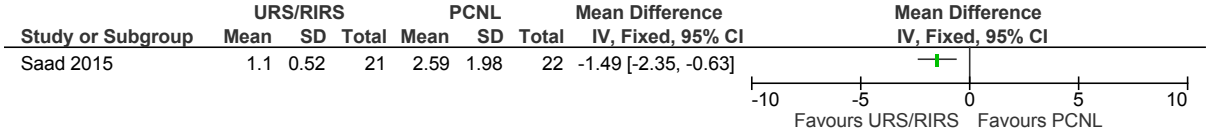
1

Figure 92: Retreatment (by renal unit)



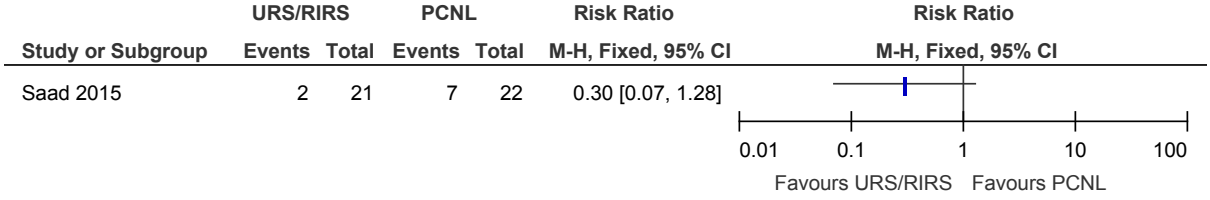
2

Figure 93: Length of hospital stay (days) (by renal unit)



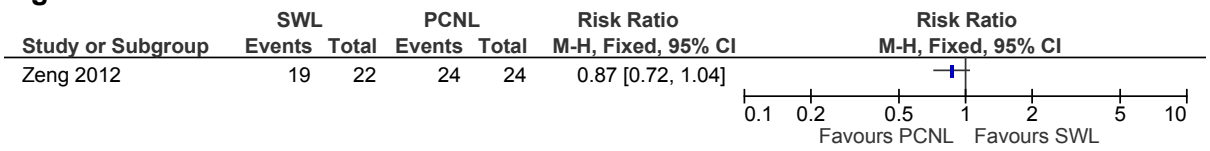
3

Figure 94: Minor adverse events (by renal unit)



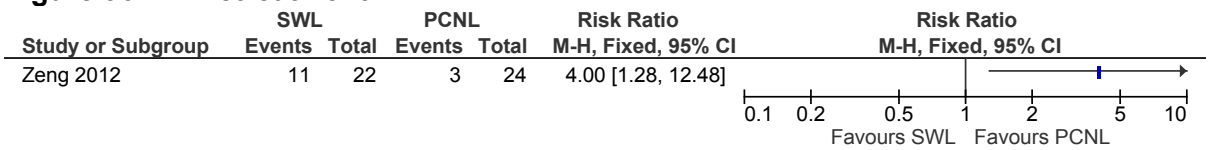
4 **E.1.9.2 SWL vs PCNL (non-randomised studies)**

Figure 95: Stone-free state



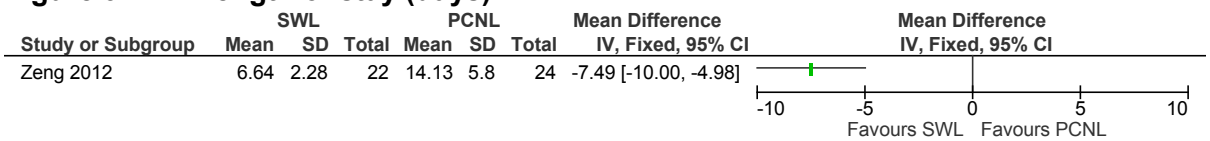
5

Figure 96: Retreatment



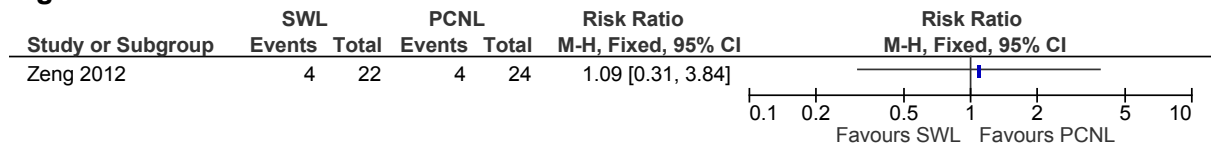
6

Figure 97: Length of stay (days)



7

Figure 98: Minor adverse events

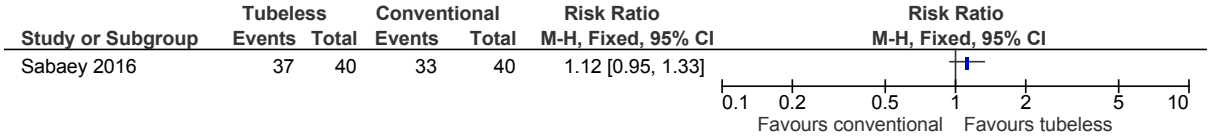


1 E.2 Within surgery comparisons

2 E.2.1 Adult, renal, 10-20mm

3 E.2.1.1 PCNL: Tubeless versus standard

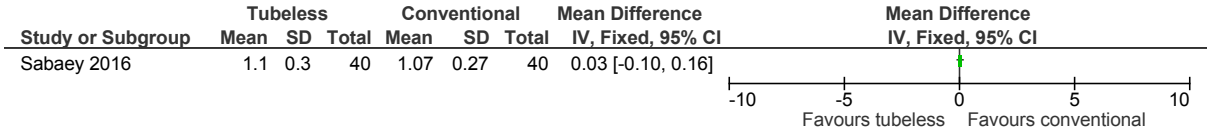
Figure 99: Stone free state



Time-point: Sabaey 2016, not reported

4

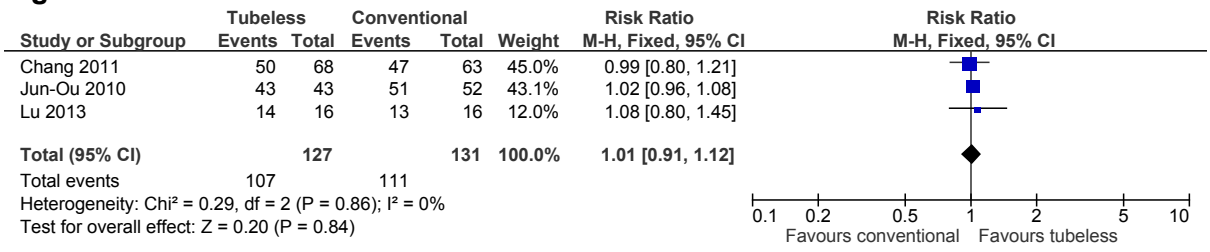
Figure 100: Length of hospital stay (days)



5 E.2.2 Adult, renal, >20mm

6 E.2.2.1 PCNL: Tubeless versus standard

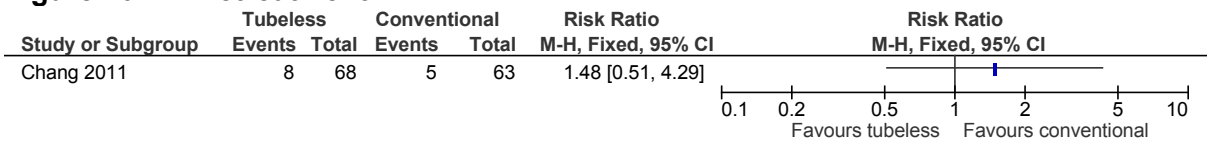
Figure 101: Stone-free state



Time-point: Chang 2011, mean 18-19 months; Jun-Ou 2010, 1 day; Lu 2013, 2 weeks

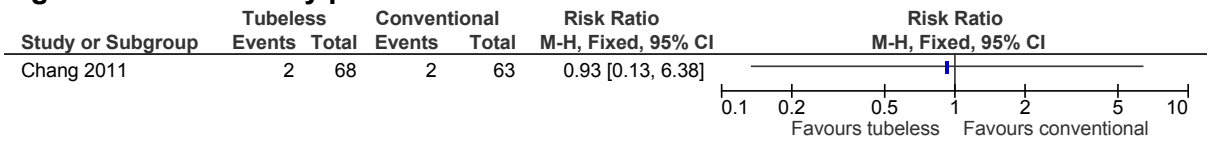
7

Figure 102: Retreatment



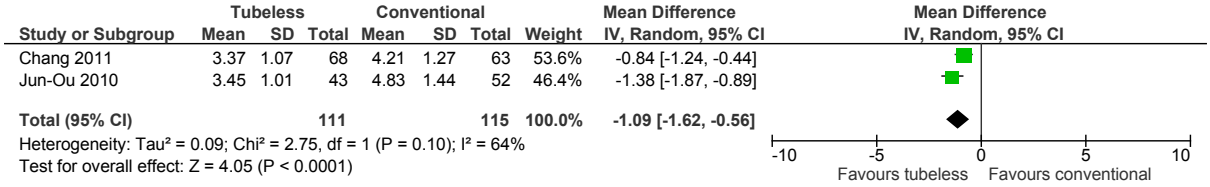
8

Figure 103: Ancillary procedures



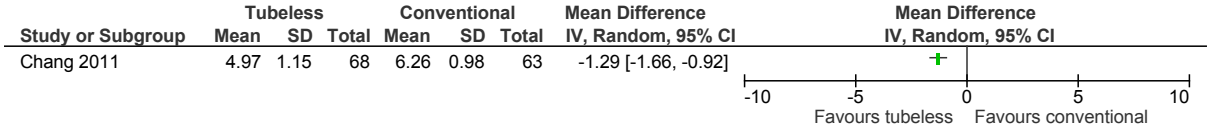
1

Figure 104: Length of hospital stay (days)



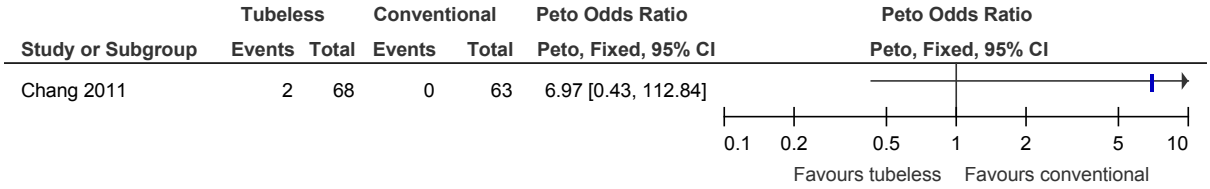
2

Figure 105: Pain (1-2 days)



