Caesarean Section (appendix G – evidence tables)

National Collaborating Centre for Women's and Children's Health

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This guideline has been fully funded by NICE. Healthcare professionals are expected to take it fully into account when exercising their clinical judgement. However, the guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient.

Implementation of this guidance is the responsibility of local commissioners and/or providers

Contents

PLEASE NOTE: This document contains both the original evidence tables, and the evidence tables for those sections which are new or have been updated in the 2011 edition. When designing the updated guideline, an additional chapter was added (guideline summary). This means that all of the cross-references in the evidence tables to the original guideline are now incorrect. Where tables refer to a chapter number, that number is now one higher in the updated guideline. For example, the old evidence tables cross refer to chapter 4 for planned CS but this is now chapter 5 in the full guideline.

Evidence Tables from 2004 guideline

Chapter 1 Introduction

Evidence tables 1.1 and 1.2 show the distribution of demographic and clinical characteristics for women giving birth using data from the NSCSA. The avearge age of women giving birth was 29 years, 16% were from ethnic minority groups. Forty one percent of all women were in their first pregnancy.

1.1 Demographic factors and CS rate for women giving birth in England & Wales (n = 147,087)

	All women (%)	CS before labour (%)	CS during labour (%)
Maternal age (years)			
12–19	7.4	4.4	9.3
20–24	17.4	6.2	9.9
25–29	28.1	8.8	12.1
30–34	29.9	11.9	13.1
35–39	14.0	15.0	14.3
40–50	2.4	20.1	15.8
Missing data	0.8	11.4	10.0
Ethnicity			
White	84.3	10.2	11.8
Black African	2.0	12.3	21.0
Black Caribbean	1.3	9.5	15.4
Black Other	0.9	10.2	14.3
Bangladeshi	0.7	7.8	11.7
Indian	2.5	9.4	13.9
Pakistani	3.1	8.4	10.4
Chinese	0.8	6.8	12.3
Asian Other	1.4	9.2	15.5
Other	2.1	8.7	13.2
Not known	0.2	7.0	9.4
Missing data	0.7	7.8	9.8

1.2 Clinical factors and CS rate for women giving birth in England & Wales (n = 147,087)

	% All women	% CS before labour	%CS during labour
Number of previous vaginal deliveries			
0	47.9	13.8	19.5
≥ 1	51.4	6.6	5.8
Missing data	0.7	10.3	8.9
Number of previous CS			
0	89.9	6.0	10.8
1	7.9	42.7	33.3
≥ 2	1.5	83.1	70.8
Missing data	0.7	11.0	8.3
Gestation (weeks)			
< 28	0.5	19.6	14.1
28–32	1.1	41.3	21.4
33–36	5.1	22.2	17.9
≥ 37	93.0	9.0	11.8
Missing data	0.3	10.3	10.4
Onset of labour			
Spontaneous	67.3	–	9.8
Induction	22.1	–	19.3
CS before labour	10.0	–	–
Missing data	0.6	–	–
Presentation			
Cephalic	95.9	7.9	11.0
Breech	3.6	60.8	71.2
Transverse	0.4	65.7	100
Missing data	0.1	39.0	57.3
Birthweight			
≤ 2500	5.8	23.5	18.1
2501-4000	81.2	9.3	11.0
> 4000	11.7	8.1	16.9
Missing data	1.3	19.1	15.7

Chapter 4 Planned CS

4.1 Breech presentation

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Nelson *et al.* 1986[648]	189 children with cerebral palsy born in 12 university hospitals in the USA between 1959 and 1966 Follow up and analysis at age 7 years	Observational study	Prenatal and perinatal predictors of cerebral palsy	Important predictors before onset of labour Birth weight below 2001 g Major non-CNS congenital malformation Microcephaly at birth Breech presentation Overlap observed between breech presentation and characteristics determined before onset of labour Breech presentation With CP (n = 21): Birth weight < 2.0 kg: 9/21 (43%) Micro-cephaly at birth: 2/21 (9.5%) Congenital malformation: 7/21 (33.3%) Other: 1/21 (4.8%) Any: 13/21 (61.9%)		Case–control	2b
Kitchen *et al.* 1982[58]	89 infants of gestational age from 24–28 weeks born in 1977 and 1988 in 2 Australian hospitals	Observational study Followed up after 2 years	Major handicap as defined as cerebral palsy, Mental Developmental Index < 69, deafness or blindness.	Handicap by presentation at birth (unadjusted figures): Presentation at birth: Vertex: Handicap: 16/36 (27.6%) No handicap: 42/53 (72.4%) Breech or transverse lie: Handicap: 20/36 (64.5%) No handicap: 1153 (35.5%) OR 4.77 (95% CI 1.71 to 13.62) A handicapped baby at 2 years in this population was 5 times as likely to have presented as a breech or transverse lie There was no adjustment for confounding factors for handicap		Case–control	2b

4.1 Breech presentation (external cephalic version)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Hofmeyr, Kulier Cochrane review Update 1999[63]	6 RCTs 1in South Africa 1 in Zimbabwe 2 in the Netherlands 1 in Denmark 1 in the US 612 women with a breech presentation. 3 trials: gestation 37 weeks or more 2 trials: gestation 36 weeks or more 1 trial: 33 to 40 weeks.	External cephalic version (ECV) (with or without the use of tocolysis) vs. No ECV	Non-cephalic births	ECV: 99/303 (32.7%) No ECV: 242/309 (78.3%) RR 0.42 (95% CI 0.35 to 0.50)	External cephalic version for breech presentation at 36 weeks compared with no external cephalic version reduces the incidence of non-cephalic births by 60%. Results were consistent from study to study	Systematic review of randomised controlled trials.	1a
Hofmeyr Cochrane review (Update 1994)[64]	3 RCTs and quasi-randomised trials. 1 in Sweden 1 in Zimbabwe 1 in the Netherlands 889 women with singleton breech presentation before term. ECV before 37 weeks of gestation. 1 trial ECV from 28 weeks 1 trial ECV from 33–36 weeks 1 trial ECV from 32 weeks	External cephalic version (ECV) before term vs. No ECV attempt	Non-cephalic births	ECV: 197/434 (38.5%) No ECV: 204/455 (44.8%) RR 1.02 (95% CI 0.89 to 1.17)	Performing ECV in breech babies before 37 weeks compared with no ECV does not make a difference to the incidence of non-cephalic births. Results were consistent from study to study	Systematic review of randomised and quasi randomised controlled trials.	1a
Hofmeyr Cochrane review update 2001[66]	6 RCTs 617 women with breech presentation at term and no contraindication to ECV	Routine beta-mimetic tocolysis for ECV at term vs. no tocolysis	Failed ECV	Tocolysis: 136/317 (42.9%) No tocolysis: 176/300 (58.7%) RR 0.74 (95% CI 0.64 to 0.87)	The use of betamimetic tocolysis during ECV compared with no tocolysis reduces the incidence of failed ECV by 30%. Results were consistent from study to study	Systematic review of randomised and quasi randomised controlled trials.	1a

4.1 Breech presentation health economics (ECV)

Study	Population	Intervention details	Cost outcomes	Results	Comments	Study type	EL
Gifford 1995[69]	Pregnant women with breech presentation of the baby at term.	1) ECV with TOL (for infants still in breech) 2) ECV with planned CS 3) Selected TOL for infants meeting specific criteria and CS for all others 4) planned CS for all breech infants	Literature review to identify cost and outcomes (probabilities of positive and negative consequences) of the four management options derived from RCTs California state charge data for 1993 as proxy for costs	Expected costs/case were: 1) US$8071 for the ECV and TOL strategy; 2) US$8276 for the ECV and CD strategy; 3) US$8755 for the selected TOL strategy; 4) US$9544 for the scheduled CD strategy	No incremental analysis was performed. Results highly sensitive to probabilities used.	Decision analysis model	
Adams 2000[73]	695 women presenting with breech delivery	ECV	Mean Apgar scores Local hospital charges only. 1996 prices No synthesis of costs and benefits Resource use not analysed separately from costs	ECV attempted in 139 (20%) patients with breech presentation Unsuccessful ECV 56%, of which 7% proceeded to vaginal delivery Successful ECV 44% , of which 67% proceeded to vaginal delivery Estimated savings in charges, US$648/delivery Savings from ECV versus ECV not attempted: around $3000/delivery Potential savings from attempted ECV greater than for success/failure comparisons, based on the charges. This is due to reported higher rate of CS delivery for women not undergoing attempted ECV, and higher cost of CS for the non ECV group compared with the ECV group (US$17476 vs. US$14617)	Small, single institution sample size. Not randomised so groups may not be similar. Sensitivity analysis showed that savings may be as low as under US$1000	Cost consequences	

4.1 Breech presentation health economics (ECV) (continued)

Study	Population	Intervention details	Cost outcomes	Results	Comments	Study type	EL
James 2001[53]	176 women attending one hospital 1995–97	ECV and TOL	Five outcomes recorded: ECV, uncomplicated cephalic delivery, assisted vaginal delivery (breech or cephalic), elective CS or emergency CS. Health service costs only reported. Used original costs from Clark *et al.* (bottom up costs), uplifted to 1997 prices. Prices validated by Regional Finance Directorate (top down costs). Setting: North Staffordshire Cost analysis only, no synthesis of costs and benefits	Vaginal delivery: £447 (baseline) External cephalic version – additional £187 (lower grade)) – additional £193 (higher grade) Assisted delivery (ventouse): – additional £425 (lower grade) – additional £456 (higher grade) Emergency CS: – additional £1,955 (lower grade) – additional £1,992 (higher grade) Planned CS – (no vaginal delivery costs) – £2,403 (lower grade) – £2,439 (higher grade) Decision analysis: ECV yields expected cost of £1,452 vs. £1,828 for non ECV (low staff cost). Expected cost saving £376. With higher staff cost, saving of £384 is estimated. Sensitivity/threshold analysis: Cost of ECV would need to be around £718 for both ECV and non ECV approaches to yield the same overall cost (an increase of 285%) Cost of CS would need to fall to £857 for the non-ECV option to be the least cost option (a fall of 56%) Success rate of ECV would have to fall by 5% for ECV option to be the less favourable option in terms of costs	High and low figures calculated depending on the grade of staff attending delivery	Costing study within decision analysis	

4.1 Breech presentation health economics (ECV) (continued)

Study	Population	Intervention details	Cost outcomes	Results	Comments	Study type	EL
Rozenberg 2000[68]	68 women with breech presentation at 36 weeks of gestation	ECV under epidural anaesthesia after failure of first attempt with tocolysis alone	Effectiveness data: ECV Success rate CS rate for success/ failure Costs analysis covered obstetric procedures; cost data from local and national sources. No patient costs or downstream costs included	Caesarean rate successful ECV group 7.4% unsuccessful ECV group 46.3 % (p = 0.0007) Cost of delivery successful ECV £2,230 unsuccessful ECV £2,595 with no second ECV £2,118 (assuming CS delivery for 75% of breech births) Given probabilities of 57% success for initial ECV and 16% success for second ECV and 27% for ECV failure, the weighted mean cost for attempted ECV was £1,320, and for planned CV for breech without TOL £2,314	No sensitivity analysis No comparison with women who did not undergo ECV	Cost effectiveness	
Kilpatrick 1995[71]	36 women who underwent repeat ECV in one US hospital	Repeat ECV after initial failed ECV	Effectiveness data from a retrospective cohort study 1987–92 Outcome: successful achievement of vertex position in labour and consequent need for CS Hospital costs collected for sample of women retrospectively. Hospital costs only included. Costs and resources analysed together using hospital charge system, converted to 1992 prices	Cost of an ECV US$300 Repeat ECV cost was US$10,800 for 36 patients. Total delivery cost/successful ECV US$5059 (± US$2,656, p = 0.03) Total delivery cost/woman who failed repeat ECV US$8,042 (± £3,439, p = 0.03) Successful repeat ECV on 6 women, cost US$30,354 which would have been $48,252 without repeat ECV (difference $18,000). Subtraction of the cost of ECV leaves a saving of US$7,200	No sensitivity analysis Does not include complications arising from mode of delivery Cohort study may be subject to bias		

4.1 Breech presentation health economics (ECV) (continued)

Study	Population	Intervention details	Cost outcomes	Results	Comments	Study type	EL
Mauldin 1996[72]	203 pregnant women with singleton gestation	ECV	Primary effectiveness outcomes used in the model: successful ECV rate success rate impact on maternal and neonatal outcomes Health service costs only obtained from insurer Prices from year 1996	ECV initial success rate 48% Infants who remained vertex 83 % Vaginal delivery after successful ECV 66% CS after successful ECV 34% Unsuccessful ECV remaining vertex 14% and of these 67% delivered vaginally 5% were transverse and 81% breech Higher parity, transverse oblique presentation, longer pregnancy and posterior placenta were all associated with significantly increased likelihood of successful version Cost estimates ECV US$285 Cephalic CS US$9967 Breech CS US$10,783 Cephalic VD US$5,583 Breech VD US$ 5,996 All VD US$5,585 All CS US$9,883 Mean savings/successful; ECV US$2,462 compared with unsuccessful ECV at 48% success Higher success rate would yield higher savings	Resources not analysed separately from costs No synthesis of costs and benefits	Cost effectiveness	

4.1 Breech presentation health economics (ECV) (continued)

Study	Population	Intervention details	Cost outcomes	Results	Comments	Study type	EL
Mauldin 1998[649]	84 twin gestations with vertex and non vertex twins: 41 selected for TOL 19 for ECV 24 for planned CS	Breech extraction ECV Planned CS	Clinical outcomes, maternal and neonatal morbidity rates Hospitalisation (not used in economic analysis) Charge data from one hospital (US) 1996 prices Costs and benefits not combined	Maternal morbidity rate: Breech extraction: ECV 42% CS group 37% n.s. Maternal LOS: Breech extraction 3.4 days ECV 6.3 days CS group 7.0 days (p < 0.0001) Neonatal pulmonary disease: Breech extraction 7% ECV 24% CS group 31% (p = 0.002) Neonatal infectious disease: Breech extraction 1% ECV 0% CS group 16% (p = 0.0005) Infants requiring ventilator: Breech extraction 5% ECV 12% CS group 14% (p = 0.01) Infants admitted to SCBU: Breech extraction 71% ECV 51% CS group 50% (p = 0.0001) Infant hospitalisation: Breech extraction 4.8 days ECV 12.4 days CS group 17.8 days (p = 0.0001) Charges: TOL group: US$5890 ± US$2,304 ECV group: US$8,638 ± $4,175 CS group: US$7,814 ± 3294 ANOVA p = 0.001	Retrospective cohort study in a single centre, open to bias Resources not reported separately from costs No synthesis of costs and benefits		

4.1 Breech presentation

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Van Loon *et al.* 1997[650]	235 women with singleton breech presentation at term Term defined as duration 37 weeks gestation or more Randomised between January 1993 and April 1996 US hospital	Pelvimetry results revealed to obstetricians vs. pelvimetry results not disclosed to obstetricians (mode of delivery decided clinically)	Vaginal delivery Overall CS rate Emergency CS rate	CS percentage: VD: Pelvimetry results revealed: 68/118 (57.6%) Pelvimetry results not disclosed: 58/117 (49.6%) RR 1.16 (95% CI 0.91 to 1.48) Overall CS rate: Pelvimetry results revealed: 50/118 (42.2%) Pelvimetry results not disclosed: 59/117 (50.4%) RR 0.84 (95% CI 0.64 to 1.11) Emergency CS rate: Pelvimetry results revealed: 22/118 (18.6%) Pelvimetry results not disclosed: 41/117 (35.0%) RR 0.53 (95% CI 0.34 to 0.83) NNT: 6	Revealing pelvimetry results prior to making a decision about mode of delivery did not make a difference to the vaginal delivery rate or the CS rate but reduced the emergency CS rate by 50% Computer-generated randomisation No description of allocation concealment Women were analysed by intention to treat	RCT	1b

4.1 Breech presentation and CS

Mother outcomes

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Hofmeyr and Hannah Cochrane Systematic review updated 2000[36]	3 RCTs involving 2396 women with a breech presentation at term suitable for vaginal delivery	Planned CS vs. planned vaginal delivery	Maternal morbidity (pooled) Maternal morbidity measures included: – Postpartum bleeding (including blood transfusion) – Genital tract injury – Wound infection, dehiscence or breakdown – Maternal systemic infection – Early postpartum depression – Time in hospital after delivery	Planned CS: 107/1169 (9.2%) Planned vaginal delivery: 106/1227 (8.6%) RR (95% CI): 1.29 (1.03 to 1.61)	Planned CS compared with planned vaginal delivery increases maternal morbidity by 30% Results generally consistent from study to study	Systematic review of randomised controlled trials	1b
Hannah *et al.* 2000[48]	2088 women with a singleton fetus in a frank or complete breech presentation at term. Multicentre randomised trial at 121 centres in 26 countries (high and low perinatal mortality rates)	Planned CS vs. planned vaginal delivery	Maternal mortality	Planned CS: 0/1041 Planned vaginal delivery: 1/1041	Centrally controlled randomisation Analysis was by intention to treat	RCT	1b
Gimovsky *et al.* 1983[43]	105 women with non frank breech presentations at term. US hospital	Trial of labour vs. elective CS	Maternal mortality	No report of maternal deaths	Method of randomisation not indicated.	RCT	1b
Collea *et al.* 1980[44]	208 women with frank breech presentation at term. US hospital	Trial of labour vs. elective CS	Maternal mortality	No report of maternal deaths	Method of randomisation not indicated	RCT	1b