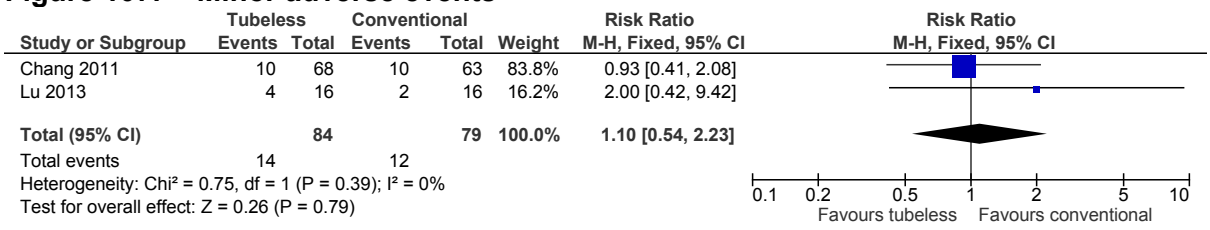
3

Figure 106: Major adverse events



4

Figure 107: Minor adverse events



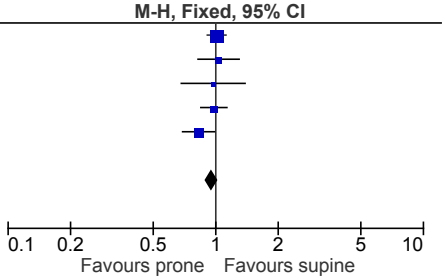
5

E.2.2.2 PCNL: Supine versus prone

Figure 108: Stone-free state

Study or Subgroup	Supine Events	Supine Total	Prone Events	Prone Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Al-Dessoukey 2014	89	101	89	102	40.1%	1.01 [0.91, 1.12]
Falahatkar 2008	32	40	31	40	14.0%	1.03 [0.82, 1.30]
Falahatkar 2011	14	18	12	15	5.9%	0.97 [0.68, 1.38]
Sio 2008	35	39	33	36	15.5%	0.98 [0.85, 1.13]
Wang 2013	44	60	55	62	24.5%	0.83 [0.69, 0.99]
Total (95% CI)		**258**		**255**	**100.0%**	**0.96 [0.89, 1.03]**
Total events	214		220			

Heterogeneity: Chi² = 4.13, df = 4 (P = 0.39); I² = 3%
Test for overall effect: Z = 1.05 (P = 0.29)



Time-point: Al-Dessoukey 2014 1 day; Falahatkar 2011, 2 weeks; Falahatkar 2008, 1 day; Sio 2008, 1 month; Wang 2013, not reported

Figure 109: Recurrence

Study or Subgroup	Supine Events	Supine Total	Prone Events	Prone Total	Peto Odds Ratio Peto, Fixed, 95% CI
Wang 2013	0	55	0	58	Not estimable

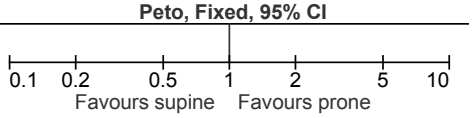


Figure 110: Retreatment

Study or Subgroup	Supine Events	Supine Total	Prone Events	Prone Total	Peto Odds Ratio Peto, Fixed, 95% CI
Wang 2013	6	60	0	62	8.34 [1.63, 42.76]

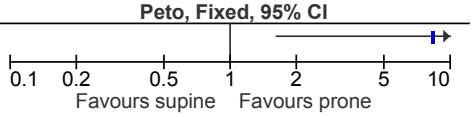


Figure 111: Ancillary procedures

Study or Subgroup	Supine Events	Supine Total	Prone Events	Prone Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Sio 2008	4	39	2	36	34.6%	1.85 [0.36, 9.48]
Wang 2013	5	60	4	62	65.4%	1.29 [0.36, 4.58]
Total (95% CI)		**99**		**98**	**100.0%**	**1.48 [0.55, 4.02]**
Total events	9		6			

Heterogeneity: Chi² = 0.11, df = 1 (P = 0.73); I² = 0%
Test for overall effect: Z = 0.77 (P = 0.44)

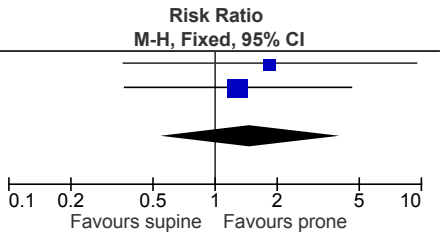


Figure 112: Length of hospital stay (hours)

Study or Subgroup	Supine Mean	Supine SD	Supine Total	Prone Mean	Prone SD	Prone Total	Weight	Mean Difference IV, Random, 95% CI
Al-Dessoukey 2014	49.88	19.7	101	81.2	35.1	102	35.7%	-31.32 [-39.14, -23.50]
Falahatkar 2008	80.02	35.9	40	73.2	44.4	40	29.3%	6.82 [-10.87, 24.51]
Falahatkar 2011	64.8	18	18	74.4	8.4	15	34.9%	-9.60 [-18.94, -0.26]
Total (95% CI)			**159**			**157**	**100.0%**	**-12.54 [-32.90, 7.82]**

Heterogeneity: Tau² = 286.15; Chi² = 21.59, df = 2 (P < 0.0001); I² = 91%
Test for overall effect: Z = 1.21 (P = 0.23)

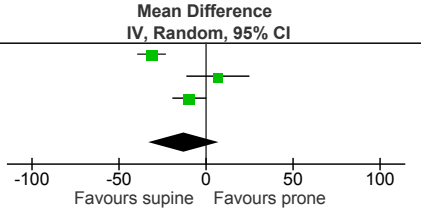


Figure 113: Major adverse events

Study or Subgroup	Supine Events	Supine Total	Prone Events	Prone Total	Weight	Peto Odds Ratio Peto, Fixed, 95% CI
Al-Dessoukey 2014	0	101	2	102	100.0%	0.14 [0.01, 2.18]
Falahatkar 2008	0	40	0	40		Not estimable
Falahatkar 2011	0	18	0	15		Not estimable
Total (95% CI)		**159**		**157**	**100.0%**	**0.14 [0.01, 2.18]**
Total events	0		2			

Heterogeneity: Not applicable

Test for overall effect: Z = 1.41 (P = 0.16)

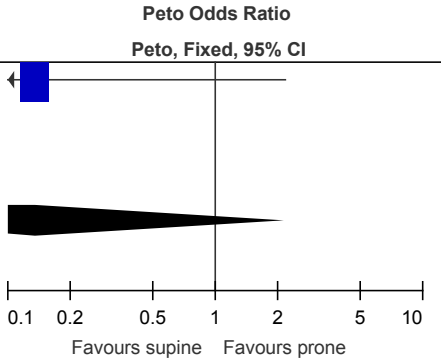
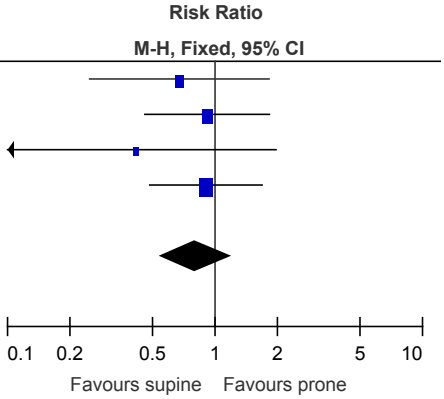


Figure 114: Minor adverse events

Study or Subgroup	Supine Events	Supine Total	Prone Events	Prone Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Al-Dessoukey 2014	6	101	9	102	21.8%	0.67 [0.25, 1.82]
Falahatkar 2008	11	40	12	40	29.2%	0.92 [0.46, 1.83]
Falahatkar 2011	2	18	4	15	10.6%	0.42 [0.09, 1.97]
Wang 2013	14	60	16	62	38.3%	0.90 [0.48, 1.69]
Total (95% CI)		**219**		**219**	**100.0%**	**0.81 [0.54, 1.21]**
Total events	33		41			

Heterogeneity: Chi² = 1.08, df = 3 (P = 0.78); I² = 0%

Test for overall effect: Z = 1.05 (P = 0.30)



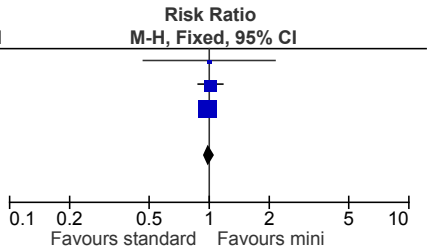
E.2.2.3 PCNL: Mini versus standard

Figure 115: Stone-free state

Study or Subgroup	Mini PCNL Events	Mini PCNL Total	Standard PCNL Events	Standard PCNL Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Feng 2001	5	8	5	8	4.1%	1.00 [0.47, 2.14]
Karakan 2017	42	47	44	50	35.3%	1.02 [0.88, 1.17]
Sakr 2017	72	75	73	75	60.5%	0.99 [0.93, 1.05]
Total (95% CI)		**130**		**133**	**100.0%**	**1.00 [0.93, 1.07]**
Total events	119		122			

Heterogeneity: Chi² = 0.19, df = 2 (P = 0.91); I² = 0%

Test for overall effect: Z = 0.08 (P = 0.94)



Time-point: Feng 2001, not reported; Karakan 2017, 1 month; Sakr 2017, 1 month

Figure 116: Retreatment

Study or Subgroup	Mini PCNL Events	Mini PCNL Total	Standard PCNL Events	Standard PCNL Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Feng 2001	0	9	0	10		Not estimable
Sakr 2017	3	75	2	75	100.0%	1.50 [0.26, 8.72]
Total (95% CI)		**84**		**85**	**100.0%**	**1.50 [0.26, 8.72]**
Total events	3		2			

Heterogeneity: Not applicable

Test for overall effect: Z = 0.45 (P = 0.65)

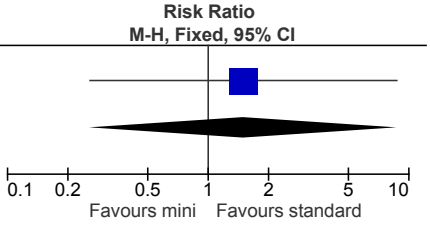
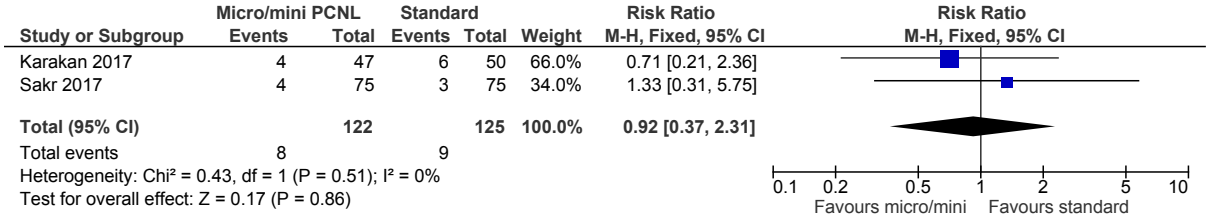
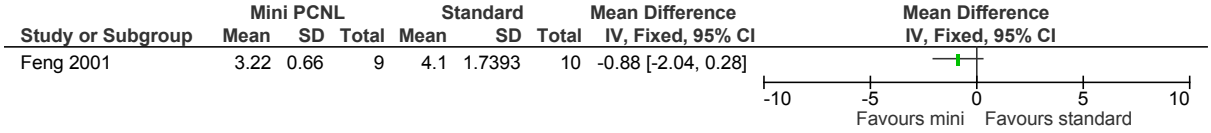