Baby outcomes

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Hofmeyr and Hannah Cochrane Systematic review updated 2000[36]	3 RCTs involving 2396 women with a breech presentation at term suitable for vaginal delivery[3]	Planned CS vs. planned vaginal delivery	Perinatal and neonatal death (excluding fatal anomalies)	Planned CS: 3/1166 (0.26%) Planned vaginal delivery: 14/1222 (1.15%) RR 0.29 (95% CI 0.10-0.86) Countries with low (20/1000 or less) perinatal mortality rate was 0.26 (95% CI 0.03 to 2.00)	Planned CS is associated with a 70% decrease in mortality compared with planned vaginal delivery for breech delivery at term.	Systematic review of randomised controlled trials	1a

4.1 Breech presentation and CS (continued)

Baby outcomes

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Hofmeyr and Hannah Cochrane Systematic review updated 2000[36]	3 RCTs involving 2396 women with a breech presentation at term suitable for vaginal delivery	Planned CS vs. planned vaginal delivery	Perinatal death or neonatal morbidity Neonatal morbidity measures included: – Birth trauma – Seizures occurring at less than 24 hours of age or requiring two or more drugs to control them. – Apgar score of less than 4 at 5 min – Cord blood base deficit of at least 15 – Hypotonia for at least 2 hours – Stupor, decreased response to pain or coma. – Intubation and ventilation for at least 24 h – Tube feeding for 4 days or more – Admission to the neonatal intensive care unit for longer than 4 days.	Planned CS: 20/1132 (0.18%) Planned vaginal delivery: 66/1152 (5.73%) RR 0.31 (95% CI 0.19 to 0.52) Countries with low (20/1000 or less) perinatal mortality rate was 0.13 (95% CI 0.05 to –0.31)	Planned CS is associated with a 70% decrease in death or morbidity compared with planned vaginal delivery for breech delivery at term.	Systematic review of randomised controlled trials	1a
Hofmeyr and Hannah Cochrane Systematic review updated 2000[36]	3 RCTs Involving 2396 women with a breech presentation at term suitable for vaginal delivery.	Planned CS vs. planned vaginal delivery	5-minute Apgar < 7	Planned CS: 11/1164 (0.94%) Planned vaginal delivery: 38/1211 (3.14%) Total: 3/1039 (0.3%) RR 0.32 (95% CI 0.17 to 0.61)	Planned CS compared with planned vaginal delivery reduced the incidence of 5min Apgar score < 7 by 70%	Systematic review of randomised controlled trials	1a
Hannah *et al.* [48]	Pregnant women with a singleton fetus in a frank or complete breech presentation Randomised multicentre trial	Planned CS 1041 Planned vaginal birth 1042	Perinatal mortality, neonatal mortality or serious neonatal morbidity Maternal mortality or serious maternal morbidity	Planned CS: Low national perinatal mortality rate: 0/514 High national perinatal mortality rate: 3/525 (0.6%) Planned vaginal birth: Low national perinatal mortality rate: 3/511 (0.6%) High national perinatal mortality rate: 10/528 (1.9%) Total: 13/1039 (1.3%) Relative risk 0.23 (95% CI 0.07 to 0.81) p = 0.01	Overall, a policy of planned CS one baby will avoid death or serious morbidity for every additional 14 CS done May be higher (up to 39) in Countries with a high PMR And as low as 7 in a country with a low PMR Babies with lethal congenital abnormalities Excluded from analysis	RCT	1b

4.2 Multiple pregnancy

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Crowther, 2000[37]	60 pairs of twins (see trial below for more details)	Vaginal delivery versus CS for second twin in a breech position	Maternal: Duration of hospitalisation, febrile morbidity, need for blood transfusion, operative morbidity Neonatal: Apgar scores, birth trauma, neonatal mortality and morbidity	Maternal febrile morbidity: RR 3.67 (95% CI 1.15 to 11.69)	Only one trial	Systematic review	1a
Rabinovici, 1987[45]	60 women in spontaneous or induced labour with twin pregnancy-both twins alive-first twin vertex, 2nd twin breech/transverse lie Gestational age 35–42 weeks Exclusion criteria: Fetal anomaly Signs of abruption or acute placental insufficiency. Indication for CS or vaginal delivery Cervix > 7 cm dilated	As above	As above	Maternal febrile morbidity: Elective CS: 11/27 (40.7%) Vaginal delivery: 3/27 (11.1%) RR 3.67 (95 % CI 1.15 to 11.69) No difference in neonatal outcomes	Blinding of treatment allocation not possible Exclusion after randomisation 9% No pretrial sample size given	RCT	1b
Rhydstrom, 2001[87]	18125 twins delivered in Sweden between 1991 and 1997 Breech vaginal delivery vs. CS all twins, all gestations	Observational study	Neonatal mortality by mode of delivery and presentation-breech vaginal delivery vs. CS	All gestations: OR 1.47 (95% CI 0.99 to 2.17) < 32 weeks: OR 2.50 (95% CI 1.58 to 3.99) 32–36 weeks: OR 0.40 (95% CI 0.13 to 1.24) > 37 weeks: OR 0.48 (95% CI 0.13 to 1.71)		Cohort	2b
Abu-Heija,1997[651]	58 sets of twin pregnancies with twin 1 breech 37 delivered by CS. 21 delivered vaginally	Observational study	Perinatal mortality and morbidity	No differences in perinatal mortality by mode of delivery No differences in perinatal morbidity as measured by Apgar scores at 1 and 5 minutes		Cohort	2b

4.2 Multiple pregnancy (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Essel, 1996[652]	68 women carrying twin gestations breech–breech and breech–transverse presentations delivered in a South African hospital between February 1989 27 delivered by CS 41 delivered vaginally Inclusion criteria for vaginal delivery Estimated fetal weight < 3500 g Well-flexed fetal head No footling breech presentation Clinically adequate maternal pelvis	Prospective observational study (CS vs. vaginal delivery)	Birth weights, 5-minute Apgar score ≤ 7, neonatal mortality	Both twin 1 and twin 2 in the CS group had greater birth weights than their cohort delivered vaginally ($p < 0.02$ for twin 1 and $p < 0.01$ for twin 2) No difference in Apgar score or neonatal mortality	Underpowered for neonatal mortality	Cohort	2b
Blickstein, 1993[653]	69 sets of twins in breech-vertex presentation 35 delivered by CS 24 delivered vaginally	Retrospective observational study	Maternal outcomes: – Maternal mortality – Postpartum haemorrhage – Febrile morbidity Baby outcomes: – Perinatal death – Birth trauma	There was no difference any of the maternal or baby outcomes		Cohort	2b
Greig, 1999[88]	457 sets of twins Second twin Breech and vertex presentation	Record review	1- and 5-minute Apgar scores, umbilical artery and vein pH, duration of neonatal hospitalisation, incidence and length of ventilation, IVH, birth trauma, mortality rates (Apgar score results presented by mean according to weight group)	Study did not show any difference in any of the outcomes other than mean 1-minute Apgar This was lower in breech, vaginal births at birth weight > 2500 g ($p = 0.02$) There was only one case of significant birth trauma among the 457 sets of twins which occurred in the vaginal delivery group		Cohort	2b

4.2 Multiple pregnancy (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Gocke, 1989[654]	136 twin gestations with non-vertex second twins Birth weights > 1500 g	Observational study (delivery by CS vs. vaginal delivery of second twin) Vaginal delivery group consists of attempted external version and primary breech extraction	Maternal outcomes: – Postpartum hospital stay – Need for blood transfusion – Endometritis Baby outcomes: – Neonatal death – Birth trauma – 5-minute Apgar score < 7 – Admission to SCBU	No difference in any outcomes other than length of maternal hospital stay. This was longer with CS ($p < 0.05$)	Length of hospital stay anticipated to be longer with CS	Cohort	2b
Petterson, 1993[80]	Babies delivered in Western Australia 1980–1989 226,517 singletons 5132 twins 225 triplets	Observational study	Cases of cerebral palsy	Cerebral palsy/1000 live births: Singleton: 1.6 (95% CI 1.4 to 1.8) Twin: 7.4 (95% CI 5.3 to 10.0) Triplet: 95% CI 26.7 (11 to 60)		Longitudinal	3
Dommergues, 1995[93]	55 sets of triplets CS 23, vaginal delivery 23	Observational study	Neonatal mortality	Neonatal mortality by mode of delivery: CS: 0/69 (0.0%) Vaginal delivery: 1/69 (1.5%) p value: NS		Cohort	2b
Ziadeh, 2000[94]	41sets of triplets at 28 weeks or more 20 delivered by CS, 21 delivered vaginally	Observational study	Baby outcomes: – Perinatal death – Apgar score of < 7 at 5 minutes	Perinatal death by mode of delivery: CS: 18/60 (30.0%) Vaginal delivery: 14/63 (22.2%) $p < 0.05$ Apgar score < 7 at 5 minutes: CS: 8/60 (3.3%) Vaginal delivery: 6/63 (9.5%) $p < 0.05$		Cohort	2b
Clarke,1994[655]	19 triplet pregnancies delivered between 1981 and 1982 in a hospital in New Zealand: CS 12; vaginal delivery 7 Mean gestation at delivery 33 weeks (all) CS 31 weeks and 6 days Vaginal delivery 35 weeks and 2 days	Observational study	Perinatal death Apgar < 7 at 5 minutes	Perinatal death: CS: 6/18 (33.3%) Vaginal delivery: 0/21 (0.0%) Apgar score < 7 at 5 minutes CS: 18/36 (50.0%) Vaginal delivery: 3/21 (14.9%)		Cohort	2b

4.2 Multiple pregnancy (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Wildschut, 1995[92]	31 triplet pregnancies for planned abdominal delivery versus 39 for planned vaginal birth	Retrospective cohort	Perinatal mortality and early neonatal complications	Perinatal mortality: Perinatal mortality*: Vaginal: 7.8% CS: 18.4% p = 0.02 Neonatal complications: Vaginal: 36% CS: 31% p = 0.03 *Fetuses < 500 g excluded		Cohort	2b

Timing of planned CS for twin pregnancy

Study	Population	Intervention	Outcomes	Results	Comments	Design	EL
Chasen, 1999[96]	79 sets of twins delivered by CS between 36 weeks and 37 weeks 6 days vs. 47 sets of twins delivered between 38 weeks and 40 weeks 2 days Delivered at a US hospital between 1993 and 1997 Inclusion criterion: gestational age ≥ 36 weeks gestation	Observational study	Respiratory distress syndrome and transient tachypnoea of the newborn	Incidence of respiratory distress syndrome by mode of delivery: Neonates with respiratory disorders: Gestation at delivery < 38 weeks: 10/11 (90.9%) Neonates without respiratory disorders: Gestation at delivery < 38 weeks: 69/115 (60.6%) p = 0.04		Case–control study	3

4.3 Preterm birth and CS; 4.4 Small for gestational age and CS*

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Sachs, 1983[101]	376350 singleton deliveries, vertex and breech, all birth weights	Audit	Neonatal mortality rate (NMR) = number of live born infants dying within the first 28 days/1000 live births	All vertex births: NMR VD: 243 (1521) NMR CS: 246 (285) RR 1.0 Birth weights 1000–1500 g: NMR VD: 172 (99) NMR CS: 129 (70) RR 1.3 (95% CI 1.1 to 1.5) Neonatal MR for vaginal vs. caesarean births	The results for vertex presentations only are given here	Audit	3
Atrash, 1991[102]	Retrospective collection of data on recorded neonatal deaths of single births (n = 7808)		RR and 95% confidence intervals of mortality among single caesarean births compared with vaginal births in different weight groups	500–1499 g: RR 0.72: (95% CI 0.69 to 0.76) 1500–2499 g: RR 1.46: (95% CI 1.31 to 1.63) 2500–3499 g: RR 2.06: (95% CI 1.85 to 2.30) 3500–8165 g: RR 2.08: (95% CI 1.78 to 2.44) Total: RR 1.57: (95% CI 1.49 to 1.65)	Actual data were not published, only calculated RR. Neonatal mortality risk also calculated in terms of race (results not given here as only locally relevant)	Audit	3
Grant, 2000[35]	Systematic review of elective CS versus expectant management for delivery of the small baby. Six studies identified. Details of the 2 trials addressing preterm vertex births are shown here						
Lumley, 1984[40]	Patients delivering from 26–31 weeks	Planned CS vs. expectant management with selective CS	Multiple maternal and neonatal mortality and morbidity indices	Nil published	Abandoned as > 40% of elig1ble patients were withdrawn pre randomisation on consultants discretion	RCT	1b
Wallace,1984[41]	Established preterm labour, 26–33 weeks, cephalic	Planned CS vs. expectant management with selective CS	Apgar, neonatal death, neonatal complications		Abandoned as birth weights of babies entered into the study were in excess of VLBW.	RCT	1b
Rosen, 1984[100]	17,260 vertex deliveries at all birth weights, collected retrospectively	Retrospective review of cases	Intra partum death, neonatal death, gross neonatal neurological morbidity	Neonatal deaths: 1000 g: VD–ND 25; CS–ND 13; p = 0.5 2000 g: VD–ND 5; CS–ND 4; p = 0.0002 3000 g: VD–ND 9; CS–ND 3; p = 0.014	Selection of results only (35 variables considered)	Survey	3

4.3 Preterm birth and CS; 4.4 Small for gestational age and CS* (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Topp, 1997[99]	175 cases from the Danish Cerebral Palsy register, 687 controls (4/case) randomly selected preterm babies	Search of maternity birth records for details of pregnancy and birth	Complications in pregnancy and mode of delivery when comparing cases with CP and matched controls	Rate of CS higher in cases but not when breech and vertex considered separately: Cases (n = 175); controls (n = 687) V: 75 cases (59%); 266 controls (50%) OR 1.47 (95% CI 0.96 to 2.24); p: NS B: 43 cases (90%);121 controls (79%) OR 1.81 (95% CI 0.6 to 5.47); p: NS Total: 118 cases (67%); 387 controls (56%); OR 1.67 (95% CI 1.16 to 2.41); p = 0.01		Case–control	2b

Studies included consider all small babies: preterm and SGA

4.6 Mother-to-child transmission of maternal infections

HIV

Study	Population	Intervention	Outcomes	Results	Comments	Design	EL
European Mode of Delivery Collaboration, 1999[47]	n = 436 women between 34 and 38 weeks of pregnancy with confirmed HIV-1 diagnosis without indication (or contraindication)	Caesarean section delivery vs. vaginal delivery	HIV infection status of child by 18 months (n = 370)	Intention-to-treat by infection status: CS: negative 167 (98.2%); positive 3 (1.8%); OR 0.2 (95% CI 0.1 to 0.6) VD: negative 179 (89.5%); positive 21 (10.5%); OR 1.0	No woman breastfed Randomisation through computer generated lists and analysis by intention to treat and by actual mode of delivery	RCT	1b
	For CS delivery in various European countries, including the UK			Actual mode of delivery by infection status: CS (all) : negative 196 (96.5%); positive 7 (3.5%); OR 0.4 (95% CI 0.2 to 0.9) Elective CS: negative 165 (97.6%); positive 4 (2.4%); OR 0.4 0.3 (95% CI 0.1 to 0.8) Emergency CS: negative 31 (91.2%); positive 3 (8.8%); OR 0.4 1.0 (0.3 to 3.7) VD: negative 179 (89.5%); positive 21 (10.5%); OR 0.4 (1.0)			
Urbani, 2001[124]	307 women who delivered by CS	59 HIV positive women, 248 HIV negative women. Cross-sectional study	Demographic comparisons, indications for CS, mean maternal haemoglobin, endometritis, durationof hospital stay	Endometritis: HIV+ 24%; HIV– 7%; 5 p = 0.0003 Hospital stay (mean days): HIV+ 4.2; HIV– 4.3; p: NS Mean duration of antibiotic use: no data given No other differences between the HIV+ and HIV– groups	HIV positive women had a CD4 count < 200.	Cross-sectional	3
Rodrigues, 2001[122]	86 HIV+ women undergoing a CS	Case–control study Comparison with 86 HIV negative women having CS	Minor and major postoperative complications	Minor complications: HIV+ 66.3%; HIV– 41.8%; OR 2.73 (95% CI 1.4 to 6.1) Major complications: HIV+ 9.3; HIV– 3.4; OR 2.84 (95% CI 0.65 to 14.06)		Case control	2b