Figure 117: Ancillary procedures



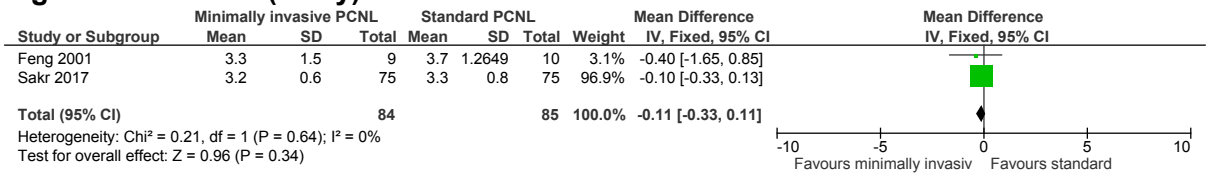
1

Figure 118: Length of hospital stay (days)



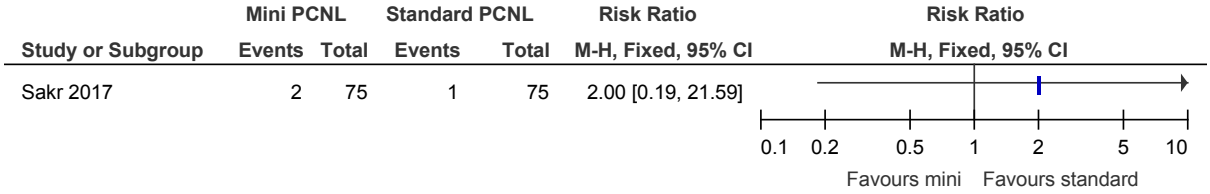
2

Figure 119: Pain (1 day)



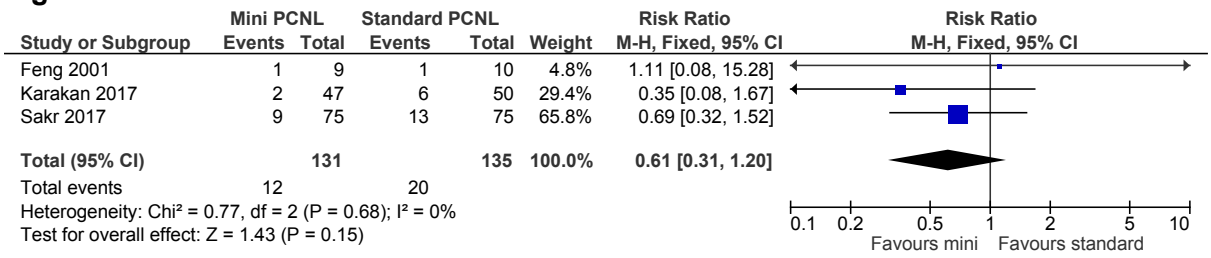
3

Figure 120: Major adverse events



4

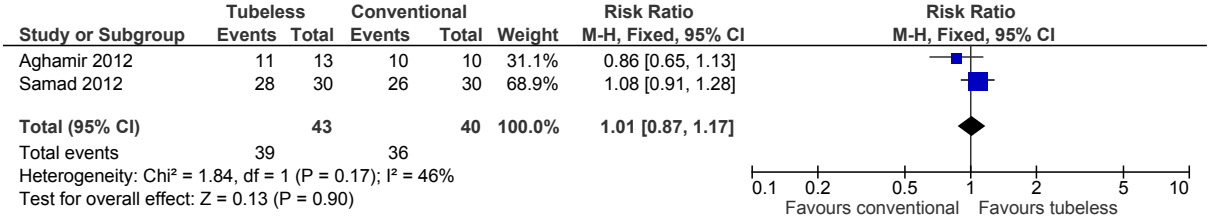
Figure 121: Minor adverse events



1 E.2.3 Children, renal, >20mm

2 E.2.3.1 PCNL: Tubeless versus standard

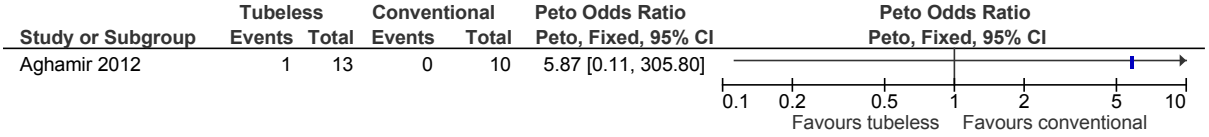
Figure 122: Stone-free state



Time-point: Aghamir 2012, 1 month; Samad 2012, 1 week

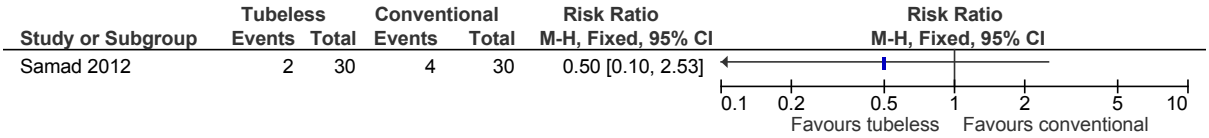
3

Figure 123: Retreatment



4
5

Figure 124: Ancillary procedures



6

Figure 125: Length of hospital stay

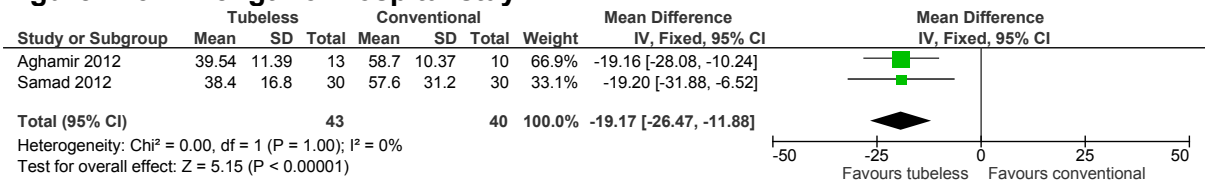


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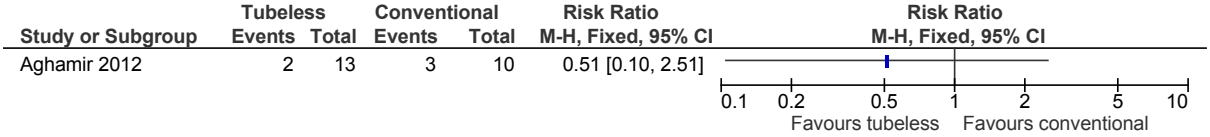
Figure 126: Minor adverse events



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Appendix F: GRADE tables

F.1 Between surgery comparisons

F.1.1 Adults, ureteric, <10mm

Table 37: Clinical evidence profile: SWL versus URS/

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	SWL	URS	Relative (95% CI)	Absolute		
Stone free state (follow-up 2 weeks - 3 months)												
8	randomised trials	serious[1]	very serious[2]	no serious indirectness	no serious imprecision	none	476/569 (83.7%)	92.9%	RR 0.9 (0.8 to 0.99)	93 fewer per 1000 (from 9 fewer to 186 fewer)	⊕OOO VERY LOW	CRITICAL
Retreatment (follow-up 2 weeks - 3 months or time-point not reported)												
6	randomised trials	serious[1]	serious[3]	no serious indirectness	no serious imprecision	none	71/540 (13.1%)	2.3%	RR 5.01 (1.39 to 18.04)	116 more per 1000 (from 11 more to 494 more)	⊕⊕OO LOW	CRITICAL
Ancillary procedures (follow-up 2-4 weeks or time-point not reported)												
5	randomised trials	serious[1]	very serious[5]	no serious indirectness	serious[4]	none	50/471 (10.6%)	4.1%	RR 2.29 (0.71 to 7.4)	53 more per 1000 (from 12 fewer to 262 more)	⊕OOO VERY LOW	CRITICAL
Quality of life - EQ-5D mean index (follow-up 4 weeks; range of scores: 0-1; Better indicated by higher values)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	34	31	-	MD 0.1 lower (0.15 to 0.05 lower)	⊕⊕⊕O MODERATE	CRITICAL
Quality of life - EQ-5D VAS value (follow-up 4 weeks; range of scores: 0-100; Better indicated by higher values)												

1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	34	31	-	MD 11.5 lower (15.95 to 7.05 lower)	⊕⊕⊕O MODERATE	CRITICAL
Minor adverse events (follow-up time-point not reported)												
5	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[4]	none	7/511 (1.4%)	2%	RR 0.67 (0.29 to 1.52)	7 fewer per 1000 (from 14 fewer to 10 more)	⊕OOO VERY LOW	CRITICAL
Major adverse events (follow-up time-point not reported)												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	0/326 (0%)	5.7%	OR 0.15 (0.05 to 0.47)	48 fewer per 1000 (from 29 fewer to 54 fewer)	⊕⊕⊕O MODERATE	CRITICAL
Failed technology (follow-up time-point not reported)												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[4]	none	1/326 (0.31%)	2.3%	OR 0.27 (0.06 to 1.21)	17 fewer per 1000 (from 22 fewer to 5 more)	⊕⊕OO LOW	CRITICAL
Pain (range of scores: 0-10; Better indicated by lower values) (follow-up 4 weeks)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[4]	none	34	31	-	MD 1.6 higher (0.29 to 2.92 higher)	⊕OOO VERY LOW	CRITICAL
Readmission to hospital (follow-up time-point not reported)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[4]	none	2/32 (6.3%)	12.5%	RR 0.50 (0.10 to 2.54)	62 fewer per 1000 (from 112 fewer to 192 more)	⊕OOO VERY LOW	CRITICAL
Length of hospital stay (follow-up days)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[4]	none	69	87	-	MD 2.20 lower (3.09 to 1.31 lower)	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 or 2 increments because heterogeneity, I2= 85%, p= > 0.1, unexplained by subgroup analysis
[3] Downgraded by 1 or 2 increments because heterogeneity, I2= 62%, p= > 0.1, unexplained by subgroup analysis
[4] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.
[5] Downgraded by 1 or 2 increments because heterogeneity, I2= 72%, p= > 0.1, unexplained by subgroup analysis
[6] Could not be calculated as there were no events in the intervention or comparison group