4.6 Mother-to-child transmission of maternal infections (continued)

HIV

Study	Population	Intervention	Outcomes	Results	Comments	Design	EL
Maiques-Montesinos, 1999[123]	45 HIV+ women having CS	Comparison with 90 matched controls	Baseline compared with post-operative characteristics, duration of hospital stay, need for postoperative antibiotics, incidence of minor and major puerperal complications	Days of hospital stay; HIV+ 8.0; HIV– 7.0; p < 0.0005 Need for post operative antibiotics; HIV+ 29; HIV– 18; p < 0.00001 Mild temperature (37.5-380) ; HIV+ 15; HIV– 9; p < 0.002 Fever (> 380 C) ; HIV+ 17; HIV– 10;p < 0.0005 Wound infection; HIV+ 12; HIV– 6; p < 0.003	HIV positive women with CD4 within normal limits did not differ in terms of hospital stay with control women	Retrospective case–control	2b
Grubert, 1999[121]	62 HIV+ women undergoing CS	Compared with 62 HIV negative women	Major complications (fever > 48 hours requiring antibiotics, further surgery needed, blood transfusion) Minor complications (transient fever, impaired wound healing, lochiostasis, endometritis)	Minor complications: HIV+ 5; HIV– 4; OR 1.3 (95% CI 0.3 to 4.9) Major complications: HIV+ 20; HIV– 77; OR 3.7 (95% CI 1.4 to 9.6) No difference between women on antiretrovirals and those who were not		Retrospective case–control	2b

HIV health economics

Note: level of evidence is not relevant to economic models and therefore not been included here

Study	Population	Intervention details	Cost Outcomes	Results	Comments	Study type
Halpern 2000[127]	4958 HIV positive women who did not breastfeed	Planned CS versus VD	Cases of mother-to-child transmission of HIV avoided Child's life-years saved based on average US life expectancy of 75.8 years and the estimated life expectancy of 9.4 years for an HIV-infected child Costs estimated from published data, inflated to 1998 prices, reported at population level only Discounting at 5%	68% women received ART Seroprevalence rate 1.7/1000 Planned CS vs. VD led to a reduction of: – 466 vases with no ART – 198 cases with ZDV – 120 cases with combination ART Planned CS resulted in saving of US$4,359,377 Incremental cost effectiveness of planned CS over VD: ECS was the dominant strategy (more effective, less costly) when no ART used Incremental cost-effectiveness of planned CS over VD with ZDV: US$1,131/case avoided and US$112,693/life year saved With combination ART: US$1,697/case avoided and US$112,693/life year saved	Resources and costs not reported separately Results were sensitive to vertical transmission rates and costs of treating paediatric HIV disease	Cost-effectiveness with modelling
Mrus 2000[126]	Hypothetical cohort of expectant mothers with HIV	Planned CS versus VD	Total life time costs Quality adjusted life expectancy Maternal death rate, HIV transmission rate Data from literature review (RCTs) including complication rates Future medical costs discounted	Base line results: Caesarean section 34.9 infected infants/1000 deliveries Vaginal delivery 62.3 infected infants Compared with vaginal delivery, CS results in US$3900 savings/birth and 24.7 fewer HIV infected infants/100,000 deliveries (dominant strategy) This result did not change over a wide range of assumptions Threshold analysis Only when transmission rate fell to 1.3% and the RR of transmission exceeded 89% did the elective CS cost more than VD	Extensive sensitivity analysis undertaken on all parameters	Cost-effectiveness with modelling

HIV health economics (continued)

Note: level of evidence is not relevant to economic models and therefore not been included here

Study	Population	Intervention details	Cost Outcomes	Results	Comments	Study type
Chen 2001[128]	7000 HIV infected women	Planned CS versus VD	Effectiveness data from published RCTs (1996–99) Outcome: Proportion refusing CS delivery Proportion undergoing vaginal and CS delivery Transmission rates Complication rates (from prospective studies not RCT data) Third party payer costs, derived from review of the evidence, converted into 1998 US$ prices Lifetime costs discounted at 5% Resource use data from completed studies (1995–99) Price years 1998	Cost data used in the model: VD without complications: US$2,269 VD with complications: US$3,230 CS without complications: US$4,316 CS with complications: US$5,576 Lifetime costs of medical care for paediatric HIV: US$86,130 Synthesis costs and benefits Cost saving of US$37,284/case of perinatal HIV infection prevented after elective CS was recommended (range US$7,742 when cost of CS was US$5,577, to US$286,963 when life time costs of medical care for paediatric HIV infection was £335,809) Threshold analysis: CS is no longer a cost-saving option under the following conditions: If perinatal transmission rate were decreased by 43.3% for all methods If the cost of uncomplicated vaginal delivery was less than US$556 If the cost of uncomplicated CS delivery was less than US$5,907 If the discounted lifetime costs for paediatric HIV infection was less than US$49,000		Cost-effectiveness analysis
Ratcliffe 1998[125]	Hypothetical cohort of women with confirmed HIV status	Strategies to prevent transmission of HIV Planned CS vs. other mode of delivery Bottle feeding Bottle feeding plus CS Bottle feeding plus CS plus ZDV	Health service costs from data published in 1991 and 1996 And from one London maternity unit; adjusted to 1996 prices Evidence data from published studies 1992–97	Cost: No intervention £502.50 Bottle feeding £503.80 Bottle feeding plus CS £726.20 Bottle feeding plus ZDV £1,189.30 All three £1,411.70 Incremental cost effectiveness ratios (cost/transmission avoided compared with next best option) Bottle feeding £15 Bottle feeding plus CS £9,248 Bottle feeding plus ZDV £7,594 All three £18,546	Reported ICER from clinical ad public health perspective (different estimates of transmission risk). Public health perspective reported here	

Hepatitis B virus

Study	Population	Intervention	Outcomes	Results	Comments	Design	EL
Lee *et al.* 1988[135]	447 infants born to mothers positive for Hepatitis B e antigen and hepatitis B surface antigen who received hepatitis B immunisation antenatally 62 delivered by CS 385 delivered by vaginal delivery	After birth infants were given differing schedules of hepatitis vaccine and immunoglobulin at 2 weeks and 1 and 2 months: Schedule: 1 = vaccine alone 2 = vaccine +HBIG x 1 3 = vaccine + HBIG x 2	Hepatitis B infection in neonates	HBV infected/total infants: Vaccine alone: CS: 3/9 (33%) VD: 39/99 (39%) Vaccine +HBIG x 1: CS: 3/43 (7%) VD: 45/221 (20%) Vaccine + HBIG x 2: CS: 6/62 (< 10%) VD: 96/385 (24.9%) p < 0.02		Non-randomised controlled study	2a

Hepatitis C virus

Study	Population	Intervention	Outcomes	Results	Comments	Design	EL
Pembrey, 2001[138]	1474 hepatitis C virus infected women from 36 centres in eight Western European countries	Observational study	Effect of mode of delivery on risk of mother-to-child transmission of HCV	Risk of vertical transmission for women with HIV co-infection: CS:13/159 (8.2%); crude OR 0.43 (95% CI 0.23 to 0.80) VD: 57/329 (17.3%) Risk of vertical transmission for women without HIV co-infection: CS: 15/218 (6.9); crude OR 1.19 (95% CI 0.64 to 2.20) VD: 39/666 (5.9)	Adjustment for breastfeeding status, centre category and maternal age at delivery	Retrospective analysis of audit data	3
Papaevangelou, 1998[656]	62 offspring born to 54 HCV and HIV co-infected women in a New York hospital between March 1987 and October 1994	Observational study	Infant HCV infection as assessed by nested RNA PCR	Risk of vertical transmission by mode of delivery: CS: 3/16 (18.8%); RR 1.09 (95% CI 0.31 to 3.83) VD: 6/35 (17.1%)		Cohort	2b

Genital herpes simplex virus

Study	Population	Intervention	Outcomes	Results	Comments	Study type	Evidence level
Nahmias, 1971[142]	238 women with genital herpes during pregnancy or at their first postpartum visit	Observational study	Neonatal infection with HSV	Number of infections: Vaginal delivery: 4/9 Abdominal delivery: 0/2	Very small numbers	Observational study	3
Scott, 1996[152]	46 pregnant women with first episode of HSV during pregnancy	Acyclovir 400 mg tds versus placebo from 36 weeks gestation	Delivery by CS for recurrent infection	OR = 0.04 (95% CI 0.002 to 0.745) for delivery by CS in women taking acyclovir compared with placebo		RCT	1b
Brocklehurst, 1998[151]	63 pregnant women with recurrent genital herpes infection < 36 weeks	Acyclovir orally from 36 weeks till term. Control group received placebo	Delivery by CS for recurrent infection	OR = 0.44 (95% CI 0.09 to 1.59) for delivery by CS in women taking acyclovir compared with placebo		RCT	1b
Braig, 2001[153]	288 pregnant women with at least one episode of HSV during pregnancy, 201 women with a history of genital herpes but no recurrence in the index pregnancy	Group 1: 167 women received oral acyclovir from 36 weeks till term Group 2: 121 women given placebo Group 3: 201 women (history only) received placebo	Viral shedding in pregnancy and CS for HSV	CS: Group 1: 8.4% Group 2: 16.5% Group 3: 9.9% p < 0.001 Viral shedding: Group 1: 0% Group 2: 5% Group 3: 0.5% p < 0.05		RCT	1b

Genital herpes simplex virus health economics

Note: level of evidence is not relevant to economic models and therefore not been included here

Study	Population	Intervention details	Cost Outcomes	Results	Comments	Study type
Randolph 1993[154]	Hypothetical cohort of 1 million women with and without herpes lesions at delivery, and women with and without a history of HSV and herpes lesions at delivery	Universal CS	Efficacy of CS Neonatal deaths Neonatal severe disability Neonatal moderate disability Neonatal normal outcome Incremental maternal mortality following CS (in excess of vaginal delivery mortality QALY analysis assumed death = 0 severe disability 0.1 weighting Moderate disability 0.5 weighting. Future costs and benefits (QALYs) discounted at 4% Hospital care and lifetime disability costs included. Price date not given Costs over 30 years Calculated as incremental cost of CS over standard delivery.	Efficacy of CS 80% Neonatal deaths 0.183 Neonatal severe disability 0.154 Neonatal moderate disability 0.101 Neonatal normal outcome 0.562 Incremental maternal mortality following CS (in excess of vaginal delivery mortality) 0.00015 9 neonatal cases averted/million births for women with a history of HSV/ lesions at delivery 18 neonatal cases prevented/million births for women with no history. Universal CS delivery represents US$2.5 million/case of neonatal HSV averted from women with recurrent herpes For women with no history of genital HSV before delivery, the cost/case of is a saving of over US$38,000	Costs and resources not reported separately, but estimates based on non-systematic review of the literature Extensive sensitivity analysis around rates of transmission validity findings, but no sensitivity analysis of cost data	Cost-effectiveness analysis, with decision analysis
Randolph 1996[155]	10,000 women with at least one documented outbreak of genital herpes	Four strategies: A: CS B: acyclovir prophylaxis and CS C: acyclovir prophylaxis in late pregnancy and vaginal delivery, with screening and follow up of infants D: Do nothing	Case of vertically transmitted herpes prevented Resource use and cost reported separately Price year not reported	Strategy A: US$4,056,203/case prevented (2.8 cases) Strategy B: US$3,076,749/case prevented (5.5 cases) Strategy C: US$2,363,634/case prevented (5.0 cases) Strategy D: US$361,724/case prevented (nil) Incremental cost/case prevented (compared with doing nothing, strategy D): A: US$1,319,457 B: US$493,641 C: US$ 400,382	Effectiveness data from RCTs One hospital setting. Sensitivity analysis not thoroughly investigated, which weakens the conclusions	

Genital herpes simplex virus health economics (continued)

Note: level of evidence is not relevant to economic models and therefore not been included here

Study	Population	Intervention details	Cost Outcomes	Results	Comments	Study type
Scott 1998[156]	46 pregnant women with their first case of HSV during pregnancy (group 1) a history of HSV (group 2) or a diagnosis of HSV before pregnancy but no frequent recurrence (group 3)	Acyclovir suppression versus no therapy	Risk of HSV recurrence at delivery and CS rates in treated and untreated groups Recurrence without therapy 30% Costs based on clinical charges during 1995	Mean cost/patient US$7,225 treated and US$7,625 not treated Highest cost savings US$455/patient produced by women whose first episode occurred during pregnancy Rate of CS was the most sensitive variable for groups 1 and 2 Results also sensitive to compliance rates	Effectiveness data from RCT Costs/resources not reported separately Given the lack of details of costs, difficult to apply to other settings	Cost analysis (prevention and treatment)

4.7 Maternal request for CS

Rates of maternal request for CS

Study	Population	Intervention	Outcomes	Results	Comments	Design	EL
Gamble[157]	12 observational studies including total of 13285 women in Australia, Ireland, Sweden and UK In 11 studies the women were surveyed just after delivery In one study women were surveyed ante natally (n = 33)	Observational study	Rates of maternal request for CS	All CS: 1.5% to 28% Elective CS: 5% to 48% In absence of known current or previous obstetric complications: 0% to 1%	Variety if methods used: structured questionnaires/ interviews and review of case notes Data collection was primarily done by clinicians Post hoc rationalisation Studies did not address quality or amount of information women were given about CS Limited investigation of reasons for requesting CS such as previous negative birth experiences or sexual abuse	Review	3
Gamble[157]	310 women in Australia recruited from antenatal clinics, between 36 to 40 weeks of gestation	Observational study	Rates of maternal request for CS	Nulliparae: 2.9% Multiparae: 9.2% All women: 6.4%	Data collected using questionnaires	Cross-sectional	3
Johanson[158]	117 women attending a UK antenatal clinic	Observational study	Rates of maternal request for CS	Nulliparae: 9% Multiparae: 5% All women: 8%	Data collected using questionnaires	Cross-sectional	3

4.7 Maternal request for CS (continued)

Rates of maternal request for CS

Study	Population	Intervention	Outcomes	Results	Comments	Design	EL
Hildingsson[160]	3061 women attending 593 antenatal clinics in Sweden	Observational study	Rates of maternal request for CS	Preference for CS: All women: 8.2% Parity: Primiparae: 7.0%; RR 1.00 Multiparae: 9.0%; RR 1.2 (95% CI 1.0 to 1.6) Age: < 25 years: 8.0%; RR 1.0 (95% CI 0.7 to 1.4) 25–35 years: 8.0%; RR 1.0 > 35 years: 11.0%; 1.5 (95% CI 1.0 to 2.1) Previous mode of delivery: VD: 5.0%; RR 1.0 Elective CS: 49.0%; RR 9.4 (95% CI 6.9 to 12.8) Emergency CS: 32.0%; 6.2 (95% CI 4.6 to 8.3)	Data collected using questionnaires	Cross-sectional	3
NSCSA[4]	2475 women booked to deliver in 40 maternity units in England, Wales and Northern Ireland, surveyed antenatally (average gestation 35 weeks)	Observational study	Maternal preference for delivery	Preference for CS: All women: 5.3% Primigravida: 3.3% All multiparae: 7.0% Multiparae, previous SVD only: 3.2% Multiparae with previous CS: 19.9% Multiparae with previous operative vaginal delivery: 7.0% Multiparae with previous stillbirth or neonatal death: 9.4% No problems reported in current pregnancy: 4.7%	Data collected using questionnaire	Cross-sectional	3
Potter[161]	1612 pregnant women in Brazil Interviewed twice antenatally and once postpartum	Observational study	Maternal preference for delivery	80–90% of all women declared preference for vaginal delivery Over 80% of multiparae with no previous CS and 42% of multiparae with previous CS had a preference for vaginal delivery	CS rates in Brazil: 70% in private sector, 30% in public sector	Cross-sectional	3

4.7 Maternal request for CS (continued)

Rates of maternal request for CS

Study	Population	Intervention	Outcomes	Results	Comments	Design	EL
Osis[162]	656 women who had given birth in Brazil, interviewed postnatally	Observational study	Maternal preference for delivery	Preference for vaginal delivery was expressed by 90% of women who had had a previous vaginal delivery compared with 75% of women who had had previous CS only		Cross-sectional	3
Edwards[159]	All women attending an antenatal clinic in Wales July–November 1999	Observational study	Maternal preference for delivery	Preferred mode of delivery (n = 344): Await spontaneous labour/ IOL at term +12 days: 79% IOL at 39 weeks: 6% Elective CS at 39 weeks: 14% Reasons given for elective CS preference: To avoid vaginal trauma: 28% Safer for baby: 25% To avoid a long labour: 21% Timed delivery: 18% Existing medical problems: 7% To prevent an emergency CS: 2%	Response rate to survey not reported	Cross-sectional	3

Fear of childbirth

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Melender[165]	481 women 16–40 weeks gestation, Finland 2000–2001	Observational study Use of a structured questionnaire about objects, causes and manifestation of fear	Factor analysis of the structured questionaire	Of 329 respondents, 78% expressed fears relating to pregnancy, childbirth or both. Fears concerning childbirth, health care staff, family life and CS were more common among primiparous than multiparous women ($p < 0.001$) Childbirth fear occurred more often in primiparous women who hd not attended antenatal classes compared with those who had attended them ($p = 0.009$) Fear of healthcare workers was more common among women who had problems in the current pregnancy compared with those who had not and among those who were planning an elective CS The causes of fear were reported to be alarming information, negative stories told by others and diseases Manifestations of fears included stress symptoms, influence on everyday life, wish to have CS, and wish to avoid current pregnancy and childbirth	Response rate 69%	Cross-sectional	3

Fear of childbirth (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Saisto[166]	100 pregnant women (about 33 weeks), in their second pregnancy requesting elective CS due to fear of childbirth that was not present in their first pregnancy 200 women with at least 1 previous birth and no history of fear of childbirth	Observational study	Spontaneous miscarriage before first delivery Spontaneous miscarriage between deliveries Previous infertility Time between deliveries Epidural analgesia in first delivery Duration of second stage of delivery Vacuum extraction in first delivery Emergency CS in first delivery Induction of labour in first delivery Duration and intervention during third stage of labour in first delivery	Spontaneous miscarriage before first delivery: OR 1.73, 95% CI 1.05 to 2.85 Spontaneous miscarriage between deliveries: OR 3.11, 95% CI 1.16 to 8.34 Time between deliveries: OR 1.44, 95% CI 1.19 to 1.75 Vacuum extraction in first delivery: OR 4.50, 95% CI 2.18 to 9.31 Emergency CS in first delivery: OR 26.91, 95% CI 11.86 to 61.07 Duration of second stage of labour was longer in the group of cases (62 minutes, SD 35) compared with controls (47 minutes, SD 30) No difference between the groups for previous infertility, epidural analgesia in first delivery, induction of labour in first delivery and duration and intervention during third stage of labour in first delivery	Odds ratios are reported to be adjusted odds ratios although it is not clear what had been adjusted for	Case–control	3
Johnson[26]	Pregnant women at least 16 years of age in Sheffield, England, surveyed at 32 weeks gestation	Observational study Questionaire to measure: 1. W-DEQ scores: Wijma Delivery Expectancy/Experience Questionaire (W-DEQ) (a validated 33 item questionnaire measurement of fear of childbirth based on women's cognitive appraisals regarding the delivery during pregnancy) 2. measure of state/trait anxiety (STAI) (validated, based on 40 item questionnaire separated into scales of state anxiety and trait anxiety)	Emergency CS Spontaneous vertex delivery Assisted vaginal delivery Elective CS	Mean W-DEQ score for all women: 65.41 (SD 17.49) No difference in fear of childbirth levels between women who were aware of complications that may lead to a CS and those who were not No difference in scores according to mode of delivery. OR (95% CI) of emergency CS vs. spontaneous vertex delivery: Medical risk: 2.48 (1.12 to 5.52) Nulliparity: 9.11 (3.78 to21.96) Previous CS: 9.94 (2.83 to 34.93) Reason to expect CS: 1.95 (0.84 to 4.52) Age: 1.09 (1.02 to 1.17) Fear of childbirth (W-DEQ) scores: 1.00 (0.98 to 1.01)	Questionnaire sent out to 1200 women, response rate 35% Compared with the population, a higher proportion of women in the study group were aged between 30-39 .years. The elective CS rate was 11% in the study group compared with 6% in the hospital population	Cross-sectional	3

Fear of childbirth (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Ryding[167]	Pregnant women at least 32 weeks gestation in Sweden 1992–1993 Excluded women planning an elective CS and those that received treatment for their fear of childbirth	Observational study Cases: those delivered by emergency CS (n = 97) Controls: women from the same population that delivered vaginally, matched for age and parity (n = 194)	Fear of childbirth measured by a questionnaire at 32 weeks gestation, using 1. W-DEQ scores. Score of 84 or above considered to be serious fear of childbirth (upper 10th centile of distr1bution of scores) 2. STAI - state and trait anxiety index 3. Stress coping inventory (SCI)	Mean W-DEQ score for all women: 54.1 (s.d.21.1): Mean difference in score (cases–controls): W-DEQ: 10.3 (95% CI 5.3 to 15.3) STAI: 2.7 (95% CI 0.1 to 5.3) SCI: SCI (95% CI –0.3 to 10.3)	Emergency CS rate in Sweden 6.3%, overall CS rate 9.1% 84% response rate to questionnaire	Nested case–control	3

Fear of childbirth (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Saisto[168]	176 low-risk and physically healthy pregnant women referred to the antenatal clinic because of fear of vaginal delivery	Provision of information and conversation regarding previous obstetric experiences, feelings and misconceptions and psychotherapy with a trained obstetrician at 24, 28 32, 36 and 38 weeks gestation vs. usual care–standard information distribution and routine obstetric appointments at 24 and 36 weeks All participants were given 3 questionnaires (before randomisation, 4 weeks before due date, 3 months after delivery) Refusal to answer the questionnaire was used as an indication of the woman's motivation for treatment and confrontation of fears	Primary outcome measure: CS rate Other outcome measures: Duration of labour, pregnancy related anxiety, satisfaction with childbirth	176 women randomised 112 women (64%) completed all 3 questionnaires Women who did not complete questionnaires had fewer appointments (OR 2.03 95% CI 1.30, 3.21). Non response to questionnaires was equal between the two groups Overall, 62% of all randomised women who initially chose to deliver by CS chose to have a vaginal birth Women choosing to deliver by CS: Intervention group n = 85: 20 (23%) Control group (n = 91): 26 (28%) RR 0.82 (95% CI 0.50 to 1.36); 1.00 No difference in mean score for anxiety during pregnancy between the two groups (p > 0.05) Significantly lower mean scores for fear of pain in labour in intervention group (p = 0.04) No difference in mean score for fear of obstetricians unfriendly behaviour between the two groups (p = 0.05) Duration of labour was shorter in the intervention group (6.8 (SD 3.8) hours) compared with 8.5 (SD 4.8) hours in the control group (p = 0.04) No difference in use of epidural analgesia between the groups (85% to 82%)	Women identified by either request for CS or a screening questionaire Randomisation in blocks of 20 using sealed opaque envelopes Intention to treat analysis Women in the intervention group mentioned birth related concerns more frequently in the pre-randomisation questionnaire than those in the control group	RCT	1b

Chapter 5 Factors affecting likelihood of CS during intrapartum care

5.1. Place of birth

Home birth

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Olsen, 2003[171]	11 low-risk multiparous women	Planned home vs. planned hospital birth	Operative delivery, perineal sutures, nitrous oxide and oxygen, pethidine, baby not breastfed, mother disappointed about allocation, father did not state that he was relieved	No actual data provided Statistical analysis: all no difference	Systematic review including one RCT Underpowered due to small numbers	RCT	1b
Olsen, 1997[172]	Six trials included. 24092 low-risk pregnant women	Home vs. hospital births	Perinatal and maternal mortality and morbidity outcome measures of low Apgar scores, maternal lacerations and intervention rates (induction, augmentation, episiotomy, operative vaginal birth and CS)	Perinatal mortality: OR 0.87 (95% CI 0.54 to 1.41) Apgar: OR 0.55 (95% CI 0.41 to 0.74) Lacerations: OR 0.67 (95% CI 0.54 to 0.83) *Inductions: (95% CI 0.06 to 0.39 *Augmentation: (95% CI 0.26 to 0.69) *Episiotomy: (95% CI 0.02 to 0.39) *Operative vaginal birth: (95% CI 0.03 to 0.42) *CS (95% CI 0.05 to 0.31) *Range of ORs given	Individual data not given	Meta analysis of comparative and cohort studies	2b
Janssen, 2002	862 planned home births and 571 hospital births with midwives and 743 physician led hospital births	Home vs. hospital care	Epidural use, induced, augmentation, episiotomy, CS, 3-degree tear, PPH, infection, Apgar < 7 at 5 minutes, transfer to another hospital, use of oxygen > 4hours	Home vs. physician hospital birth: Epidural: OR 0.20 (95% CI 0.14 to 0.27) Induction: OR 0.16 (95% CI 0.11 to 0.24) Augmentation: OR 0.33 (95% CI 0.23 to 0.47) Episiotomy: OR 0.22 (95% CI 0.13 to 0.33) CS: OR 0.30 (95% CI 0.22 to 0.43) 3-degree tear: OR 0.85 (95% CI 0.43 to 1.66) PPH: OR 0.90 (95% CI 0.58 to 1.45) Infection: OR 0.24 (95% CI 0.1 to 0.59) Apgar: OR 0.84 (95% CI 0.32 to 2.19) Transfer: OR 1.4 (95% CI 0.39 to 5.04) Oxygen > 4hours: OR 0.54 (95% CI 0.27 to 1.07) Home vs. midwife hospital birth: Epidural: OR 0.25 (95% CI 0.17 to 0.35) Induction: OR 0.30 (95% CI 0.20 to 0.46) Augmentation: OR 0.34 (95% CI 0.24 to 0.51) Episiotomy: OR 0.43 (95% CI 0.27 to 0.69) CS: OR 0.66 (95% CI 0.44 to 0.99) 3-degree tear: OR 0.53 (95% CI 0.28 to 1.00) PPH: OR 0.90 0.83 (95% CI 0.50 to 1.38) Infection: OR 0.26 (95% CI 0.10 to 0.68) Apgar: OR 2.28 (95% CI 0.59 to 8.8) Transfer: OR 1.00 (95% CI 0.30 to 3.40 Oxygen > 4 hours: OR 0.65 (95% CI 0.30 to 1.41)	OR was adjusted for maternal age, lone parent status, income quintile, substance use and parity	Cohort	2b

Childbirth care in a midwifery-led unit

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Hodnett, 2003[181]	Six trials (see below)	Birth centre ('home like' care) vs. usual care	CS rate (38 other outcomes)	Reported in all six trials (meta analysis) OR 0.85 (95% CI 0.72 to 1.00)	Individual trials described below	Systematic review	1a
*Byrne[183]	200 women with normal uncomplicated pregnancies attending and antenatal clinic in Australia Exclusion criteria: Any pregnancy risk factors or presentation to antenatal clinic after 30 weeks gestation	Birthing centre care, described as home-like surroundings to encourage women to feel relaxed and to use their own resources to cope with labour v usual care (Cont)	Primary outcomes: maternal satisfaction Intervention rates: CS Episiotomy Method of feeding at 6 weeks postpartum Costs	Intact perineum: Intervention group (n = 100): 20 Control group (n = 100): 27 RR 0.74 (95% CI 0.45 to 1.23) Episiotomy: Intervention group (n = 100): 35 Control group (n = 100):27 RR 1.30 (95% CI 0.85 to 1.97) 1st/2nd degree tear Intervention group (n = 100): 37 Control group (n = 100):32 RR 1.16 (95% CI 0.79 to 1.70) CS: Intervention group (n = 100): 9 Control group (n = 100): 14 RR 0.64 (95% CI 0.29 to 1.42)	No differences in mothers perception of control, satisfaction, anxiety and bonding or method of feeding at 6 weeks postpartum between the two groups	RCT	1b
*Waldernstorm[182]	1860 women giving birth in Stockholm between 1989–93 Exclusion criteria: Women with a complicating general condition e.g. diabetes or hypertension, drug users and smokers	Birthing centre care described as home like, no further details (Int) vs. usual care (Cont)	CS Instrumental vaginal delivery Episiotomy	CS: Intervention group (n = 928): 7.1% Control group (n = 932): 8.9% p > 0.05 Instrumental vaginal delivery: Intervention group (n = 928): 3.9% Control group (n = 932): 4.5% p > 0.05 Episiotomy: Intervention group (n = 928): 7.8% Control group (n = 932): 8.3% p > 0.05		RCT	1b

Childbirth care in a midwifery-led unit (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
*Hundley[185]	2844 low risk women, as defined by existing booking criteria for general practitioner units in Grampian, Scotland Exclusion criteria: pre-existing maternal disease, infertility, complicated obstetric history and multiple pregnancy	Care and delivery of low-risk women in a midwife-managed birth unit , described as 'homely', in which women retain a sense of control (Int) vs. care and delivery in a consultant-led labour ward	Maternal and perinatal morbidity	No difference in percentage of women who had normal deliveries between the groups Difference in % was 2.9% (–0.5% to 6%)	1900 women randomised to midwifery managed units and 944 to labour ward 34% transferred to labour ward antepartum, 16% transferred intrapartum Significant differences in monitoring, fetal distress, analgesia, mobility and use of episiotomy No differences in fetal outcome	RCT	1b
*Klein[187]	114 low-risk women	Birth centre care described as an attractive room with a double bed. No routine enema, shaving, IV infusion or EFM vs. routine hospital care in a labour ward	Mode of delivery, oxytocin use, epidural use, episiotomy, Apgar, morbidity of neonate	No difference in any outcome measured		RCT	1b
*MacVicar, 1993[184]	3510 women with no obvious risk factors	Midwife-led care in a birth centre which was furnished to resemble a normal household bedroom with no equipment in view vs. obstetrician-led care	Complications in antenatal, intrapartum and postnatal period. Maternal and fetal morbidity and mortality. Women's satisfaction	CS: Experimental: 144 (7%) Control: 78 (7%) p: NS		RCT	1b
*Chapman, 1986[186]	148 parous women	Randomised to standard care or 'home-like' care	Length of labour, mode of delivery, complications	Only 3 CSs occurred, all in the control group. This was not statistically significant		RCT	1b

* denotes trials included in systematic review by Hodnett, 2003[181]

Delayed admission to labour ward

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Lauzon, 2001[190]	209 low-risk nulliparous women, 37 weeks of gestation, singleton pregnancy, spontaneous onset of labour	Intervention group received 'labour assessment' which included FHR determination, maternal BP and urine tests, frequency and duration of contractions, status of amniotic membranes and cervical dilatation assessment. If all of these were normal and < 3 cm dilated with intact membranes the woman was allowed to go home or remain in a 'home-like' area to walk around. Control group admitted direct to labour ward	CS, amniotomy, anaesthesia, episiotomy, forceps, vacuum, length of labour, time in labour ward postpartum stay, satisfaction (sense of control), oxytocin administration, Apgar	CS: OR 0.7; (95% CI 0.27 to 1.79) Time in labour ward: WMD –5.2 hours (95% CI –7.06 to 3.34) Oxytocics: OR0.45 (95% CI 0.25 to 0.80) Analgesia: OR0.36; (95% CI 0.16 to 0.78 Sense of control: WMD 16.00; (95% CI 7.52 to 24.48 No difference with other outcomes	Only one study included in the review. Insufficient power to detect a difference in CS due to small size	Systematic review (1 RCT)	1b

5.2 Reducing the likelihood of CS

One-to-one support in labour

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Hodnett, 2001[194]	5000 women in 14 trials	Continuous support during labour (intervention) versus routine care (control)	Medication for pain relief Operative vaginal delivery CS 5-minute Apgar scores < 7	Outcome OR Medication for pain relief: OR 0.71 (95% CI 0.20 to 0.81) Operative VD: OR 0.77 (95% CI 0.65 to 0.90) CS: OR 0.77 (95% CI 0.64 to 0.91) 5-minute Apgar scores < 7: OR 0.5 (95% CI 0.28 to 0.87)	Support differed between trials in terms of person, timing and duration	Systematic review	1a
Hodnett, 2002[195]	6915 women at thirteen hospitals, with a live, singleton fetus, 34 weeks gestation or more and were in established labour	Usual care (control, n = 3461) or continuous emotional support by a specially trained nurse (intervention, n = 3454)	Primary: CS rate Secondary: other intrapartum events and indicators of maternal and neonatal morbidity	CS rate: Intervention: 432 (12.5%) Control: 437 (12.6%) RR 0.99 (95% CI 0.87 to 1.12) p =0.44 No difference in secondary outcomes	Comparison of patients evaluation of future preferences for labour favoured the continuous support group	Multi centred RCT	1b

Pregnancy after 41 weeks

Study	Population	Intervention	Outcomes	Results	Comments	Design	EL
Crowley , 2003[196]	Women included in RCT that compared induction of labour with expectant management for pregnancies continuing beyond 41 weeks	Induction of labour	Perinatal mortality CS	Perinatal mortality: 19 trials; n = 7925; Peto OR 0.20; 95% CI 0.06 to 0.70 CS: 9 RCTs; n = 5954;Peto OR 0.87; 95% CI 0.77 to 0.99		Systematic review	1a