Table 38: Surgery (URS, SWL or PCNL) versus non-surgical treatment

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Surgery	Non-surgical treatment	Relative (95% CI)	Absolute		
Stone free state (follow-up 4 weeks)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	91/104 (87.5%)	70.9%	RR 1.23 (1.1 to 1.39)	163 more per 1000 (from 71 more to 277 more)	⊕⊕OO LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

F.1.2 Adults, ureteric, 10-20mm

Table 39: SWL versus URS

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	SWL	URS	Relative (95% CI)	Absolute		
Stone free state (follow-up 1 session - 3 months)												
13	randomised trials	serious[1]	serious[3]	no serious indirectness	serious[2]	none	609/902 (67.5%)	85.2%	RR 0.85 (0.79 to 0.92)	128 fewer per 1000 (from 68 fewer to 179 fewer)	⊕OOO VERY LOW	CRITICAL
Retreatment (follow-up 1 week to 3 months or time-point not reported)												
10	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	241/706 (34.1%)	8.7%	RR 4.43 (3.39 to 5.79)	298 more per 1000 (from 208 more to 417 more)	⊕⊕⊕O MODERATE	CRITICAL

Ancillary procedures - Lower ureteric (follow-up 1-4 weeks or time-point not reported)												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	25/136 (18.4%)	8.7%	RR 2.12 (1.11 to 4.05)	97 more per 1000 (from 10 more to 265 more)	⊕⊕OO LOW	CRITICAL
Ancillary procedures - Upper ureteric (follow-up 1-4 weeks or time-point not reported)												
6	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	77/330 (23.3%)	25.4%	RR 1.12 (0.85 to 1.48)	30 more per 1000 (from 38 fewer to 122 more)	⊕⊕OO LOW	CRITICAL
Readmission (follow-up 2 weeks) (follow-up 2 weeks)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	2/100 (2%)	0%	Peto OR 7.46 (0.46 to 120.17)	-	⊕OOO VERY LOW	CRITICAL
Length of hospital stay - Hours (Better indicated by lower values) (follow-up hours)												
4	randomised trials	serious[1]	very serious[5]	no serious indirectness	no serious imprecision	none	82	82	-	MD 25.84 lower (32.64 to 19.05 lower)	⊕OOO VERY LOW	CRITICAL
Pain VAS (range of scores: 0-10; Better indicated by lower values) (follow-up time-point not reported)												
3	randomised trials	serious[1]	very serious[4]	no serious indirectness	serious[2]	none	52	50	-	MD 0.69 lower (1.82 lower to 0.44 higher)	⊕OOO VERY LOW	IMPORTANT
Major adverse events (follow-up 3 months or time-point not reported)												
6	randomised trials	serious[1]	serious[7]	no serious indirectness	very serious[2]	none	22/503 (4.4%)	4.3%	RR 0.63 (0.14 to 2.74)	16 fewer per 1000 (from 37 fewer to 75 more)	⊕OOO VERY LOW	CRITICAL
Minor adverse events (follow-up 1 week to 3 months or time-point not reported)												
10	randomised trials	serious[1]	serious[9]	no serious indirectness	serious[2]	none	26/787 (3.3%)	6.1%	RR 0.47 (0.21 to 1.05)	32 fewer per 1000 (from 48 fewer to 3 more)	⊕OOO VERY LOW	CRITICAL
Failed technology (follow-up time-point not reported)												

1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	0/14 (0%)	6.3%	Peto OR 0.15 (0.00 to 7.80)	53 fewer per 1000 (from 63 fewer to 281 more)	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed 1 MID or by 2 increments if the confidence interval crossed both MIDs
[3] Downgraded by 1 or 2 increments because heterogeneity, I2=50%, p= > 0.1, unexplained by subgroup analysis
[4] Downgraded by 1 or 2 increments because heterogeneity, I2=89%, p= > 0.1, unexplained by subgroup analysis
[5] Downgraded by 1 or 2 increments because heterogeneity, I2=86%, p= > 0.1, unexplained by subgroup analysis
[6] Could not be calculated as there were no events in the comparison group
[7] Downgraded by 1 or 2 increments because heterogeneity, I2=60%, p= > 0.1, unexplained by subgroup analysis
[8] Risk difference calculated in Review Manager
[9] Downgraded by 1 or 2 increments because heterogeneity, I2=53%, p= > 0.1, unexplained by subgroup analysis

Table 40: URS versus PCNL

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**URS**	**PCNL**	**Relative (95% CI)**	**Absolute**		
Stone free state (follow-up 3-4 weeks)												
5	randomised trials	serious[1]	very serious[2]	no serious indirectness	serious[3]	none	229/268 (85.4%)	100%	RR 0.89 (0.8 to 0.99)	110 fewer per 1000 (from 10 fewer to 200 fewer)	⊕OOO VERY LOW	CRITICAL
Retreatment (follow-up time-point not reported)												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	11/79 (13.9%)	7%	RR 1.57 (0.66 to 3.72)	40 more per 1000 (from 24 fewer to 190 more)	⊕OOO VERY LOW	CRITICAL
Ancillary procedure (follow-up 3 days or time-point not reported)												
4	randomised trials	serious[1]	serious[4]	no serious indirectness	no serious imprecision	none	62/220 (28.2%)	4.9%	RR 4.3 (1.36 to 13.61)	162 more per 1000 (from 18 more to 618 more)	⊕⊕OO LOW	CRITICAL
Length of hospital stay (days) (Better indicated by lower values)												
5	randomised trials	serious[1]	very serious[6]	no serious indirectness	no serious imprecision	none	235	235	-	MD 3.24 lower (3.95 to 2.53 lower)	⊕OOO VERY LOW	CRITICAL

Major adverse events (4 weeks or time-point not reported)												
4	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	8/220 (3.6%)	0%	Peto OR 8.31 (2.04 to 33.9)	-	⊕⊕⊕O MODERATE	CRITICAL
Minor adverse events (4 weeks or time-point not reported)												
4	randomised trials	serious[1]	very serious[6]	no serious indirectness	very serious[3]	none	32/218 (14.7%)	11.8%	RR 0.95 (0.31 to 2.94)	6 fewer per 1000 (from 81 fewer to 229 more)	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 or 2 increments because heterogeneity, I2= 78%, p= > 0.1, unexplained by subgroup analysis
[3] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
[4] Downgraded by 1 or 2 increments because heterogeneity, I2= 58%, p= > 0.1, unexplained by subgroup analysis
[5] Could not be calculated as there were no events in the intervention or comparison group
[6] Downgraded by 1 or 2 increments because heterogeneity, I2=80%, p= > 0.1, unexplained by subgroup analysis

F.1.3 Children, ureteric, <10mm

Table 41: SWL versus URS

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**SWL**	**URS**	**Relative (95% CI)**	**Absolute**		
Stone free state (follow-up 6-8 months)												
1	randomised trials	serious[1]	no serious inconsistency	serious indirectness[3]	serious[2]	none	6/14 (42.9%)	94.1%	RR 0.46 (0.25 to 0.84)	508 fewer per 1000 (from 151 fewer to 706 fewer)	⊕⊕⊕O VERY LOW	CRITICAL
Retreatment (follow-up 6-8 months)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	8/14 (57.1%)	0%	OR 17.96 (3.66 to 88.1)	-	⊕⊕⊕O MODERATE	CRITICAL
Ancillary procedures (follow-up 6-8 months)												

1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	5/14 (35.7%)	5.9%	RR 6.07 (0.8 to 46.1)	299 more per 1000 (from 12 fewer to 1000 more)	⊕⊕OO LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
[3] Downgraded by 1 increment if the outcome definition reported did not meet definition of outcome in protocol

F.1.4 Adults, renal, <10mm

Table 42: SWL versus URS

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	SWL	URS	Relative (95% CI)	Absolute		
Stone free state (follow-up 3 months)												
4	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	172/201 (85.6%)	88.2%	RR 0.95 (0.88 to 1.02)	44 fewer per 1000 (from 106 fewer to 18 more)	⊕⊕⊕O MODERATE	CRITICAL
Retreatment (follow-up time-point not reported)												
3	randomised trials	serious[1]	serious[2]	no serious indirectness	serious[3]	none	47/137 (34.3%)	5.7%	RR 5.97 (0.98 to 36.42)	283 more per 1000 (from 1 fewer to 1000 more)	⊕OOO VERY LOW	CRITICAL
Ancillary procedures (follow-up time-point not reported)												
4	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	21/207 (10.1%)	3.9%	RR 2.39 (1.13 to 5.04)	54 more per 1000 (from 5 more to 158 more)	⊕⊕OO LOW	CRITICAL
Readmission (follow-up time-point not reported)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	0/32 (0%)	8.6%	OR 0.14 (0.01 to 1.39)	73 fewer per 1000 (from 85 fewer to 30 more)	⊕OOO VERY LOW	CRITICAL

Major adverse events (follow-up time-point not reported)											
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	0/105 (0%)	3%	OR 0.13 (0.01 to 1.28)	26 fewer per 1000 (from 30 fewer to 8 more)	⊕OOO VERY LOW	CRITICAL
Minor adverse events (follow-up time-point not reported)											
4	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	0/207 (0%)	5%	OR 0.13 (0.04 to 0.46)	43 fewer per 1000 (from 26 fewer to 48 fewer)	⊕⊕⊕O MODERATE	CRITICAL
Failed technology (follow-up time-point not reported)											
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	1/32 (3.1%)	14.3%	OR 0.22 (0.03 to 1.77)	112 fewer per 1000 (from 139 fewer to 110 more)	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 or 2 increments because heterogeneity, I2= 65%, p= > 0.1, unexplained by subgroup analysis
[3] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 43: SWL versus PCNL

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**SWL**	**PCNL**	**Relative (95% CI)**	**Absolute**		
Stone free state (follow-up 3 months)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	12/19 (63.2%)	100%	RR 0.64 (0.45 to 0.9)	360 fewer per 1000 (from 100 fewer to 550 fewer)	⊕OOO VERY LOW	CRITICAL
Retreatment (follow-up time-point not reported)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	2/22 (9.1%)	10%	RR 0.91 (0.14 to 5.86)	9 fewer per 1000 (from 86 fewer to 486 more)	⊕OOO VERY LOW	CRITICAL

Ancillary procedures (follow-up time-point not reported)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	3/22 (13.6%)	0%	OR 7.44 (0.73 to 75.95)	-	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 44: Surgery (URS, SWL or PCNL) versus non-surgical treatment

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Surgery**	**Non-surgical**	**Relative (95% CI)**	**Absolute**		
Stone free state (follow-up 3 months - 2.2 years)												
2	randomised trials	serious[1]	very serious[2]	no serious indirectness	very serious[3]	none	120/201 (59.7%)	9.1%	RR 8.28 (0.09 to 756.16)	662 more per 1000 (from 83 fewer to 1000 more)	⊕OOO VERY LOW	CRITICAL
Ancillary procedures (follow-up time-point not reported)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	7/100 (7%)	12%	RR 0.58 (0.21 to 1.64)	50 fewer per 1000 (from 95 fewer to 77 more)	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 or 2 increments because heterogeneity, I2= 95%, p= > 0.1, unexplained by subgroup analysis
[3] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

F.1.5 Adults, renal, 10-20mm

Table 45: SWL versus URS

Quality assessment	No of patients	Effect	Quality	Importance

No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**SWL**	**URS**	**Relative (95% CI)**	**Absolute**		
Stone free state (follow-up 1-3 months)												
5	randomised trials	serious[1]	serious[2]	no serious indirectness	serious[3]	none	147/197 (74.6%)	89.7%	RR 0.84 (0.74 to 0.96)	144 fewer per 1000 (from 36 fewer to 233 fewer)	⊕OOO VERY LOW	CRITICAL
Retreatment (follow-up 3 months or time-point not reported)												
5	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	105/197 (53.3%)	9.5%	RR 5.96 (3.77 to 9.42)	471 more per 1000 (from 263 more to 800 more)	⊕⊕⊕O MODERATE	CRITICAL
Ancillary procedures (follow-up time-point not reported)												
3	randomised trials	serious[1]	serious[4]	no serious indirectness	very serious[3]	none	34/112 (30.4%)	9.3%	RR 2.02 (0.69 to 5.85)	95 more per 1000 (from 29 fewer to 451 more)	⊕OOO VERY LOW	CRITICAL
Length of hospital stay - Hours (Better indicated by lower values)												
2	randomised trials	serious[1]	very serious[5]	no serious indirectness	serious[3]	none	95	95	-	MD 27.09 lower (56.49 lower to 2.31 higher)	⊕OOO VERY LOW	CRITICAL
Pain VAS (range of scores: 0-10; Better indicated by lower values) (follow-up 1 day or time-point not reported)												
2	randomised trials	serious[1]	very serious[6]	no serious indirectness	very serious[3]	none	95	95	-	MD 0.05 higher (3.91 lower to 4.01 higher)	⊕OOO VERY LOW	IMPORTANT
Minor adverse events (follow-up 3 months or time-point not reported)												
4	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	9/162 (5.6%)	4.9%	RR 1.27 (0.49 to 3.32)	13 more per 1000 (from 25 fewer to 114 more)	⊕OOO VERY LOW	CRITICAL
Major adverse events (follow-up time-point not reported)												

2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	2/70 (2.9%)	2.9%	RR 1 (0.15 to 6.71)	0 fewer per 1000 (from 25 fewer to 166 more)	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 or 2 increments because heterogeneity, I2= 52%, p= > 0.1, unexplained by subgroup analysis
[3] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
[4] Downgraded by 1 or 2 increments because heterogeneity, I2= 72%, p= > 0.1, unexplained by subgroup analysis
[5] Downgraded by 1 or 2 increments because heterogeneity, I2= 99%, p= > 0.1, unexplained by subgroup analysis
[6] Downgraded by 1 or 2 increments because heterogeneity, I2= 98%, p= > 0.1, unexplained by subgroup analysis

Table 46: SWL versus PCNL

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**SWL**	**PCNL**	**Relative (95% CI)**	**Absolute**		
Stone free state (follow-up 1-3 months)												
6	randomised trials	very serious[1]	serious[2]	no serious indirectness	no serious imprecision	none	130/214 (60.7%)	96%	RR 0.63 (0.5 to 0.79)	355 fewer per 1000 (from 202 fewer to 480 fewer)	⊕OOO VERY LOW	CRITICAL
Retreatment (follow-up 3 months or time-point not reported)												
4	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	53/118 (44.9%)	1.2%	RR 18.69 (6.07 to 57.55)	212 more per 1000 (from 61 more to 679 more)	⊕⊕⊕O MODERATE	CRITICAL
Ancillary procedures (follow-up 3 months or time-point not reported)												
4	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	30/184 (16.3%)	1.7%	RR 5.97 (2.38 to 14.95)	84 more per 1000 (from 23 more to 237 more)	⊕⊕⊕O MODERATE	CRITICAL
Quality of life (SF-36) - Physical functioning (range of scores: 0-100; Better indicated by higher values) (follow-up 3 months)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	39	42	-	MD 2.7 higher (6.06 lower to 11.46 higher)	⊕OOO VERY LOW	CRITICAL

Quality of life (SF-36) - Physical role (range of scores: 0-100; Better indicated by higher values) (follow-up 3 months)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	38	42	-	MD 1.5 higher (17.73 lower to 20.73 higher)	⊕OOO VERY LOW	CRITICAL
Quality of life (SF-36) - Bodily pain (range of scores: 0-100; Better indicated by higher values) (follow-up 3 months)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	39	42	-	MD 10.1 lower (21.47 lower to 1.27 higher)	⊕OOO VERY LOW	CRITICAL
Quality of life (SF-36) - General health (range of scores: 0-100; Better indicated by higher values) (follow-up 3 months)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	37	42	-	MD 5.7 lower (13.9 lower to 2.5 higher)	⊕OOO VERY LOW	CRITICAL
Quality of life (SF-36) - Vitality (range of scores: 0-100; Better indicated by higher values) (follow-up 3 months)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	39	42	-	MD 0.8 higher (8.57 lower to 10.17 higher)	⊕OOO VERY LOW	CRITICAL
Quality of life (SF-36) - Social functioning (range of scores: 0-100; Better indicated by higher values) (follow-up 3 months)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	39	42	-	MD 5.2 higher (5.32 lower to 15.72 higher)	⊕OOO VERY LOW	CRITICAL
Quality of life (SF-36) - Emotional role (range of scores: 0-100; Better indicated by higher values) (follow-up 3 months)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	39	42	-	MD 8 higher (10.87 lower to 26.87 higher)	⊕OOO VERY LOW	CRITICAL
Quality of life (SF-36) - Mental health (range of scores: 0-100; Better indicated by higher values) (follow-up 3 months)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	39	42	-	MD 1.3 lower (9.67 lower to 7.07 higher)	⊕OOO VERY LOW	CRITICAL
Quality of life (SF-36) - Total physical (range of scores: 0-100; Better indicated by higher values) (follow-up 3 months)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	36	42	-	MD 1.8 lower (5.55 lower to 1.95 higher)	⊕OOO VERY LOW	CRITICAL
Quality of life (SF-36) - Total mental (range of scores: 0-100; Better indicated by higher values) (follow-up 3 months)												

1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	36	42	-	MD 0.7 higher (3.85 lower to 5.25 higher)	⊕OOO VERY LOW	CRITICAL
Quality of life (SF-36) - Overall health (range of scores: 0-100; Better indicated by higher values) (follow-up 3 months)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	36	42	-	MD 1.5 lower (9.51 lower to 6.51 higher)	⊕OOO VERY LOW	CRITICAL
Length of hospital stay (days) (better indicated by lower values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	28	21	-	MD 3.3 lower (5.45 to 1.15 lower)	⊕OOO VERY LOW	CRITICAL
Major adverse events (follow-up time-point not reported)												
3	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	0/165 (0%)	7%	RR 0.11 (0.02 to 0.57)	62 fewer per 1000 (from 29 fewer to 68 fewer)	⊕⊕OO LOW	CRITICAL
Minor adverse events (follow-up 1 day or time-point not reported)												
4	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	3/160 (1.9%)	4.2%	RR 0.53 (0.15 to 1.82)	20 fewer per 1000 (from 36 fewer to 34 more)	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 or 2 increments because heterogeneity, I2= 72%, p= > 0.1, unexplained by subgroup analysis
[3] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
[4] Could not be calculated as there were no events in the intervention or comparison group

Table 47: URS versus PCNL

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**URS**	**PCNL**	**Relative (95% CI)**	**Absolute**		
Stone free state (follow-up 1-3 months)												

5	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	178/211 (84.4%)	92.7%	RR 0.98 (0.9 to 1.06)	19 fewer per 1000 (from 93 fewer to 56 more)	⊕⊕⊕O MODERATE	CRITICAL
Recurrence (follow-up 1 year)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	3/39 (7.7%)	12.1%	RR 0.63 (0.15 to 2.63)	45 fewer per 1000 (from 103 fewer to 197 more)	⊕OOO VERY LOW	CRITICAL
Retreatment (follow-up time-point not reported)												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	1/78 (1.3%)	2.7%	RR 0.58 (0.08 to 4.36)	11 fewer per 1000 (from 25 fewer to 91 more)	⊕OOO VERY LOW	CRITICAL
Ancillary procedure (follow-up time-point not reported)												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	5/78 (6.4%)	5.1%	RR 1.20 (0.34 to 4.28)	10 more per 1000 (from 34 fewer to 167 more)	⊕OOO VERY LOW	CRITICAL
Length of hospital stay (days) (Better indicated by lower values)												
3	randomised trials	serious[1]	very serious[3]	no serious indirectness	no serious imprecision	none	78	65	-	MD 0.26 lower (1.65 lower to 1.12 higher)	⊕OOO VERY LOW	CRITICAL
Pain (VAS) (Better indicated by lower values) (follow-up 2-6 hours postoperatively)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	35	35	-	MD 1lower (1.64 to 0.36 lower)	⊕⊕OO LOW	IMPORTANT
Major adverse events (follow-up time-point not reported)												
3	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	4/117 (3.4%)	0%	RR 0.45 (0.15 to 1.37)	23 fewer per 1000 (from 81 fewer to 36 more)[4]	⊕OOO VERY LOW	CRITICAL
Minor adverse events (follow-up time-point not reported)												
5	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	15/211 (7.1%)	7.3%	RR 0.65 (0.35 to 1.22)	26 fewer per 1000 (from 47 fewer to 16 more)	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
[3] Downgraded by 1 or 2 increments because heterogeneity, I2= 81%, p= > 0.1, unexplained by subgroup analysis
[4] Risk difference calculated in Review Manager

Table 48: Surgery (URS, SWL or PCNL) versus non-surgical treatment

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Surgery	Non-surgical	Relative (95% CI)	Absolute		
Stone free state (follow-up 3 months)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision[2]	none	47/62 (75.8%)	0%	OR 20.09 (8.6 to 46.93)	-	⊕⊕⊕O MODERATE	CRITICAL
Ancillary procedures (follow-up time-point not reported)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	3/62 (4.8%)	21.9%	RR 0.22 (0.06 to 0.80)	171 fewer per 1000 (from 44 fewer to 206 fewer)	⊕⊕OO LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