Partogram

Study	Population	Intervention	Outcomes	Results	Comments	Design	EL
Philpott, 1972[201]	624 primigravid women, malpresentations and multiple pregnancies excluded compared with 738 similar women	Use of partogram	1. Oxytocin given 2. Labour 12–24 hours 3. Labour > 24 hours 4. Vacuum extraction 5. CS 6. Perinatal deaths	Outcome 1966 Study p 1 12.3% 9.7% < 0.01 2 29.5% 4.6% < 0.001 3 13.0% 0.6% < 0.001 4 9.1% 13.4%. < 0.001 5 9.9% 2.6% < 0.001 6 5.8% 0.6% < 0.001 1966 series (n = 738) Study series (n = 624)	Retrospective comparison Results given only as percentages or proportions of n	Descriptive study	3
WHO, 1994[202]	4 pairs of hospitals in South East Asia. All hospitals were already practicing active management of labour	One of each pair was randomly selected to receive the partogram (4 hour action line)	Duration of labour (hours) median Labour > 18 hours Labour augmented Postpartum sepsis Mode of delivery (singleton, cephalic CS	Duration of labour: Before (n = 18,254): median 3.25 hours After (n = 17,230): median 3.13 hours p = 0.819 Labour > 18 hours: Before (n = 18,254): 1147 (6.4%) After (n = 17,230): 589 (3.4%) p = 0.002 Labour augmented: Before (n = 18,254): 3785 (20.7%) After (n = 17,230): 1573 (9.1%) p = 0.023 Postpartum sepsis: Before (n = 18,254): 127 After (n = 17,230): 37 p = 0.028 Mode of delivery: Before (n = 18,254): 2278 (12.5%) After (n = 17,230): 1926 (11.2%) p = 0.841 n = number of deliveries	Active management only Results given for all women, multiparous and nulliparous together. Patterns were similar for both	Cluster RCT	1b

Partogram (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Design	EL
Lavender, 1998[203]	928 primigravid women with uncomplicated pregnancies in spontaneous labour at term	Partograms with the action line 2, 3 or 4 hours to the right of the alert line	Primary: CS rate, maternal satisfaction	Satisfaction score: 2 hours (n = 315): 23.5 (5.9%) 3 hours (n = 302): 21.4 (6.1%) 4 hours (n = 311): 19.3 (5.6%) 2 hours vs. 3 hours: RR 3.5 (95% CI 1.7 to 5.3) CS: 2 hours (n = 315): 35 (11.1%) 3 hours (n = 302): 43 (14.2%) 4 hours (n = 311): 26 (8.4%) 2 hours vs. 3 hours: RR 0.8 (95% CI 0.5 to 1.2) Results are expressed as n (%). Differences between groups are given as odds ratio (95% CI). No difference in the secondary outcomes so not reflected here		RCT	1b
Pattinson R C, 2003[204]	694 health nulliparous women in active labour, at term with a health singleton pregnancy and cephalic presentatio South Africa	Aggressive management protocol. Single line partogram, a vaginal examination every two hours and use of oxytocin infusion if the line was crossed (n = 344) vs. expectant management protocol. Two-line partogram, with the alert line and a parallel action line four hours to the right, with a vaginal examination every four hours. If the action line was reached, oxcytocin was started. The women were reassessed every two hours thereafter. Analgesia was prescr1bed on request (n = 350)	Mode of birth	Caesarean section: 16.0% vs. 23.4%. RR 0.68, 95% CI 0.50 to 0.93 Operative deliveries: 20.3% vs. 27.9%. RR 0.73, 95% CI 0.56 to 0.96	Multicentre Randomisation through sealed opaque envelope form box in labour ward and randomisation was based on a computer generated list of random numbers (perinatal death includes one protocol violation, patients enrolled into the trial with a known intrauterine death)	RCT	1b

5.3 No influence on likelihood of CS

Walking in labour

Study	Population	Intervention	Outcomes	Results	Comments	Design	EL
Bloom, 1998[208]	1067 pregnant women presenting in spontaneous labour between 36 to 41 weeks of gestation Inclusion criteria: Regular uterine contractions with cervical dilatation of 3–5 cm, cephalic presentation Exclusion criteria: Women with any known complication of pregnancy including breech presentation	Walking as desired during the first stage of labour (intervention) vs. usual care (control) Usual care: women in this group assumed their choice of supine, lateral or sitting positions during labour	Episiotomy SVD Forceps Shoulder dystocia CS	Episiotomy: Intervention (n = 536): 122 (23%) Control (n = 531): 124 (23%) RR 0.97 (95% CI 0.78 to 1.21) SVD: Intervention (n = 536): 490 (91%) Control (n = 531): 483 (91%) RR 1.00 (95% CI 0.97 to 1.04) Forceps: Intervention (n = 536): 23 (4%) Control (n = 531): 17 (3%) RR 1.34 (95% CI 0.72 to 2.48) Shoulder dystocia: Intervention (n = 536): 1 (0.2%) Control (n = 531): 2 (0.4%) RR 0.49 (95% CI 0.04 to 5.45) CS: Intervention (n = 536): 23 (4%) Control (n = 531): 31 (6%) RR 0.73 (95% CI 0.43 to 1.24)	78% of mothers in the walking group actually walked Results analysed by intention to treat Results were similar for nulliparous and parous mothers	RCT	1b
Flynn, 1978[207]	68 women in spontaneous labour 34 in each group, of whom 17 were primigravidae and 17 multigravidae	Walking as desired (intervention) versus confined to bed in left lateral position (control)	1. Uterine action 2. Mode of delivery 3. Analgesia required 4. Fetal heart rate and Apgar scores	VD: Intervention (n = 34): 31 Control (n = 34): 22 p < 0.01 Forceps: Intervention (n = 34): 2 Control (n = 34): 10 CS: Intervention (n = 34): 0 Control (n = 34): 1	Women were randomised only after they had expressed a desire to walk around during labour, potential selection bias. Very small numbers; little statistical weight	RCT	1b

Position in the second stage of labour

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Gupta, 2003[209]	RCTs which compared various positions used by pregnant women during the second stage of labour		Any upright or lateral position vs.supine position/lithotomy: 1. Duration of second stage of labour (minutes) all women: 12 studies; 3971 participants; WMD (fixed) –5.42 (95% CI –6.95 to 3.90) 2. Mode of delivery: 29 studies; 9536 participants; Peto OR 0.82 (95% CI 0.69 to 0.97) 3.Second degree perineal tears: 10 studies; 4257 participants; Peto OR 1.30 (95% CI 1.09 to 1.54) 4. Episiotomy: 11 studies; 3846 participants; Peto OR 0.73 (95% CI 0.64 to 0.84) 5 Blood loss > 500ml:10 studies; 4303 participants; Peto OR 1.76 (95% CI 1.34 to 2.32) 6. Experienced severe pain at birth: 1 study; 517 participants; Peto OR 0.59 (95% CI 0.41 to 0.83) 7. Abnormal fetal heart rate patterns: 1 study; 517 participants; Peto OR 0.31 (95% CI 0.11 to 0.91)		Systematic review	1a

Immersion in water during labour

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Nikodem, 1999[211]	988 women in three trials	Immersion vs. no immersion during labour	Maternal outcomes including mode of delivery, fetal outcomes, neonatal outcomes, caregiver outcomes	No significant difference in any of the outcomes Mode of delivery was reported in one trial but not mentioned in the review.		Systematic review	1a
Rush, 1996[213]	785 women at term in spontaneous labour with no risk factor for need for EFM or epidural	Immersion vs. no immersion during labour	Narcotic requirements, forceps and assisted deliveries, CS	SVD: Intervention: 293 (74.5%) Control: 275 (70%) p = 0.168 Forceps: Intervention: 65 (16.5%) Control: 86 (22.0%) p = 0.055 CS: Intervention: 35 (8.9%) Control: 0.615 p = 0.615		RCT	1b

Epidural analgesia during labour

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Halpern, 1998[228]	1614 nulliparous and 755 multiparous women with uncomplicated pregnancies	Epidural vs. parenteral analgesia during labour	All trials reported on CS rates as well as other maternal and neonatal outcomes	Pooled data (CS): Epidural: 97/1183 Opioid: 67/1186 OR 1.5 (95% CI 0.81 to 2.76)		Meta analysis of RCTs	1a
Howell, 1999[235]	11 studies, 3157 women	Epidural vs. other forms of analgesia	29 outcomes measured including CS	CS overall: 9 studies; Peto OR 1.30 (95% CI 0.93 to 1.83) CS dystocia: 5 studies; Peto OR 1.15 (95% CI 0.71 to 1.85) CS fetal distress: 5 studies; Peto OR 1.62 (95% CI 0.74 to 3.53)		Systematic review	1a

Complementary therapies during labour and CS

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Smith, 2003[238]	366 women using different modalities of pain management during labour	Acupuncture, aromatherapy, audio analgesia, hypnosis	Pain relief during labour. Some of the trials looked at CS. Only these results are given	Acupuncture vs. control CS: 1 study (90 participants); RR 0.96 (95% CI 0.06 to 14.83) Aromatherapy vs. control CS: 1study (22 participants); RR 2.54 (95% CI 0.11 to 56.25) Hypnosis vs. control VD: 2 studies (125 participants); RR 1.38 (95% CI 1.10 to 1.74)	CS rates were not the primary outcome in any of the trials in this review	Systematic review	1a
Simpson, 2001[236]	192 low risk nulliparous women	Raspberry leaf herb consumed in tablet form from 32 weeks of gestation	Safety; side effects; length of labour; mode of birth	No difference shown in any of the outcomes measured		RCT	1b

5.4 Failure to progress

Active management of labour

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Lopez-Zeno, 1992[657]	705 women, nulliparous, term, spontaneous labour, cephalic presentation	Active versus routine management of labour Active management of labour defined as: amniotomy within 1 hour of diagnosis of labour. If rate of cervical dilatation < 1 cm/hour then oxytocin infusion of 6mu/minute (to maximum of 36mu) Control: usual care as determined by individual woman's physician	CS rate, length of labour, maternal and neonatal morbidity	CS rate: Active (n = 351): 37 (10.5%) Control (n = 354): 50 (14.1) p < 0.05 Length of first stage: Active (n = 351): 5.05 hours Control (n = 354): 6.72 hours p < 0.0001 Length of second stage: Active (n = 351): 1.44 hours Control (n = 354): 1.43 hours p: NS Admission to delivery: Active (n = 351): 6.49 Control (n = 354): 8.15 p < 0.0001		RCT	1b
Rigoletto, 1995[658]	1934 nulliparous women, term cephalic, spontaneous labour	Active versus routine care Active management described as: childbirth classes, strict criteria for diagnosis of labour, standardised management of labour including early amniotomy and high dose oxytocin infusion, one to one nursing Control: usual care as determined by individual woman's physician	CS rate, median duration of labour, maternal fever, proportion of women whose labour lasted longer than 12 hours	CS rate: Active (n = 1009): 197 (19.5%) Control (n = 906): 176 (19.4%) RR 1.0 (95% CI 0.8 to 1.2) Median duration of labour: Active (n = 1009): 6.2 Control (n = 906): 8.9 RR (no data given) Maternal fever: Active (n = 1009): no data given Control (n = 906): no data given RR 0.6 (95% CI 0.4 to 0.9) Proportion > 12 hours: Active (n = 1009): 9% Control (n = 906): 26% p < 0.001		RCT	1b

5.4 Failure to progress (continued)

Active management of labour

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Cammu, 1996[659]	306 nulliparous women, term cephalic, spontaneous labour, clear amniotic fluid, >150cm in height and at least one ANC visit	Active management vs.control Active management described as : early amniotomy and early use of oxytocin Control – usual care as determined by individual woman's physician	Use of oxytocin and amniotomy, labour duration, mode of delivery	Amniotomy: Active (n = 152): 86 (91%) Control (n = 154): 56 (57%) p < 0.01 Oxytocin use: Active (n = 152): 80 (53%) Control (n = 154): 41 (27%) p < 0.01 Length of labour: Active (n = 152): 254 minutes Control (n = 154): 283 minutes p 0.087 CS rate: Active (n = 152): 6 (3.9%) Control (n = 154): 4 (2.6%) p: NS		RCT	1b

Use of oxytocin to augment labour

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Bidgood, 1987[252]	Sixty nulliparous women, spontaneous labour, cephalic presentation	Three groups: Group 1 – observations Group 2 – low-dose oxytocin Group 3 – high-dose oxytocin	CS rate, cervical dilatation rate, 'delay to delivery' interval, duration of second stage Condition of newborn	No difference in CS rate Cervical dilatation rate increased after oxytocin given 'Delay to delivery' and second stage shorter in high-dose group No difference in condition of newborn	'Delay to delivery' not defined Small trial	RCT	1b

Early amniotomy

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Fraser, 1999[256]	9 studies	Early routine amniotomy vs. selective amniotomy	24 outcomes related to contractions, length of labour, neonatal and maternal morbidity	Duration of labour: 3 trials (156 women); Peto OR –53.71 (WMD) (95% CI –66.457 to –40.965) CS: 8 trials (4008 women); Peto OR 1.26 (95% CI 0.96 to 1.66) 5-minute Apgar < 7: 8 trials (3076 women); Peto OR 0.54 (95% CI 0.30 to 0.96) Use of oxytocin: 8 trials (3908 women); Peto OR 0.79 (95% CI 0.67 to 0.92) Only outcomes with a difference shown	Good quality trials included Large numbers	Systematic review	1a

5.5 Eating during labour: low residue diet

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Scrutton, 1998[274]	94 women in labour, > 37 weeks, singleton, cephalic presentation	Randomised to eating (low residue diet) group or control (water only) group	1. Metabolic assessment 2. Gastric volumes 3. Labour outcomes	VD: Eating (n = 45): 20 Control (n = 43): 18 AVD: Eating (n = 45): 16 Control (n = 43): 13 CS: Eating (n = 45): 9 Control (n = 43): 12	Epidural rate higher than usual which may influence women's decision to eat or not in active labour	RCT	1b

6.1 Timing of CS: optimal gestational age for a planned CS

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Morrison, 1995[282]	All cases of respiratory distress syndrome (RDS) or transient tachypnoea of the newborn (TTN) at term requiring NICU	Prospective survey over 9 years	RR of respiratory morbidity for RDS and TTN in relation to mode of delivery and onset of parturition for each week of gestation at term	CS prelabour: Births (n): 2341 Respiratory morbidity: RR 83 RR: 35.5/1000 (95% CI 28.4 to 43.8) OR: 6.8 (95% CI 5.2 to 8.9) CS labour: Births (n): 2370 Respiratory morbidity: RR 29 RR rate/1000: 12.2 (95% CI 8.2 to 17.5) OR: 2.3 (95% CI 1.6 to 3.5) VD: Births (n): 28,578 Respiratory morbidity: RR 150 RR rate/1000: 5.3 (95% CI 4.4 to 6.2) OR: 1.0	Results are for total number of deliveries. The study then calculated risk of RR with each gestation. Significant decrease after 39 weeks of gestation	Prospective audit	3

6.3 Preoperative testing before CS

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Ransom, 1999[660]	Women transfused with blood during an admission for CS at a tertiary care hospital	Retrospective case review	Identifiable risk factors and risk of transfusion	122/125 women who had a blood transfusion had an identifiable risk factor 3/125 had no risk factor Overall urgent blood transfusion rate without risk factor is 0.8/1000 CS		Case review	3
Rayburn, 1988[661]	124 women for CS	Ultrasound pre-CS compared with 84 retrospectively collected controls		No difference in any of the outcomes: of incision of the placenta Blood loss intra operatively > 1000 ml Difficult delivery Injury of infant Injury of umbilical cord Injury to adjacent structures		Cohort	2b
Lonky, 1989[301]	46 antenatal women with a previous CS and 30 control antenatal women	Ultrasound to determine CS scar	Proportion of uterine scars visualised	Overall 13/47 (27.7%) scars were visualised on ultrasound. Only transverse scars were visualised		Cohort	3
Qureshi, 1997[303]	43 women with transverse CS scars, 80 cohorts	Ultrasound to measure thickness of wall of lower uterine segment	Whether thickness of lower uterine wall can be used as a predictor for poor wound healing	< 2mm thickness –sensitivity = 86.7%; specificity = 100%. PPV = 100%; NPV = 86.7	Methodology of study unclear	Cohort	3
Suzuki, 2000[302]	39 women for repeat elective CS, 20 had preoperative diagnosis of wall thinning and 19 did not	Manual and ultrasound examination to determine uterine wall thinning at 36 weeks of gestation	Scar dehiscence diagnosed antenatally by examination or ultrasound and confirmed at surgery	Ultrasonagraphic sensitivity for scar dehiscence = 100%; specificity = 83% No surgical findings of dehiscence in patients who felt pain and tenderness	Preoperative diagnosis of wall dehiscence was defined as wall thickness of < 2 mm on ultrasound and pain or tenderness on examination	Cohort	3

6.4 Anaesthesia for CS

General versus regional anaesthetic for CS

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Lertakyamanee, 1999[313]	341 well women at term scheduled for elective CS	CS with general (GA), epidural (EA) or spinal anaesthesia (SA)	Maternal outcomes: Success rate Total blood loss Satisfaction of mothers	Success rate: GA: 96.1% EA: 90.0% SA: 80.5% Total blood loss: GA: 378.3 ml EA: 323.8 ml SA: 257.2ml p = 0.0001 (GA > EA, SA) No difference between the satisfaction scores in the different groups	Success rate not defined. Non successful defined as needing to change to another method of analgesia	RCT	1b
Lertakyamanee, 1999[314]	341 well women at term scheduled for elective CS	CS with general (GA), epidural (EA) or spinal anaesthesia (SA)	Neonatal outcomes: Cord blood pH Apgar score NACS	Cord blood pH : GA: 7.29 EA: 7.31 SA: 7.30 p = 0.045 (GA<EA) Apgar 1 minute: GA: 6.7 EA: 8.3 SA: 8.7 p = 0.001 (GA<EA,SA) Apgar 5 minutes: GA: 9.2 EA: 9.7 SA: 9.8 p = 0.004 (GA<EA,SA) NACS: GA: 34.4 EA: 34.9 SA: 34.8 p: NS	NACS = neurologic and adaptive scores, normal value not given	RCT	1b

6.4 Anaesthesia for CS (continued)

General versus regional anaesthetic for CS

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Kavak, 2001[316]	104 well women at term scheduled for elective CS	CS with general (GA) or spinal anaesthesia (SA)	Neonatal outcomes: 1. Umbilical artery blood gas 2. Neonatal depression 3. Total hospital stay 4. Apgar	1. No difference in any blood gas parameters 2. 4/38 infants in the GA group vs3/46 infants in SA group were treated with oxygen and bag and mask. None needed further respiratory support (p > 0.05) 3. No difference between the groups 4. No difference between the groups. All infants were vigorous at birth	Under powered for the outcomes. Infants well in both groups	RCT	1b
Wallace, 1995[14718}	88 women with severe pre-eclampsia, decision already made to deliver by CS	CS with general (GA), epidural (EA) or spinal anaesthesia (SA)	1. Apgar scores 2. Arterial blood gas parameters 3. Maternal BP changes 4. Complications	No difference between the two groups was found for any of the outcomes. No adverse outcomes were found in either group	Underpowered for the outcomes as no adverse outcomes occurred	RCT	1b
Hong, 2002[319]	25 women with grade-4 placenta praevia	CS with general (GA), epidural (EA)	1. Blood loss, post operative transfusions, urine output, Apgar at 1 and 5 minutes 2. Circulatory changes 3. Haematological changes	Blood loss: GA: 1623 ml EA: 1418 Transfusions: GA: 1.08 units EA: 0.38 units Urine output: GA: 118 ml EA: 153 ml Apgar 1 minute: GA: 8 EA: 8 Apgar 5 minutes: GA: 10 EA: 9 p > 0.05 for each outcome Circulatory changes graphically represented; no differences Haematological changes graphically represented; immediate postoperative haematocrit significantly lower in the GA group	Underpowered for the outcomes. One adverse outcome occurred (emergency hysterectomy)	RCT	1b

Health economics

Study	Population	Intervention details	Cost Outcomes	Results	Comments	Study type	EL
Riley 1995[325]	94 women undergoing CS	Epidural versus spinal anaesthesia for non-emergency CS	Effectiveness data from a single institution/ study of 94 women randomly selected to receive spinal (intervention) or epidural (control) analgesia Effectiveness data were collected retrospectively from patient records Hospital and patient costs were collected prospectively (materials, drugs, nursing time) based on data from patient records (1990–92) for all resources not common to both 1992 prices	Total operating room time: Spinal 67–99 minutes Epidural 81–121 minutes ($p < 0.001$) Post-anaesthesia care unit time: Spinal 64–140 minutes Epidural 52–136 minutes (NS) Need for intraoperative analgesia: Spinal 17% Epidural 38% ($p = 0.04$) Need for postoperative pain relief: Spinal 23% Epidural 15% (p value not given) Complication rates: Spinal 0% Epidural 13% ($p = 0.003$) Total costs: Spinal US$23.21–25.46 depending upon needle Epidural US$43.62 Spinal anaesthesia is the dominant option	No synthesis of costs and benefits No sensitivity analysis No detailed economic analysis	Cost-consequence study	

Place of induction of regional anaesthesia

Study	Population	Intervention details	Cost Outcomes	Results	Comments	Study type	EL
Soni, 1989[326]	100 women scheduled for elective surgery in general, orthopaedics or ENT surgery	Anaesthesia induced in anaesthetic room or in theatre	Mean changes in indices of anxiety (baseline to induction)	LAAS: anaesthetic room 4.9; theatre 5.3; difference between groups 0.4 NS Heart rate (bpm): anaesthetic room 1.72; theatre 0.12; difference between groups 1.6 NS Systolic BP (mmHg): anaesthetic room 8.8; theatre 12.7; difference between groups 3.6NS Respiratory rate (breaths/min): anaesthetic room –0.6; theatre –1.58; difference between groups 0.98 $p < 0.05$	LAAS = linear analogue anxiety score	RCT	1b

Procedures to avoid hypotension

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Emmett, 2002[337]	Women having spinal anaesthesia for CS	Use of an intervention to prevent hypotension	Reduction in the incidence of hypotension during spinal anaesthetic for CS	Crystalloid 20 ml/kg vs. control: RR 0.78 (95% CI 0.6 to 1.0) Pre-emptive colloid vs. crystalloid: RR 0.54 (95% CI 0.37 to 0.78) Ephedrine vs. control: RR 0.70 (95% CI 0.57 to 0.85) Lower-limb compression vs. control: RR 0.75 (95% CI 0.59 to 0.94)		Systematic review 1a	
Sutherland, 2001[339]	100 women for elective CS (ASA I) Thigh circumference > 64 cm excluded	Sequential compression device in addition to elastic stockings	1. Number of women developing hypotension 2. Umbilical artery pH (mean) 3. Proportion of neonates with Apgar scores < 9 (mean)	Number of women developing hypotension: Intervention group: 65% Control group: 80% p = 0.12 RR of developing hypotension 1.2 (95% CI 1.0 to 1.6) Umbilical artery pH (mean) Intervention group: 7.32 (0.10%) Control group: 7.34 (0.07%) p = 0.24 Proportion of neonates with Apgar scores < 9 (mean): Intervention group: 2 (4%) Control group: 2 (4%) p = 1.0	Due to difference in outcome measures the results of this trial could not be added to the trials in the above review on limb compression	RCT	1b
Fong,1996[341]	50 normotensive women for elective CS	Epidural administration of ephedrine	Incidence of hypotension, nausea and vomiting and itching	Hypotension was defined as < 90 mmHg or < 70% of baseline. It was measured in 3 phases: start of epidural to attainment of T4 level; T4 level to delivery of infant; delivery to end of CS. No difference at any of these phases. No difference in terms of nausea, vomiting or itching	Due to difference in outcome measures the results of this trial could not be added to the trials in the above review	RCT	1a

Procedures to manage hypotension

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Lee, 2002[342]	292 women undergoing elective CS (7 RCTs)	Ephedrine vs. phenylephedrine for the treatment of hypotension during spinal anaesthesia for CS	Maternal hypo- and hypertension and bradycardia; neonatal umbilical cord ph and Apgar scores	Ephedrine vs.phenylephrine: Maternal: Hypotension management and treatment: no difference (RR1.00, 95% CI 0.96 to 1.06) Bradycardia more likely with phenylephrine than with epinephrine (RR 4.79, 95% CI 1.47 to 15.6) Neonatal: Women given phenylephrine had neonates with higher umbilical arterial pH values than those given ephedrine (WMD 0.03, 95% CI 0.2 to 0.04) No difference in terms of true acidosis, defined as umbilical artery pH < 7.2 (RR0.78, 95% CI 0.16 to 3.92) No difference in Apgar scores at 1 minute and 5 minutes	Either drug can be used for the management of hypotension with spinal anaesthesia	Systematic review	1a

Failed intubation

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Han, 2001[348]	1067 cases of women for elective CS with general anaesthesia (ASA 1–2)	Laryngeal mask used after rapid sequence induction	Effective airway obtained; air leakage or partial airway obstruction; need for intubation; hypoxia	Effective airway obtained in 1060 (99%) of women Air leakage or partial airway obstruction occurred in 22 (2.1%) Intubation was needed in 7 women (0.71%) No episodes of hypoxia occurred		Case series	3

Use of antacid before CS

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Stuart[662]	385 women undergoing emergency CS under GA, Hong Kong, 1991–94	Metoclopramide 10mg iv + 0.3M sodium citrate 30 ml orally (MC) 0.3M sodium citrate 30 ml orally Ranitidine 50 mg iv + 0.3M sodium citrate 30 ml orally (RC) Omeprazole 40 mg iv + 0.3M sodium citrate 30 ml orally (OC)	1-minute Apgar score < 7 gastric volume and pH	C (n = 120); MC (n = 65); RC (n = 50); OC (n = 50); RMC (n = 49); OMC (n = 50) Apgar score 1 minute < 7: C: 19 MC: 18 RC: 12 OC: 17 RMC: 13 OMC: 12 pH median (range): C: 5.01 (0.86 to 6.99) MC: 4.88 (0.76 to 6.98) RC: 5.70 (2.08 to 7.31) OC: 5.76 (2.26 to 7.25) RMC: 5.58 (1.29 to 7.50) OMC: 5.92 (1.1 to 6.86) Gastric volume ml median (range): C: 55 (9360) MC: 50 (230) RC: 46 (3204) OC: 6 (7210) RMC: 40 (8210) OMC: 41 (3270) pH < 2.5, vol > 25 ml: C: 17 (14%) MC: 9 (14%) RC: 1 (2%) OC: 1 (2%) RMC: 3 (6%) OMC: 4 (8%) pH < 3.5, vol > 25 ml: C: 28 (23%) MC: 15 (23%) RC: 4 (8%) OC: 3 (6%) RMC: 5 (10%) OMC: 6 (12%)	Randomisation not described Not blinded	RCT	1b

Use of antacid before CS (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
		Ranitidine 50 mg + metoclopramide 10 mg iv +0.3M sodium citrate 30 ml orally (RMC) Omeprazole 40 mg + metoclopramide 10 mg iv +0.3M sodium citrate 30 ml orally (OMC)					
Rout[357]	Women with term singleton pregnancies undergoing emergency CS under GA, South Africa 1993 Exclusion criteria: History of gastrointestinal disorder except heartburn Those receiving antacids or H2 receptor blockers	50 mg ranitidine iv + 30ml 0.3M sodium citrate Placebo (saline) + 30 ml 0.3M sodium citrate	At risk of aspiration defined as pH < 3.5, volume > 25 ml	50 mg ranitidine iv + 30 ml 0.3M sodium citrate (n = 292): At risk of aspiration: 7 Placebo (saline) + 30 ml 0.3M sodium citrate (n = 303): 12 p = 0.5	Patients and assessors blinded Randomisation not described	RCT	1b

Use of antiemetics

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Stein[369]	75 healthy women undergoing elective CS under spinal anaesthesia, USA, 1997 Exclusion criteria: – History of nausea or vomiting associated with previous surgery or anaesthesia – Nausea or vomiting within 24 hours prior to CS – Diabetes mellitus – Morbid obesity	Acupressure wrist bands + 2 ml iv saline Placebo wristbands + 10 mg slow iv metoclopromide Placebo wristbands + 2 ml iv saline	Nausea Sedation during surgery assessed using a visual analogue scale 0–10 (score greater than 2 considered positive for these outcomes Hypotension Apgar score < 7 at 5 minutes	Nausea: Acupressure (n = 25): 6 (24%); RR 0.3 (95% CI 0.1 to 0.7); 1.5 (0.5 to 4.7) Metoclopromide (n = 25): 4 (16%); RR 1.00 (95% CI 0.2 0.1 to 0.5) Placebo (n = 25): 19 (76%); 1.00 Vomiting: Acupressure (n = 25): 3 (12%); RR 0.5 (95% CI 0.1 to 1.8) Metoclopromide (n = 25): 1 (4%); RR 0.2 (95% CI 0.0 to 1.3) 1.00 Placebo (n = 25): 6 (24%); 1.00 Hypotension: Acupressure (n = 25): 64% Metoclopromide (n = 25): 68% Placebo (n = 25): 76% 5-minute Apgar < 7: Acupressure (n = 25): 0 Metoclopromide (n = 25): 0 Placebo (n = 25): 0 p > 0.05	Randomisation 'using envelopes' Women and assessors blinded to treatment group	RCT	1b

Use of antiemetics (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Numazaki[364]	60 ASA I parturients, 21–38 years, undergoing elective CS, Japan 2000 Exclusion criteria: Gastrointestinal diseases History of motion sickness History of nausea or vomiting in intraoperative or postdelivery period Those who received antiemetics 24 hrs before surgery	iv lignocaine 0.1 mg/kg + placebo iv lignocaine 0.1 mg/kg + propofol 1mg/kg/h (drugs administered after clamping of the cord, stopped at end of surgery)	Intraoperative and postdelivery emetic episodes Sedation (assessed using linear numeric scale 0–10) Requirement for antiemetic rescue medication	Propofol (n = 30): Emesis free: 23 (77%) Nausea: 3 (10%) Retching: 2 (7%) Vomiting: 3 (10%) Rescue antiemetics: 2 (7%) Severity of nausea: median (range): 0 (0–7) Sedation: median (range): 1 (0–5) Placebo (n = 30): Emesis free: 11 (37%) Nausea: 9 (30%) Retching: 4 (13%) Vomiting: 8 (27%) Rescue antiemetics: 10 (33%) Severity of nausea: median (range): 0 (0–10) Sedation: median (range): 1 (0–5) RR (95% CI) propofol vs. placebo: Emesis free: 2.1 (1.2 to 3.5) Nausea: 0.3 (0.1 to 1.1) Retching: 0.5 (0.1 to 2.5) Vomiting: 0.4 (0.1 to 1.3) Rescue antiemetics: 0.2 (0.0 to 0.8) Severity of nausea: median (range): p = 0.03 Sedation: median (range): p = 0.63	Randomisation process not described Women and assessors blinded	RCT	1b
Fuj2[365]	120 ASA I parturients , 22–35 years undergoing spinal anaesthesia for elective CS, Japan 1998 Exclusion criteria: Gastrointestinal diseases History of motion sickness History of nausea or vomiting in intraoiperative or post dlivery period Those who received antiemetics 24 hours before surgery	Granisetron (G) 3 mg Droperidol (D) 1.25 mg Metoclopramide (M) 10 mg Placebo (saline) (P) Administered iv after clamping of the cord	Intraoperative post delivery and post operative emetic episodes	Nausea, vomiting: Granisetron (n = 30): 4 (13%) Droperidol (n = 30): 5 (17%) Metoclopramide (n = 30): 6 (20%) Placebo (n = 30): 19 (63%) G vs. P: RR 0.2 (95% CI 0.1 to 0.5) 1.00 G vs. D: RR 0.8 (95% CI 0.2 to 2.7) 1.00 G vs. M: RR 0.8 (95% CI 0.3 to 2.4) 1.00 D vs. P: RR 0.3 (95% CI 0.1 to 0.6) 1.00 D vs. M: RR 1.00 M vs. P: RR 0.3 (0.1 to 0.7) 1.00	Randomisation using random numbers list Women and assessors blinded	RCT	1b

Use of antiemetics (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Lussos[363]	42 ASA I–2 parturients at term undergoing elective CS under spinal anaesthesia, USA, 1991 Exclusion criteria: History of nausea or vomiting in the week before surgery Diabetes Maternal history suggestive of chronic uteroplacental insufficiency	10 mg iv metoclopromide Placebo Given before spinal anaesthesia for delivery	Self-reported Nausea Vomiting Umbilical artery pH	Metoclopromide (n = 21): Nausea: 3 (14%) Retching and vomiting: 1 (5%) Umbilical artery pH: 7.21 (SD 0.21) Placebo (n = 21): Nausea: 17 (81%) Retching and vomiting: 9 (43%) Umbilical artery pH: 7.22 (SD 0.09) RR (95% CI) metoclopromide vs. placebo: Nausea: 0.2 (0.1 to 0.5) Retching and vomiting: 0.1 (0.0 to 0.8) Umbilical artery pH: p > 0.05	Randomisation not described Women and assessors blinded	RCT	1b
Pan[366]	48 healthy ASA I, 2 parturients scheduled to undergo non-urgent CS, USA, 1996 Exclusion criteria: Nursing women Psychiatric disease History of motion sickness	8 mg ondansetron 0.625 mg droperidol saline (placebo) All given after clamping of umbilical cord	Number of episodes of nausea/vomiting	Ondansetron (O) (n = 16); droperidol (D) (n = 16); placebo (P) (n = 16) At least 1 episode of nausea: O: 5 (31%) D: 4 (25%) P: 11 (70%) O vs. P: RR 0.4 (95% CI 0.2 to 1.0); 1.00 O vs. D: RR 1.2 (95% CI 0.4 to 3.8); 1.00 D vs. P: RR 0.4 (0.1 to 0.9); 1.00 At least 1 episode of vomiting O: 1 (6%) D: 2 (13%) P: 7 (44%) O vs. P: RR 0.2 (0.0 to 1.5); 1.00 O vs. D: RR 0.5 (0.0 to 5.0);1.00 D vs. P: RR 0.4 (0.1 to 1.8); 1.00	Computer-generated random assignment Women and assessors blinded	RCT	1b