F.1.6 Adults, renal, >20mm

Table 49: SWL versus PCNL

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	SWL	PCNL	Relative (95% CI)	Absolute		
Stone free state (follow-up 3 months)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	1/7 (14.3%)	85.7%	RR 0.17 (0.03 to 1.05)	711 fewer per 1000 (from 831 fewer to 43 more)	⊕OOO VERY LOW	CRITICAL

Retreatment (follow-up time-point not reported)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	2/9 (22.2%)	22.2%	RR 1 (0.18 to 5.63)	0 fewer per 1000 (from 182 fewer to 1000 more)	⊕OOO VERY LOW	CRITICAL
Ancillary procedures (follow-up time-point not reported)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	0/9 (0%)	0%	-	-	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 50: URS versus PCNL

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**URS**	**PCNL**	**Relative (95% CI)**	**Absolute**		
Stone free state (follow-up discharge - 3 months)												
3	randomised trials	serious[1]	very serious[2]	no serious indirectness	no serious imprecision	none	86/95 (90.5%)	90%	RR 1.02 (0.84 to 1.24)	18 more per 1000 (from 144 fewer to 216 more)	⊕OOO VERY LOW	CRITICAL
Retreatment (follow-up time-point not reported)												
2	randomised trials	serious[1]	serious[6]	no serious indirectness	very serious[3]	none	4/65 (6.2%)	1.4%	RR 1.91 (0.08 to 46.71)	13 more per 1000 (from 13 fewer to 216 more)	⊕OOO VERY LOW	CRITICAL
Ancillary procedures (follow-up time-point not reported)												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	1/65 (1.5%)	10.3%	RR 0.34 (0.06 to 2.11)	81 fewer per 1000 (from 99 fewer to 16 more)	⊕OOO VERY LOW	CRITICAL
Length of hospital stay (days) (Better indicated by lower values)												

3	randomised trials	serious[1]	very serious[4]	no serious indirectness	serious[3]	none	95	97	-	MD 0.87 lower (2.29 lower to 0.54 higher)	⊕OOO VERY LOW	CRITICAL
Pain (VAS) (range of scores: 0-10; Better indicated by lower values)												
2	randomised trials	serious[1]	very serious[7]	no serious indirectness	very serious[3]	none	65	67	-	MD 0.38 lower (1.74 lower to 0.98 higher)	⊕OOO VERY LOW	IMPORTANT
Major adverse events (follow-up time-point not reported)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	0/32 (0%)	0%	-	0 fewer per 1000 (from 60 fewer to 60 more)	⊕⊕OO LOW	CRITICAL
Minor adverse events (follow-up time-point not reported)												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	11/65 (16.9%)	26.2%	RR 0.65 (0.35 to 1.24)	92 fewer per 1000 (from 170 fewer to 63 more)	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 or 2 increments because heterogeneity, I2= 77%, p= > 0.1, unexplained by subgroup analysis
[3] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
[4] Downgraded by 1 or 2 increments because heterogeneity, I2= 92%, p= > 0.1, unexplained by subgroup analysis
[5] Could not be calculated as there were no events in the intervention or comparison group
[6] Downgraded by 1 or 2 increments because heterogeneity, I2= 55%, p= > 0.1, unexplained by subgroup analysis
[7] Downgraded by 1 or 2 increments because heterogeneity, I2= 87%, p= > 0.1, unexplained by subgroup analysis

F.1.7 Children, renal, 10-20mm

Table 51: SWL versus URS

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**SWL**	**URS**	**Relative (95% CI)**	**Absolute**		
Stone free state (follow-up 3 months)												

1	randomised trials	serious	no serious inconsistency	no serious indirectness	serious[2]	none	21/30 (70%)	86.7%	RR 0.81 (0.61 to 1.06)	165 fewer per 1000 (from 338 fewer to 52 more)	⊕⊕OO LOW	CRITICAL
Residual stones (insignificant stone) (follow-up 1 session)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	0/30 (0%)	3.3%	OR 0.14 (0 to 6.82)	28 fewer per 1000 (from 33 fewer to 156 more)	⊕OOO VERY LOW	CRITICAL
Residual stones (significant stone) (follow-up 1 session)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	9/30 (30%)	10%	RR 3 (0.9 to 10.01)	200 more per 1000 (from 10 fewer to 901 more)	⊕⊕OO LOW	CRITICAL
Retreatment (follow-up time-point not reported)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	9/30 (30%)	0%	OR 10.11 (2.48 to 41.23)	-	⊕⊕⊕O MODERATE	CRITICAL
Length of hospital stay (hours) (Better indicated by lower values)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	30	30	-	MD 6 lower (8.95 to 3.05 lower)	⊕⊕⊕O MODERATE	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 52: SWL versus PCNL

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**SWL**	**PCNL**	**Relative (95% CI)**	**Absolute**		
Stone free state (follow-up 3 months)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	88/106 (83%)	94.3%	RR 0.88 (0.8 to 0.97)	113 fewer per 1000 (from 28 fewer to 189 fewer)	⊕⊕OO LOW	CRITICAL

Retreatment (follow-up time-point not reported)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	44/106 (41.5%)	2.8%	RR 14.67 (4.7 to 45.77)	383 more per 1000 (from 104 more to 1000 more)	⊕⊕⊕O MODERATE	CRITICAL
Ancillary procedures (follow-up time-point not reported)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	15/106 (14.2%)	5.7%	RR 2.5 (1.01 to 6.2)	85 more per 1000 (from 1 more to 296 more)	⊕⊕OO LOW	CRITICAL
Major adverse events (follow-up time-point not reported)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	0/106 (0%)	0%	-	-	⊕OOO VERY LOW	CRITICAL
Minor adverse events (follow-up time-point not reported)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	1/106 (0.94%)	8.5%	OR 0.19 (0.05 to 0.67)	68 fewer per 1000 (from 26 fewer to 80 fewer)	⊕⊕⊕O MODERATE	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 53: URS versus PCNL (non-randomised studies)

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**URS**	**PCNL**	**Relative (95% CI)**	**Absolute**		
Stone free state (follow-up end of procedure or 1 month)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	33/36 (91.7%)	86.7%	RR 1.06 (0.91 to 1.23)	52 more per 1000 (from 78 fewer to 199 more)	⊕OOO VERY LOW	CRITICAL

Stone free state (follow-up 2 weeks)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	19/23 (82.6%)	84%	RR 0.98 (0.76 to 1.27)	17 fewer per 1000 (from 202 fewer to 227 more)	⊕OOO VERY LOW	CRITICAL
Minor adverse events (follow-up time-point not reported)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	4/36 (11.1%)	4.4%	RR 2.50 (0.49 to 12.89)	66 more per 1000 (from 22 fewer to 523 more)	⊕OOO VERY LOW	CRITICAL
Minor adverse events (follow-up time-point not reported)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	4/23 (17.4%)	12%	RR 1.45 (0.36 to 5.79)	54 more per 1000 (from 77 fewer to 575 more)	⊕OOO VERY LOW	CRITICAL
Length of stay (Better indicated by lower values) (days)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	36	45	-	MD 0.74 lower (1.11 to 0.37 lower)	⊕OOO VERY LOW	CRITICAL
Length of stay (Better indicated by lower values) (days)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	23	25	-	MD 0.1 higher (0.19 lower to 0.39 higher)	⊕OOO VERY LOW	CRITICAL
Major adverse events (sepsis) (follow-up time-point not reported)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	1/23 (4.3%)	0%	Peto OR 8.06 (0.16 to 407.6)	44 more per 1000 (from 67 fewer to 154 more)[3]	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.

[3] Risk difference calculated in Review Manager

F.1.8 Children, renal, >20mm

Table 54: URS versus PCNL

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	URS	PCNL	Relative (95% CI)	Absolute		
Stone free state (follow-up 1 month)												
1	randomised trials	serious[1]	no serious inconsistency	serious[3]	serious[2]	none	15/21 (71.4%)	95.5%	RR 0.75 (0.56 to 1)	239 fewer per 1000 (from 420 fewer to 0 more)	⊕OOO VERY LOW	CRITICAL
Retreatment (follow-up time-point not reported)												
1	randomised trials	serious[1]	no serious inconsistency	serious[3]	very serious[2]	none	2/21 (9.5%)	4.5%	RR 2.1 (0.2 to 21.42)	51 more per 1000 (from 37 fewer to 939 more)	⊕OOO VERY LOW	CRITICAL
Length of hospital stay (days) (Better indicated by lower values)												
1	randomised trials	serious[1]	no serious inconsistency	serious[3]	serious[2]	none	21	22	-	MD 1.49 lower (2.35 to 0.63 lower)	⊕OOO VERY LOW	CRITICAL
Minor adverse events (follow-up time-point not reported)												
1	randomised trials	serious[1]	no serious inconsistency	serious[3]	very serious[2]	none	2/21 (9.5%)	31.8%	RR 0.3 (0.07 to 1.28)	223 fewer per 1000 (from 296 fewer to 89 more)	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 55: SWL versus PCNL (non-randomised studies)

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	SWL	PCNL	Relative (95% CI)	Absolute		
Stone free state (3 months) (follow-up 3 months)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	19/22 (86.4%)	100%	RR 0.87 (0.72 to 1.04)	130 fewer per 1000 (from 280 fewer to 40 more)	⊕OOO VERY LOW	CRITICAL
Retreatment (follow-up 3-5 days postoperatively for PCNL and 2 weeks postoperatively for SWL)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	11/22 (50%)	12.5%	RR 4 (1.28 to 12.48)	375 more per 1000 (from 35 more to 1000 more)	⊕OOO VERY LOW	CRITICAL
Length of stay (Better indicated by lower values)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	22	24	-	MD 7.49 lower (10 to 4.98 lower)	⊕OOO VERY LOW	CRITICAL
Minor adverse events (follow-up time-point not reported)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	4/22 (18.2%)	16.7%	RR 1.09 (0.31 to 3.84)	15 more per 1000 (from 115 fewer to 474 more)	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias

[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.