Use of antiemetics (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Pan[367]	164 healthy ASA I, 2 parturients scheduled to undergo non-urgent CS, USA, 2000 Exclusion criteria: Nursing women Psychiatric disease Those taking antiemetics	10 mg metoclopromide 4 mg ondansetron 10 ml physiological saline (placebo) All given after clamping of umbilical cord	Number of episodes of nausea/vomiting Rescue medication	Metoclopromide (M) (n = 51); ondansetron (O) (n = 54); Placebo (P) (n = 51) At least 1 episode nausea: M: 26 (51%) O: 14 (26%) P: 36 (71%) M vs. P: RR 0.7 (95% CI 0.5 to 1.0) M vs. O: RR 2.0 (95% CI 1.2 to 3.3) O vs. P: RR 0.4 (95% CI 0.2 to 0.6) At least 1 episode vomiting: M: 9 (12%) O: 8 (15%) P: 19 (37%) M vs. P: RR 0.5 (95% CI 0.2 to 0.9) M vs. O: 1.2 (95% CI 0.5 to 2.8) O vs. P: 0.4 (95% CI 0.2 to 0.8) Rescue medication required: M: 3 (6%) O: 2 (4%) P: 13 (25%) M vs. P: 0.2 (95% CI 0.1 to 0.8) M vs. O: 1.6 (95% CI 0.3 to 9.1) 0.1 (95% CI 0.0 to 0.6)	Computer-generated random assignment Women and assessors blinded	RCT	1b
Abouleish[368]	74 women with term pregnancies, ASA I,2 , 18–40 years undergoing CS under spinal; anaesthesia, USA, 1999 Exclusion criteria: Fetal distress Intent to breastfeed Maternal medical problems Psychiatric disease Pregnancy-induced hypertension History of motion sickness Morbid obesity History of vomiting 24 hours preoperatively	4 mg ondansetron 0.9% physiological saline (placebo)	Nausea	Ondansetron (n = 36): 21 (58%) Placebo (n = 38): 30 (79%) RR (95% CI) ondansetron vs. placebo: 0.7 (0.5 to 1.0)	Computer-generated random assignment Women and assessors blinded	RCT	1b

Use of antiemetics (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Mandell[663]	135 healthy term parturients ASA I, 2, singleton pregnancies, elective or non-urgent CS under epidural anaesthesia, USA 1992	0.5 mg droperidol Placebo Given after clamping of umbilical cord	Nausea Vomiting	Droperidol (n = 67): Nausea: 9 (13%) Vomiting: 3 (4%) Placebo (n = 61): Nausea: 25 (41%) Vomiting: 8 (13%) RR (95% CI) droperidol vs. placebo: Nausea: 0.3 (0.2 to 0.6) Vomiting: 0.3 (0.1 to 1.2)	Randomisation not described Women and assessors blinded	RCT	1b
Cohen[362]	58 healthy parturients undergoing elective CS under GA	10 mg metoclopromide iv Saline (placebo) Given before induction of GA	Apgar scores Umbilical artery pH	Metoclopromide (n = 30): 1-minute Apgar score < 7: 2; 5-minute Apgar score < 7: 0 Umbilical artery pH: 7.23 (SD 0.01) Placebo (n = 28): 1-minute Apgar score < 7: 3 5-minute Apgar score < 7: 0 Umbilical artery pH: 7.24 (SD 0.01)	Randomisation not described Women and assessors blinded	RCT	1b
	Metanalysis of 7 RCTs that evaluate the effectiveness of antiemetics (n = 618)	Ondansetron vs. placebo Metoclopramide vs. placebo Droperidol vs. placebo Ondansetron vs. metoclopramide Ondansetron vs. droperidol	Nausea Vomitting	Ondansetron vs. placebo (n = 271): Nausea: pooled RR 0.4 (95% CI 0.2 to 0.8) Vomiting : pooled RR 0.3 (95% CI 0.2 to 0.7) Metoclopramide vs. placebo (n = 254): Nausea: pooled RR 0.3 (0.1 to 0.7) Vomiting : pooled RR 0.3 (95% CI 0.2 to 0.6) Droperidol vs. placebo (n = 128): Nausea: pooled RR 0.3 (95% CI 0.2 to 0.5) Ondansetron vs. metoclopramide (n = 165): Nausea: pooled RR 0.5 (95% CI 0.3 to 0.9) Vomiting : pooled RR 0.8 (95% CI 0.3 to 2.0) Ondansetron vs. droperidol (n = 92) Nausea: pooled RR 1.0 (95% CI 0.4 to 2.3) Vomiting : pooled RR 0.5 (95% CI 0.0 to 5.0) (fixed effects)		Meta-analysis	1a

Avoiding aortocaval compression

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Wilkinson, 1995[333]	293 women (3 trials) for CS	Lateral tilt (10–15 degrees) vs. no lateral tilt (supine) at CS	Low Apgar scores; severe neonatal depression; umbilical artery pH	Low Apgar: Lateral tilt: 9/111 Control: 20/136 Peto OR 0.53 (95% CI 0.25 to 1.16) Severe neonatal depression: Lateral tilt: 2/50 Control: 2/50 Peto OR 1.00 (95% CI 0.14 to 7.32) Umbilical artery pH: WMD 0.03 (95% CI 0.01 to 0.04) Only data from two trials was used for analysis	Methodological quality of trials poor	Systematic review	1a
Rees, 2002[335]	60 healthy women having elective CS	15-degree lateral tilt vs. full lateral tilt	Arm and leg blood pressure; ephedrine requirements; symptoms; fetal heart rate; cord gases; Apgar scores	Leg–arm pressure over time was significantly lower in the 15-degree tilt ($p < 0.001$). Mean leg systolic arterial pressure lower for all readings in the 15-degree tilt group ($p < 0.05$) at 4, 5, 6 and 8 minutes No difference: Arm systolic pressure Ephedrine requirements Symptoms Fetal outcomes	Full lateral tilt and 15-degree tilt are both associated with aortic compression	RCT	1b
Matorras, 1998[334]	204 women for emergency CS	Lateral tilt vs. supine	1) Fetal heart rate tracing 2) Uterine activity 3) Umbilical artery acid-base status 4) Newborn evaluation 5) Maternal parameters	1) Mean basal heart rate was higher in the lateral tilt group (137.5 vs. 131.1, $p = 0.02$). No difference in accelerations or decelerations 2) No difference 3) PO_2 significantly lower in left lateral group (14.03 Hgmm vs.16.02, $p = 0.04$). No difference in pH, pCO_2, O_2 saturation or bicarbonate 4) Proportion of neonates with Apgar < 7 same in both groups 5) No difference in maternal infectious or haematological parameters		RCT	1b

6.5 Surgical techniques for CS

Methods to prevent HIV transmission

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Tanner, 2002[377]	All members of the surgical team practicing in a surgical theatre in any surgical discipline 18 trials identified	Comparison of 2 or more of: single gloves, double gloves, glove liners, coloured puncture indicator systems, cloth outer gloves, steel outer gloves	Primary objective – measure of number of postoperative wound infections in surgical patients Secondary: objective – measure of the number of blood-borne infections in postoperative patients or number of perforations	Single vs. double latex 1: 8 studies (5267 participants); OR 0.90 (95% CI 0.74 to 1.08) Single vs. double latex 2: 8 studies (5264 participants); OR 3.72 (95% CI 2.82 to 4.91) Single latex orthopaedic vs. double latex 1: 1 study (682 participants); OR 0.16 (95% CI 0.08 to 0.3) Single latex orthopaedic vs. double latex 2: study (682 participants); OR 0.98 (95% CI 0.43 to 2.22) Double latex outermost vs. double latex indicator outermost: 2 studies (562 participants); OR 1.28 (95% CI 0.61 to 2.69) Double latex innermost vs. double latex indicator innermost: 2 studies (562 participants); OR 1.32 (0.65) Double latex outermost vs. double latex with liner outermost: 2 studies (357 participants); OR 0.72 (95% CI 0.46 to 1.11) Double latex innermost vs. double latex with liner innermost: 2 studies (331 participants); OR 8.66 (95% CI 0.68 to 109.77) Double latex innermost vs. latex liner with cloth innermost: 2 studies (190 participants); OR 8.49 (95% CI 2.89 to 24.94) Double latex innermost vs. latex inner with steel weave innermost: 1study (223 participants); OR 1.30 (95% CI 0.64 to 2.64) 1= outermost glove perforations 2= innermost glove perforations	Only glove perforations measured in the identified trials	Systematic review	1a

6.5 Surgical techniques for CS (continued)

Methods to prevent HIV transmission

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Eggleston, 1997[376]	162 CS were randomised	Use of surgical pass trays	Glove perforation. All gloves used at CS were tested for perforation using warm water installation Mean surgical time Blood loss	Glove perforation: Pass tray (221 pairs gloves): 19% No pass tray (223 pairs gloves): 16.1% p = 0.5 Mean surgical time: Pass tray (221 pairs gloves): 47.1 minutes No pass tray (223 pairs gloves): 49.5 minutes p = 0.7 Blood loss: Pass tray (221 pairs gloves): 907 ml No pass tray (223 pairs gloves): 889 ml p = 0.05 No difference in rates of perforation between different surgical team members, i.e. surgeon, assistants and technicians		RCT	1b
Eggleston, 1997[376]	Surgical team members from 192 CS (USA) were randomised	Control group: to employ normal instrument pass techniques Intervention group: used surgical pass trays for instruments 444 pairs of gloves were collected and tested. 223 from the control group and 221 from the intervention group This included 38 sets from double-gloving	Perforations in gloves	Control (n = 223): 36 Intervention (n = 221): 42 RR 1.2 (95% CI 0.8 to 1.8) 11 perforations occurred in the double glove set		RCT	1b

Use of adhesive drapes

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Ward, 2001[379]	620 women undergoing CS	Plastic adhesive wound drapes vs. no plastic drape	Wound infection and hospital stay	Infected: Drapes (n = 305): 34 No drapes (n = 298): 30 p = 0.933 Hospital stay: Drapes (n = 305): 10.6 days (SD 3.9) No drapes (n = 298): 10.2 days (SD 3.9) p = 0.6964		RCT	1b
Cordtz, 1989[380]	1340 women for CS	CS with adhesive drape vs. no adhesive drape (women were randomised to 4 groups, drapes and re-disinfection being the variables)	Wound infection	No difference in wound infection between drape group (58, 17.2%) and no drape group (43, 12.1%)		RCT	1b

Abdominal-wall incision

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Mathai, 2002[386]	101 women with singleton, term pregnancy for CS with spinal anaesthesia	Joel Cohen (JC) vs. Pfannensteil (P) incision for CS	Primary: 1) Women receiving first dose of analgesia within 4 hours of surgery Secondary: 2) Time between surgery and first dose of analgesia 3) Time from skin incision to delivery of the infant 4) Time from skin incision to closure 5) Blood loss 6) Time from surgery to intake of food 7) Total dose of analgesics 8) Febrile morbidity 9) Preoperative haematocrit 10) Postoperative haematocrit 11) Time to breastfeeding 12) Duration of stay in SCBU 13) Duration of hospital stay	Results given as means/group: **Outcome / JC* / P** / p** 1 / 23 / 41 / 0.0001 2 (hours) / 4.1 / 3.3 / 0.0164 3 (min) / 3.7 / 5.6 / < 0.0001 4 (min) / 33.1 / 44.5 / < 0.0001 5 (ml) / 410 / 468 / 0.0239 6 (hours) / 10.68 / 12.78 / 0.0191 7 / 2.05 / 2.94 / < 0.0001 8 / 3 / 12 / 0.0104 11 / 6.9 / 12.4 / < 0.0001 13 (days) / 4.4 / 5.9 / < 0.0001 * (n = 51); ** (n = 50) No difference between the groups for preoperative haematocrit or postoperative haematocrit or duration of stay in SCBU		RCT	1b

Abdominal-wall incision (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Stark, 1994[385]	245 women for CS	Pfannenstiel vs. Joel Cohen incision	Duration of the operation; febrile morbidity; duration of requirements for analgesia; doses of analgesia required	Duration of operation: Joel Cohen incision: 21.7 minutes Pfannenstiel incision: 23.3 minutes $p < 0.05$ Febrile morbidity: Joel Cohen incision: 7.4% Pfannenstiel incision: 18.6% $p < 0.05$ Duration of requirements for analgesia: Joel Cohen incision: 166 hours Pfannenstiel incision: 20.1 hours p: NS Doses of analgesia: Joel Cohen incision: 2.9 Pfannenstiel incision: 3.3 p: NS	Details of randomisation not given	RCT	1b
Ayers, 1987[387]	97 women for CS	Maylard vs. Pfannensteil incision	Blood loss; febrile morbidity; total operating time; incision sizes; difficulty with delivery; long term complications at 6 weeks	Data was not given or else depicted graphically not numerically. Authors comment that there was no difference for blood loss or febrile morbidity. Maylard incision had a significantly larger median and mean. Difficulty with delivery correlated negatively and significantly with incision < 13cm. No difference in 6 week complications	No data given	RCT	1b
Giacolone, 2002[388]	97 women for CS	Maylard vs. Pfannensteil incision	Febrile morbidity; length of hospital stay; blood transfusion; post operative pain (VAS); number of analgesic tablets used; quality of life scores; 3-month follow up; isokinetic measurements of abdominal muscles	No difference between the two incisions for any of the outcomes Incomplete data given		RCT	1b

Method of skin incision

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Hasselgren, 1984[389]	586 women undergoing elective abdominal surgery	One knife for the skin and a second knife for the deep incision vs. one knife for both skin and deep layers	Wound infection	Wound infection rate in the one-knife group was 3.6% and 5.5% in the two-knife group This was not statistically different	Method of randomisation not described Not CS patients Patient data not given	RCT	1b
Johnson, 1990[391]	240 women undergoing abdominal surgery	Abdominal incision with knife vs. abdominal incision with diathermy	Inflammation and wound infection rate	No difference in inflammation and infection between scalpel group (26/130, 20%) and diathermy group (18/110, 16.4%); p 0.47	Not CS patients	RCT	1b

Method of opening the abdomen

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Burger, 2002[381]	Review of prospective RCTs comparing midline, paramedian, transverse and oblique abdominal incisions	Comparison between different abdominal incisions	Wound infection, wound dehiscence, incisional hernia	Wound infection: 10 RCTs (3586 women), 4 non-RCTs (2548 women); p: NS Dehiscence: 9 trials (2551 women); p: NS Hernia: 9 trials (2551 women); p: NS Postoperative pain: 2 trials (209 women); p < 0.001		Systematic Review	1a
Hendrix, 2000[382]	48 cases of fascial dehiscence following CS or gynaecological surgery complicating 17,995 operations, 8950 CS and 9405 gynaecology operations. 144 controls	Case–control study	Univariate analysis identified independent variables and risk factors	Risk for dehiscence with vertical incisions not increased with respect to risk with Pfannensteil incisions (p = 0.39, 2 tailed test). This was true for all patients including obstetric patients (OR 1.3, 95% CI 0.5 to 3.4) 47/48 of the cases had wound infection compared with 1/144 controls) p < 0.0001, OR 37.8, 95% CI 14.8 to 96.8	Wound infection most significant risk factor for fascial dehiscence	Case–control	3
Lindholt,1994[383]	108 women undergoing CS	Percutaneous vs. intracutaneous suture	Wound complications, Mean satisfaction score with the cosmetic appearance of the scar	Wound complications–no difference Cosmetic satisfaction–no difference between suture method Transverse commented on as being preferred more to midline		Non-randomised controlled trial	2a

Extension of the uterine incision

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Rodriguez, 1994[395]	296 women for CS	Blunt vs. sharp extension (scissors) of the uterine incision	Extensions of incisions Endometritis Mean length of extension Postpartum Hb Decrease in Hb Umbilical cord pH Delivery time	Extensions of incisions: Blunt (n = 139): 16 Sharp (n = 147): 20 p = 0.61 Endometritis: Blunt (n = 139): 63 Sharp (n = 147): 65 p = 0.81 Mean length of extension: Blunt (n = 139): 3.2 cm Sharp (n = 147): 3.2 cm p = 0.98 Postpartum Hb: Blunt (n = 139): 10.27 g/dl Sharp (n = 147): 9.92 g/dl p = 0.12 Decrease in Hb: Blunt (n = 139): 1.8 g/dl Sharp (n = 147): 2.2 g/dl p = 0.15 Umbilical cord pH: Blunt (n = 139): 7.26 Sharp (n = 147): 7.27 p = 0.49 Delivery time: Blunt (n = 139): 11.5 minutes Sharp (n = 147): 11.7 minutes p = 0.84	No differences for any of the outcomes	RCT	1b