F.2 Within surgery comparisons

F.2.1 Adult, renal, 10-20mm

Table 56: PCNL: Tubeless versus standard

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Tubeless	Standard	Relative (95% CI)	Absolute		
Stone free state (follow-up time-point not reported)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	37/40 (92.5%)	82.5%	RR 1.12 (0.95 to 1.33)	99 more per 1000 (from 41 fewer to 272 more)	⊕⊕OO LOW	CRITICAL
Length of hospital stay (Better indicated by lower values)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	40	40	-	MD 0.03 higher (0.1 lower to 0.16 higher)	⊕⊕OO LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

F.2.2 Adult, renal, >20mm

Table 57: PCNL: Tubeless versus standard

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Tubeless	Standard	Relative (95% CI)	Absolute		
Stone free state (follow-up 1 day - 19 months)												

3	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	107/127 (84.3%)	81.3%	RR 1.01 (0.91 to 1.12)	8 more per 1000 (from 73 fewer to 98 more)	⊕⊕⊕O MODERATE	CRITICAL
Retreatment (mean follow-up 18-18.92 months)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious imprecision[2]	none	8/68 (11.8%)	7.9%	RR 1.48 (0.51 to 4.29)	38 more per 1000 (from 39 fewer to 260 more)	⊕OOO VERY LOW	CRITICAL
Ancillary procedure (mean follow-up 18-18.92 months)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious imprecision[2]	none	2/68 (2.9%)	3.2	RR 0.93 (0.13 to 6.38)	2 fewer per 1000 (from 28 fewer to 172 more)	⊕OOO VERY LOW	CRITICAL
Length of hospital stay (days) (Better indicated by lower values)												
2	randomised trials	serious[1]	serious[3]	no serious indirectness	serious[2]	none	111	115	-	MD 1.09 lower (1.62 to 0.56 lower)	⊕OOO VERY LOW	CRITICAL
Pain (follow-up 2 days; range of scores: 0-10; Better indicated by lower values)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	68	63	-	MD 1.29 lower (1.66 to 0.92 lower)	⊕⊕⊕O MODERATE	IMPORTANT
Minor adverse events (mean follow-up 18-18.92 months or time-point not reported)												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	14/84 (16.7%)	14.2%	RR 1.10 (0.54 to 2.23)	14 more per 1000 (from 65 fewer to 175 more)	⊕OOO VERY LOW	CRITICAL
Major adverse events (mean follow-up 18-18.92 months)												

1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	2/68 (2.9%)	0%	Peto OR 6.97 (0.43 to 112.84)	-	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
[3] Downgraded by 1 or 2 increments because heterogeneity, I2= 64%, p= > 0.1, unexplained by subgroup analysis

Table 58: PCNL: Supine versus prone

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Supine**	**Prone**	**Relative (95% CI)**	**Absolute**		
Stone free state (follow-up 1 day - 1 month)												
5	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	214/258 (82.9%)	86.3%	RR 0.96 (0.89 to 1.03)	35 fewer per 1000 (from 96 fewer to 26 more)	⊕⊕⊕O MODERATE	CRITICAL
Recurrence (follow-up time-point not reported)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	0/55 (0%)	0%	See comment	0 fewer per 1000 (from 34 fewer to 34 more)[3]	⊕OOO VERY LOW	CRITICAL
Retreatment (follow-up time-point not reported)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	6/60 (10%)	0%	Peto OR 8.34 (1.63 to 42.76)	100 more per 1000 (from 20 more to 181 more)[3]	⊕⊕⊕O MODERATE	CRITICAL
Ancillary procedures (follow-up time-point not reported)												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	9/99 (9.1%)	6.1%	RR 1.48 (0.55 to 4.02)	29 more per 1000 (from 27 fewer to 181 more)	⊕OOO VERY LOW	CRITICAL

Length of hospital stay (hours) (Better indicated by lower values)												
3	randomised trials	serious[1]	very serious[4]	no serious indirectness	serious[2]	none	159	157	-	MD 12.54 lower (32.90 lower to 7.82 higher)	⊕OOO VERY LOW	CRITICAL
Major adverse events (follow-up time-point not reported)												
3	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	0/159 (0%)	1.3%	Peto OR 0.14 (0.01 to 2.18)	13 fewer per 1000 (from 34 fewer to 9 more)[3]	⊕OOO VERY LOW	CRITICAL
Minor adverse events (follow-up time-point not reported)												
3	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	33/219 (15.1%)	18.7%	RR 0.81 (0.54 to 1.21)	50 fewer per 1000 (from 121 fewer to 55 more)	⊕⊕OO LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
[3] Risk difference calculated in Review Manager
[4] Downgraded by 1 or 2 increments because heterogeneity, I2= 91%, p= > 0.1, unexplained by subgroup analysis

Table 59: PCNL: Mini versus standard

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Mini PCNL**	**Standard PCNL**	**Relative (95% CI)**	**Absolute**		
Stone free state (follow-up 1 month or time-point not reported)												
3	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	119/130 (91.5%)	88%	RR 1 (0.93 to 1.07)	0 fewer per 1000 (from 62 fewer to 62 more)	⊕⊕OO LOW	CRITICAL
Retreatment (follow-up time-point not reported)												

2	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	3/84 (3.6%)	1.3%	RR 1.5 (0.26 to 8.72)	6 more per 1000 (from 10 fewer to 100 more)	⊕OOO VERY LOW	CRITICAL
Ancillary procedures (follow-up time-point not reported)												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	8/122 (6.6%)	8 %	RR 0.92 (0.37 to 2.31)	6 fewer per 1000 (from 50 fewer to 105 more)	⊕OOO VERY LOW	CRITICAL
Length of hospital stay (days_ (Better indicated by lower values)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	9	10	-	MD 0.88 lower (2.04 lower to 0.28 higher)	⊕⊕OO LOW	CRITICAL
Pain (1 day) (range of scores: 0-10; Better indicated by lower values)												
2	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	84	85	-	MD 0.11 lower (0.33 lower to 0.11 higher)	⊕⊕OO LOW	CRITICAL
Major adverse events (follow-up time-point not reported)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	2/75 (2.7%)	1.3%	RR 2 (0.19 to 21.59)	13 more per 1000 (from 11 fewer to 268 more)	⊕OOO VERY LOW	CRITICAL
Minor adverse events (follow-up time-point not reported)												
3	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	12/131 (9.2%)	12%	RR 0.61 (0.31 to 1.20)	47 fewer per 1000 (from 83 fewer to 24 more)	⊕⊕OO LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

F.2.3 Children, renal, >20mm

Table 60: PCNL: Tubeless versus standard

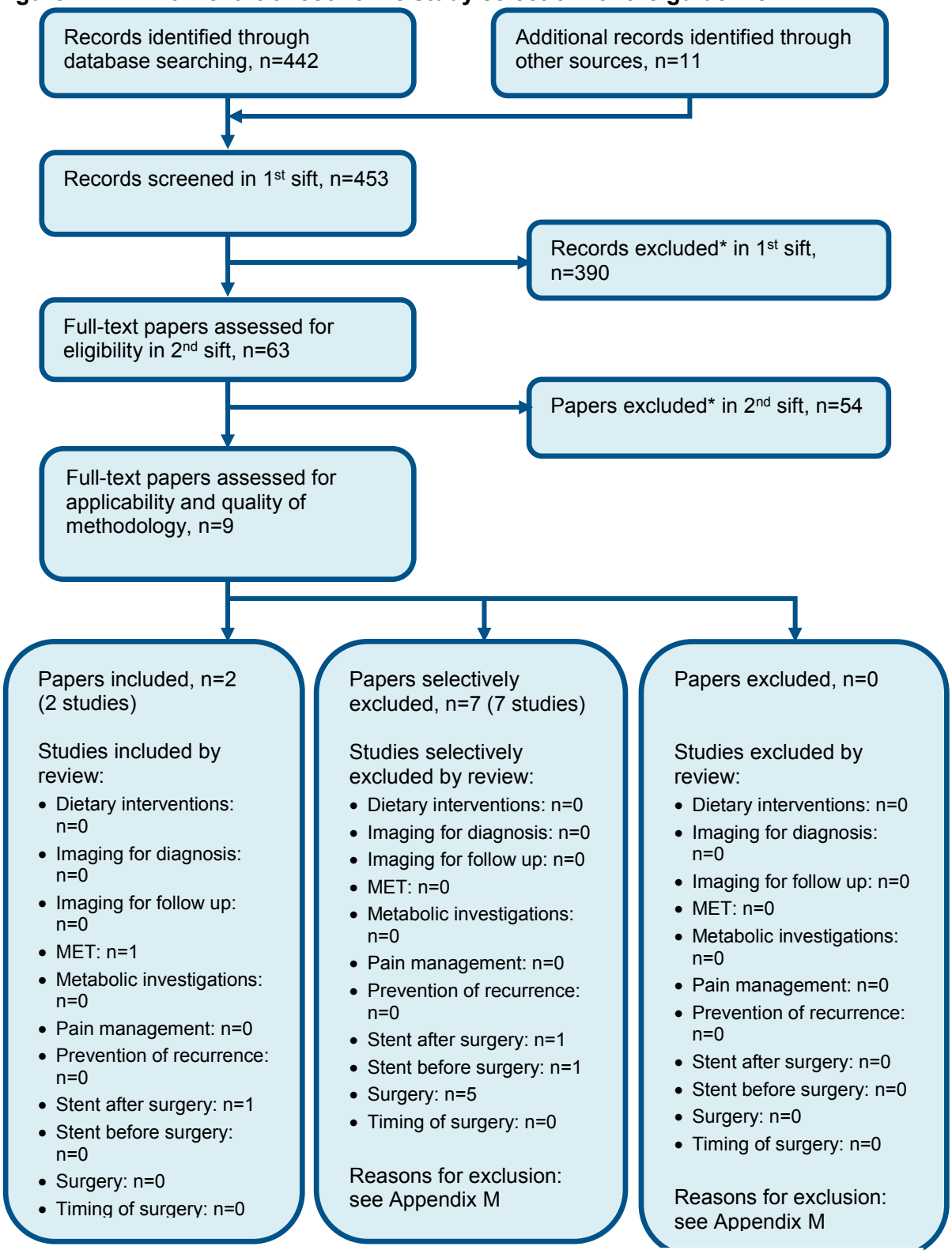
Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Tubeless PCNL	Conventional	Relative (95% CI)	Absolute		
Stone free state (follow-up 1 week to 1 month)												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	39/34 (90.7%)	93.3%	RR 1.01 (0.87 to 1.17)	9 more per 1000 (from 121 fewer 159 more)	⊕⊕⊕O MODERATE	CRITICAL
Retreatment (follow-up 1 month)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	1/13 (7.7%)	0%	OR 5.87 (0.11 to 305.8)	-	⊕OOO VERY LOW	CRITICAL
Length of hospital stay - Hours (Better indicated by lower values)												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	43	40	-	MD 19.17 lower (26.47 to 11.88 lower)	⊕⊕⊕O MODERATE	CRITICAL
Minor adverse events (follow-up 1 month)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	2/13 (15.4%)	30%	RR 0.51 (0.10 to 2.51)	147 fewer per 1000 (from 270 fewer to 453 more)	⊕OOO VERY LOW	CRITICAL
Ancillary procedures (follow-up time-point not reported)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	2/30 (6.7%)	13.3%	RR 0.50 (0.10 to 2.53)	67 fewer per 1000 (from 120	⊕OOO VERY LOW	CRITICAL

										fewer to 203 more)		

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Appendix G: Health economic evidence selection

Figure 127: Flow chart of economic study selection for the guideline



* Non-relevant population, intervention, comparison, design or setting; non-English language

Appendix H: Health economic evidence tables

None

Appendix I: Excluded studies

I.1 Excluded clinical studies

Table 61: Studies excluded from the clinical review

Study	Exclusion reason
Abdel-Mohsen 2013[1]	Incorrect study design
Aboumarzouk 2012[2]	Systematic review checked for references
Aghamir 2011[3]	Incorrect population
Agrawal 2008[6]	Incorrect population, stone size not reported
Agrawal 2009[5]	Incorrect population
Agrawal 2014[7]	Stone size and location not reported
Ahmed 2017 [8]	Incorrect intervention
Akar 2013[9]	Incorrect study design
Andankar 2001[13]	Incorrect study design
Anderson 1994[14]	Incorrect study design
Arcaniolo 2017[15]	Systematic review checked for references
Azili 2015[16]	Incorrect intervention
Bahilo Mateu 2017[18]	Not in English
Bas 2014[19]	Incorrect study design
Bas 2016[20]	Difference in baseline characteristics
Basiri 2006[21]	Incorrect intervention
Basiri 2008[22]	Systematic review checked for references
Basiri 2010[24]	Stone size not reported
Basiri 2014[23]	Incorrect interventions
Bhat 2017 [25]	Incorrect interventions
Bhoir 2014 [26]	Not available
Bilen 2007[28]	Stone size not reported
Bilen 2010 [27]	Stone size not reported; mixed location
Bozkurt 2010 [29]	Incorrect study design
Breda 2014[30]	Systematic review checked for references
Caione 2016 [33]	Incorrect comparison
Cakiroglu 2015[34]	Incorrect intervention
Celik 2017[36]	Stone size not reported
Ceylan 2017 [37]	Incorrect study design, not randomised
Charig 1986[40]	Incorrect study design
Chen 2014 [41]	Not available
Chen 2018 [42]	Systematic review checked for references
Cheng 2010[43]	Stone size not reported

Study	Exclusion reason
Chiong 2005[44]	Incorrect interventions
Choi 2006 [45]	Stone location not reported, not primary procedure
Choi 2014[46]	Incorrect study design
Crook 2008[47]	Stone location not reported
Cui 2015[48]	Systematic review checked for references
Daggulli 2015[49]	Incorrect study design
Demirci 2016[54]	Incorrect study design
Desai 1999[55]	No comparison group
Desai 2004[56]	Incorrect intervention
Desoky 2017[57]	Not primary procedure
Donaldson 2015[58]	Systematic review checked for references
Drake 2017 [59]	Systematic review checked for references
Dundar 2016 [60]	Incorrect comparison
Elderwy 2014[62]	Incorrect study design
El-Nahas 2013[61]	No comparison group
Elsheemy 2016[63]	RCT data exists for this strata
Elves 2000[64]	No extractable data
Falahatkar 2016[65]	Incorrect comparison
Falahatkar 2017 [67]	Mixed locations
Fang 2012[69]	Incorrect interventions
Fayad 2012[70]	Incorrect comparison
Fong 2004 [73]	Incorrect study design
Freton 2017 [74]	Mixed stone location
Gadzhiev 2017 [75]	Incorrect intervention
Ganesamoni 2013[76]	Incorrect interventions
Gao 2017[77]	Systematic review checked for references
Gao 2017[77]	Systematic review checked for references
Gökta 2000[78]	Incorrect interventions
Goldberg 2013[79]	Incorrect study design
Guercio 2011[82]	Incorrect interventions
Guven 2011[84]	RCT data exists for this strata
Guven 2013[83]	Incorrect study design
Gücük 2013 [81]	Incorrect comparison; stone size not reported
Haghighi 2017 [85]	Mixed stone location
Hammad Ather 2001 [86]	Incorrect study design, not randomised
Hatipoglu 2013[87]	Differences in baseline characteristics
Hosking 2003[89]	Incorrect study design
Hyams 2009[90]	Incorrect study design
Ishi 2014[92]	Review checked for references
Ishi 2015[93]	Review checked for references
ISRCTN[95]	Citation only
Istanbulluoglu 2009[96]	Incorrect population
Izamin 2009[97]	Incorrect study design
Jee 2013[100]	Incorrect population
Jiang 2017 [101]	Systematic review checked for references
Jones 2017 [102]	Systematic review checked for references

Study	Exclusion reason
Jones 2017 [103]	Systematic review checked for references
Jones 2017 [104]	Systematic review checked for references
Kadyan 2016[106]	Incorrect intervention
Kallidonis 2017 [107]	Systematic review checked for references
Kamel 2015[108]	Incorrect intervention
Kang 2009[109]	Not in English
Kang 2017 [110]	Systematic review checked for references
Kapoor 2008[111]	No comparison group
Kara 2010[112]	Incorrect population
Karakoc 2015[114]	Incorrect study design
Karami 2006[116]	No extractable outcomes
Karami 2013[117]	Incorrect study design
Karatag 2015 [118]	Incorrect comparison
Karlsen 2007[119]	Incorrect study design
Khalil 2013[121]	Incorrect study design
Kijvikai 2007[122]	Systematic review checked for references
Kiraç 2013[123]	Incorrect study design
Knoll 2011 [125]	Incorrect study design
Knoll 2012[124]	Incorrect study design
Koo 2011[126]	Incorrect study design
Korkes 2009[127]	Incorrect intervention
Kravchick 2005	Incorrect comparison
Kumar 2010[130]	Incorrect comparison
Kumar 2011[134]	No comparison group
Kumar 2015[133]	Incorrect intervention
Kupeli 1998[135]	Incorrect study design
Lam 2002 [136]	Incorrect study design, not randomised
Lee 2010 [137]	Incorrect study design
Lee 2015[140]	Systematic review checked for references
Lee 2017 [139]	Systematic review checked for references
Leong 2004[142]	Incorrect interventions
Liu 2013[147]	Stone size not reported
Liu 2017[145]	Stone size not reported
Liu 2017[146]	Incorrect study design
Liu 2017[144]	Mixed stone location
Lu 2017 [149]	Systematic review checked for references
Lucarelli 2013[151]	Incorrect study design
Marchant 2009[154]	Not in English
Marchant 2011[153]	Stone size and location not reported
Matlaga 2012[155]	Systematic review checked for references
Matsuura 1994[156]	Not in English
Mehrabi 2016[157]	Mixed stone locations
Menon 1993[159]	Incorrect study design
Meretyk 1997[160]	Incorrect interventions
Mi 2016[161]	Systematic review checked for references

Study	Exclusion reason
Mishra 2010[162]	Stone size not reported
Mishra 2011[163]	Incorrect study design
Moosanejad 2016[165]	Stone size not reported
Nabi 2007[166]	Systematic review checked for references
Natarajan 2014 [167]	Not available
Palmero 2016 [170]	Not in English
Pan 2013[171]	Incorrect study design
Parker 2004[172]	Incorrect study design
Pelit 2017 [175]	Incorrect study design
Peschel 1999[176]	No extractable outcomes
Preminger 2006[177]	Incorrect study design
Ravier 2015[180]	Not in English
Raza 2005[181]	Differences in baseline characteristics
Resorlu 2012[182]	Differences in baseline characteristics
Sabnis 2012 [185]	Incorrect study design
Sarica 2017[190]	Incorrect study design
Schultz-Lampel 2001[192]	Incorrect study design
Sen 2015[195]	Stone size and location not reported
Sen 2017 [194]	Incorrect study design, not randomised
Shao 2017[198]	Incorrect interventions
Sharaf 2017 [199]	Systematic review not relevant
Shokeir 2006[200]	RCT data exists for this strata
Shoma 2012[201]	Stone size not reported
Silay 2013 [202]	Incorrect study design, not comparative
Singh 2014[204]	Incorrect interventions
Sofer 2017 [206]	Incorrect study design, not randomised
Sofikerim 2007 [207]	Incorrect interventions
Song 2015[208]	Incorrect population
Srisubat 2014[209]	Systematic review checked for references
Tan 2006[210]	RCT data exists for this strata
Tavakkoli Tabasi 2007[211]	Incorrect study design
Tefekli 2007[212]	Stone size not reported
Tepeler 2014[213]	Not primary procedure
Tiselius 2006[214]	Incorrect study design
Tok 2016[215]	Incorrect study design
Torricelli 2016[216]	Incorrect interventions
Tugcu 2016[217]	Incorrect study design
Uguz 2012[218]	Incorrect comparison
Vilches 2017[220]	Not in English
Villarraga 2016[12]	Not in English
Wadhwa 2007[221]	Differences in baseline characteristics
Wang 2013[224]	Systematic review checked for references
Wang 2016[222]	Incorrect interventions
Wang 2017[223]	Systematic review checked for references

Study	Exclusion reason
Weiland 2007 [228]	Incorrect comparison; stone size not reported
Wen 2017[229]	Incorrect interventions
Wu 2004[231]	Incorrect study design
Wu 2005 [230]	Incorrect study design, not randomised
Wu 2017 [232]	Systematic review checked for references
Xu 2014[234]	Systematic review checked for references
Xu 2015[233]	Incorrect interventions
Xue 1991[235]	Not in English
Yang 2016[236]	Incorrect interventions
Yapanoglu 2009[238]	RCT data exists for this strata
Yu 2017 [239]	Stone size not reported
Yun 2012[240]	Incorrect study design
Zeng 2017 [243]	Incorrect study design; incorrect interventions
Zhang 2014[248]	Incorrect study design
Zhang 2015[247]	Systematic review checked for references
Zhao 2016[249]	Systematic review checked for references
Zheng 2014[250]	Systematic review checked for references
Zheng 2015[251]	Systematic review checked for references
Zhong 2015[252]	Incorrect intervention

I.2 Excluded health economic studies

Table 62: Studies excluded from the health economic review

Reference	Reason for exclusion
Bagcioglu 2016 [17]	This study was assessed as partially applicable with very serious limitations due to the clinical data being retrospective and not from an RCT, therefore not in keeping with the guideline clinical review.
Demir 2014 [52]	This study was assessed as partially applicable with very serious limitations due to the clinical data being retrospective and not from an RCT, therefore not in keeping with the guideline clinical review.
Koo 2011 [126]	This study was assessed as partially applicable with very serious limitations due to the clinical data being retrospective and not from an RCT, therefore not in keeping with the guideline clinical review.
Schoenthaler 2015 [191]	This study was assessed as partially applicable with very serious limitations due to the clinical data being retrospective and not from an RCT, therefore not in keeping with the guideline clinical review.
Chan 2017 [38]	This study was assessed as partially applicable with very serious limitations due to the clinical data being retrospective and not from an RCT, therefore not in keeping with the guideline clinical review.