Extension of the uterine incision (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Magann, 2002[394]	945 women for CS	Blunt vs. sharp (scissors) extension of the uterine incision	Mean blood loss (ml) Oxytocin ≥ 1l fluid Haemabate Mean HCT change > 10% decrease in HCT Transfusion Uterine scar extension > 3 cm Postpartum endometritis	Mean blood loss: Sharp (n = 470): 886 ml Blunt (n = 475): 843 ml p = 0.001 Oxytocin ≥ 1l fluid: Sharp (n = 470): 35 Blunt (n = 475): 31 RR 1.07 (95% CI 0.84 to 1.35) Haemabate: Sharp (n = 470): 22 Blunt (n = 475): 19 RR 1.08 (95% CI 0.80 to 1.45) Mean HCT change: Sharp (n = 470): 6.1 Blunt (n = 475): 5.5 p = 0.003 > 10% decrease in HCT: Sharp (n = 470): 62 Blunt (n = 475): 42 RR 1.23 (95% CI 1.03 to 1.46) Transfusion: Sharp (n = 470): 9 Blunt (n = 475): 2 RR 1.65 (95% CI 1.250 to 2.221) Uterine scar extension > 3 cm: Sharp (n = 470): 69 Blunt (n = 475): 24 RR 0.48 (95% CI 0.34 to 0.69) Postpartum endometritis: Sharp (n = 470): 66 Blunt (n = 475): 51 RR 1.16 (95% CI 0.97 to 1.38)		RCT	1b
Wilkinson, 2003[396]	526 women in 4 RCTs undergoing CS	Stapler used to extend uterine incision vs. extension digitally or with scissors	Total operating time, time to deliver the baby, blood loss, perinatal morbidity	Operating time: WMD –1.17 (95% CI –3.57 to 1.22) Time to deliver baby: WMD 0.85 (95% CI 0.48 to 1.23) Blood loss: WMD –41.22 ml (95% CI –50.63 to -31.8) No difference in perinatal morbidity outcomes	No difference in transfusions but only reported by one trial	Systematic review	1a

Fetal lacerations

Study	Population	Intervention	Outcomes	Results	Comments	Design	EL
Smith, 1997[664]	896 neonates records reviewed from infants delivered by CS USA	None	Total 17/896 laceration injuries were reported (1.9 % lacerations/indications) Reason for caesarean delivery in relation to laceration injuries: – Failure to progress: 8/450, (1.8 % lacerations/indications) – Fetal intolerance of labour: 2/156 (1.3 % lacerations/indications) – Repeat elective 1/101 (1.0% lacerations/indications) – Nonvertex presentation: 6/100 (6.0 % lacerations/indications)			Retrospective review	3

Use of forceps

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Bofill, 2000[665]	44 women for repeat elective CS	Vacuum vs. forceps vs. manual delivery of the fetal head	Time for delivery, uterine incision extension, post operative Hb, Hb drop, pain scores, Apgar at 1 and 5 minutes, cord artery pH	Vacuum delivery (n = 15): Time: 86.1 seconds Uterine incision: 1 Postoperative Hb: 10.08 Hb drop: 1.78 Pain scores: 1.17 Apgar 1 minute: 8.2 Apgar 5 minutes: 8.93 Cord pH: 7.23 Manual delivery (n = 14): Time: 84.1 seconds Uterine incision: 2 Postoperative Hb: 9.25 Hb drop: 2.2 Pain scores: 3.68 Apgar 1 minute: 7.6 Apgar 5 minutes: 8.5 Cord pH: 7.21 Forceps delivery (n = 15): Time: 125.6 seconds Uterine incision: 2 Postoperative Hb: 10.0 Hb drop: 1.96 Pain scores: 2.68 Apgar 1 minute: 7.4 Apgar 5 minutes: 8.7 Cord pH: 7.26 p value: Forceps delivery (n = 15): Time: 0.061 Uterine incision: 0.777 Postoperative Hb: 0.077 Hb drop: 0.321 Pain scores: 0.015 Apgar 1 minute: 0.2 Apgar 5 minutes: 0.06 Cord pH: 0.5		RCT	1b

Cord clamping

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Mercer, 2001[402]	Cord clamping studies from 1980-2001 for vaginal and caesarean births 7 RCTs and 2 nonrandomised trials	Cord clamping Hyperviscosity Hyperbilirubinaemia	Polycythaemia	Polycythaemia: no difference T/PT: both		Review of RCT and non-RCT evidence	1b
McDonnell, 1997[405]	185 infants from 26 to 33 weeks of gestation delivered by CS or vaginal birth	Delayed cord clamping	Infant haematocrit (Hct) at 1 and 4 hours Feasibility of delayed cord clamping	Haematocrit 1 hour: Hct delayed: 55 Hct control: 52.9 p: NS Haematocrit 4 hours: Hct delayed: 55 Hct control: 52.5 p: NS		RCT	1b

Use of uterotonics

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Dennehy, 1998[407]	40 parturients scheduled for elective CS	5 iu oxytocin intravenous (n = 20) vs.20 iu oxytocin intramyometrial (n = 19)	A) Mean decrease in systolic blood pressure one min after oxytocin B) Time till systolic blood pressure return to baseline C) Uterine tone D) Haemoglobin first day postoperative	A) 8.4 mmHg vs. 14.6 mmHg ($p < 0.001$) B) 2 minutes vs. 3 minutes ($p < 0.05$) C) No difference (graphical result) D) 107.7 ± 13.4 vs. 109.8 ± 10.4	Randomisation according to a computer-generated series of random numbers 1 dropout	RCT Placebo-controlled double blind	1b

Use of uterotonics (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Munn, 2001[408]	321 women admitted for labour and delivery	10 u/500 ml oxytocin (n = 163) vs. 80 u/500 ml oxytocin (n = 158) infused over 30 minutes after cord clamping	A) Percentage receiving additional uterotonic medication B) Percentage receiving methylergonovine, 15 methyl prostaglandin $F_{2\alpha}$ or both C) Regional anaesthesia D) Mean duration of surgery E) Percentage receiving intravenous bolus of crystalloid, press agents or both F) Mean estimate of blood loss G) Mean change in hematocrit	A) 39% vs. 19%, p < 0.001, RR 2.1, 95% CI 1.4 to 3.0 B) 9 % vs. 2%, RR 4.8, 95% CI 1.4 to 16.0 C) No significant difference D) No significant difference E) No significant difference F) 957 ± 148 ml vs. 937 ± 159 ml, p = 0.08 G) No significant difference	Randomisation scheme was stratified by whether the woman had been receiving parenteral magnesium sulphate for either pre-eclampsia or preterm labour	RCT Double blind	1b
Chou, 1994 [411]	60 women undergoing elective CS	Intramyometrial 15-methyl prostaglandin $F_{2\alpha}$, 125 g (n = 30) vs.intravenous oxytocin 20 u (n = 30)	A) Mean estimated blood loss B) Mean fall in haemoglobin C) Mean fall in hematocrit D) Side effects E) Lochial discharge Maternal arterial oxygen saturation F) Intraoperative infusion volume G) Additional oxytocics (n) H) Post delivery hospitalisation	A) No significant difference: 645 ml (SD 278, range 400 to 1500) vs. 605 ml (SD 303, range 200 to 1750) B) No significant difference: 0.98 gm/dl (SD 0.95) vs. 0.65 gm/dl (SD 0.79) C) No significant difference: 2.58 % (SD 2.96) (n = 30) vs. 2% (SD 2.96) (n = 29) D) No significant difference E) No significant difference F) 753 ml (330) vs.632 ml (174) G) 3 (10%) vs.1 (3%) H) No significant difference	Random allocation through opaque sealed envelopes	RCT Double blind	1b

Use of uterotonics (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Lokugamage, 2001[409]	40 women undergoing elective or emergency CS	500 g oral misoprostol given immediately after delivery vs. bolus intravenous injection 10 iu Syntocinon	Mean estimated blood loss Drop in serum haemoglobin Need for additional oxytocics Degree of shivering Percentage of women requiring blood transfusion Percentage of operations described as technically difficult Method by which the placenta was delivered No. of episodes of intaroperative hypertension immediately after the uterotonic agent was given Temperature	No significant difference in any outcome	Randomisation by computer-generated numbers in sealed envelopes	RCT Placebo-controlled double blind	1b
Gambling	Awaiting paper	Single dose iv carbetocin vs. 8-hour infusion of oxytocin					
Dansereau, 1999[414]	694 women undergoing elective CS in Canada	Single dose of 100 microgrammes of intravenous carbetocin compared with an 8-hour infusion of oxytocin at CS	Primary: proportion of women requiring additional oxytocic intervention for uterine atony	Overall oxytocic intervention rate was 7.4% (47 women) OR of intervention 2.03, 95% CI 1.1 to 2.8. 15/317 (4.7%) in the intervention group compared with 32/318 (10.1%) in the control group		Multicentre double blind RCT	1b

Method of placental removal

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Wilkinson[415] 3	RCTs including 224 women who underwent CS Inclusion criteria: Randomised and quasi-RCTs comparing manual removal of placenta with spontaneous separation and controlled cord traction for delivery in pregnant women undergoing CS	Manual removal of placenta at CS vs. spontaneous separation	Blood loss Postoperative haematocrit Fetomaternal bleeding Postpartum endometritis	Mean difference in blood loss: 3 trials (162 women); effect size 436 ml (95% CI 348 to 525) Mean difference in post operative drop in haematocrit: 2 trials (100 women); 4.3 (95% CI 3.3 to 5.4) Transplacental bleeding (Kleihauer): 1 trial (62 women); Peto OR 2.19 (95% CI 0.69 to 6.93) Endometritis: 1 trial (62 women); Peto OR 5.44 (1.25 to 23.75)	Trials were of reasonable quality although no mention was made of attempts to blind outcome assessment, outcomes were objective	Systematic review	1a
Cernadas[419]	108 women undergoing CS (USA) Exclusion criteria: Multiple gestation, pre-existing maternal conditions e.g. urinary tract infections, upper respiratory tract infections, pneumonia, clinically documented infections other than chorioamnionitis	Glove change vs. no glove change Manual placental delivery vs. expressed placental delivery	Febrile morbidity Postpartum endometritis	Febrile morbidity: No glove change vs. glove change: RR 0.7 (95% CI 0.3 to 1.4) Manual placental delivery vs. expressed placental delivery: RR 1.4 (95% CI 0.6 to 3.5) Postpartum endometritis: No glove change vs. glove change: RR 1.2 (95% CI 0.5 to 2.8) Manual placental delivery vs. expressed placental delivery: RR 1.5 (95% CI 0.6 to 3.6)	Study used consecutively numbered and sealed envelope containing computer-generated random group assignments	RCT	1b
Atkinson[422]	643 women undergoing CS (USA)	Glove change vs. no glove change Manual placental delivery vs. expressed placental delivery	Endometritis Postoperative drop in haematocrit Blood transfusion	No glove change vs. glove change: Postpartum endometritis: RR 1.0 (95% CI 0.79 to 1.3) Manual placental delivery vs. expressed placental delivery: Postpartum endometritis: RR 1.4 (95% CI 1.1 to 1.8) Postoperative drop in haematocrit: p = 0.14 Blood transfusion: p = 0.09	Study used consecutively numbered and sealed envelope containing computer-generated random group assignments	RCT	1b

Method of placental removal (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Chandra[421]	386 women undergoing CS (USA) Exclusion criteria: Chorioamnionitis, placenta accreta, urgent CS	Manual removal of placenta at CS vs. spontaneous separation	Estimated blood loss Endometritis	Manual placental delivery vs. expressed placental delivery: Estimated blood loss (ml): Mean difference –0.91 (–1.13 to –0.70) Endometritis: OR 1.87 (0.46 to 7.59)	Randomisation by random numbers and series of sealed envelopes	RCT	1b
Lasley[420]	333 women undergoing CS (USA) Exclusion criteria: Intrapartum antibiotics for chorioamnionitis, group B streptococcal prophylaxis	Manual removal of placenta at CS vs. spontaneous separation	Endometritis Wound infection	Manual placental delivery vs. expressed placental delivery, RR (95% CI): Endometritis: 1.83 (1.02 to 3.29) Wound infection: 2.24 (0.80 to 6.31)	Randomisation by computer-generated random numbers table with group assignments sealed in opaque envelopes	RCT	1b
Turrentine[423]	228 women in labour undergoing CS Exclusion criteria: Chorioamnionitis, use of antibiotics	Glove change v no glove change	Endometritis	No glove change vs. glove change, RR (95% CI): Postpartum endometritis: 1.1 (0.75 to 1.47)	No description of how randomisation was achieved	RCT	1b
Notelovitz[418]	62 women undergoing CS. (Durban) Exclusion criteria: Rhesus negative women	Controlled cord traction v manual removal of placenta	Rate of fetomaternal transfusion	Controlled cord traction vs. manual removal of placenta, (RR 95% CI): Rate of fetomaternal transfusion: 0.37 (0.13 to 1.07)	No description of how randomisation was achieved	RCT	1b

Exteriorisation of the uterus

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Wilkinson, 1995[424]	486 women for CS (2 trials)	Exteriorisation of the uterus vs. intraperitoneal closure	Blood loss, postoperative febrile morbidity, side effects	No difference for blood loss Exteriorisation associated with fewer postoperative febrile days (OR 0.40, 95% CI 0.17 to 0.94) Nonsignificant trend to fewer infections and more nausea and vomiting with exteriorisation		Systematic review	1a
Edi-Osagie, 1998[425]	194 women for CS	Exteriorisation of the uterus vs. intraperitoneal closure	1) Intraoperative changes in pulse rate, MABP and arterial O_2 saturation 2) Perioperative changes in Hb concentration 3) Incidence of intraoperative vomiting and pain 4) Postoperative complications, febrile and infectious morbidity 5) Immediate and late pain scores 6) Satisfaction with the operation	1) No difference 2) No difference 3) No difference 4) No difference 5) Pain scores reached significance after day 3 (exteriorisation 4.4 mean pain score vs. 3.7 for intraperitoneal repair, p = 0.046) 6) No difference		RCT	1b
Wahab, 1999[426]	288 women for CS	Exteriorisation of the uterus vs. intraperitoneal closure	Primary: 1) Perioperative Hb change 2) Duration of operation 3) Maternal morbidity 4) Length of hospital stay Secondary: intraoperative pain, nausea, vomiting, pulling or tugging	Postoperative drop in Hb: GA: Exteriorised (n = 8): mean 1.0 (SD 1.5) Not exteriorised (n = 10): mean 1.7 (SD 0.8) Total (n = 18): mean 1.4 (SD 1.2) SA: Exteriorised (n = 82): mean 1.1 (SD 0.9) Not exteriorised (n = 85): mean 1.3 (SD 1.2) Total (n = 167): mean 1.2 (SD 1.1) EA: Exteriorised (n = 49): mean 1.9 (SD 1.1) Not exteriorised (n = 54): mean 2.2 (SD 1.1) Total (n = 103): mean 1.5 (SD 1.1) All anaesthesia: Exteriorised (n = 139): mean 1.4 (SD 1.1) Not exteriorised (n = 149): mean 1.7 (SD 1.2) p < 0.05 Total (n = 288): mean 1.5 (SD 1.1) No difference for the other outcomes		RCT	1b

One- vs. two-layer closure of uterus

This section was updated and replaced in 2020. Please see the NICE website for the updated guideline.

Closure of the peritoneum

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Wilkinson, 1997[437]	1194 women (4 trials) for CS	Closure vs. no closure of the peritoneum at CS	Operating time, postoperative morbidity, analgesic requirements length of hospital stay.	Non-closure saved operating time: weighted mean difference of –6.12 minutes, 95% CI –8.00 to –4.27 No difference in the other outcomes	One of the 3 trials had sound methodology. The other 3 trials were randomised according to e.g. days of the week so potential for bias	Systematic review	1a
Hojberg, 1998[441]	40 women for elective CS	Closure vs. no closure of the parietal peritoneum at CS	Postoperative pain measured twice daily from day 1 to 5 using VAS	Results given graphically but no difference between the two groups for postoperative pain	Double blinded for postoperative observations	RCT	1b
Grundsell, 1998[442]	361 women for CS	Closure vs. no closure of the visceral and parietal peritoneum at CS	Febrile morbidity, wound infection, wound dehiscence, urinary tract infection, return to normal bowel action, operating time and hospital stay	Febrile morbidity: Closure (n = 182): 35 Non-closure (n = 179): 14 p < 0.001 Wound infection: Closure (n = 182): 7 Non-closure (n = 179): 4 p < 0.05 Operating time: Closure (n = 182): 41.3 minutes Non-closure (n = 179): 33.4 minutes p < 0.01 Hospital stay: Closure (n = 182): 6.4 days Non-closure (n = 179): 5.03 days p < 0.01		RCT	1b
Balat, 2000{14157]	266 women for CS	Closure vs. no closure of the visceral and parietal peritoneum at CS	Operation time, hospitalisation time and postoperative complications	Fever: Closure (n = 132): 88 Non-closure (n = 134): 46 p < 0.05 Wound dehiscence Closure (n = 132): 13 Non-closure (n = 134): 7 p < 0.05 Operating time (minutes): Closure (n = 132): 41 Non-closure (n = 134): 20 p < 0.001 Hospital stay: Closure (n = 132): 6.6 days Non-closure (n = 134): 3.7 days p < 0.05	Randomisation method not clear	RCT	1b

Closure of the peritoneum (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Galaal, 2000[444]	60 women for CS	Closure vs. no closure of the visceral and parietal peritoneum at CS	Duration of operation, drop in Hb, blood transfusion, estimate of blood loss, hospital stay, postoperative pyrexia, ileus, wound infection	Operating time less with non-closure) 61.9 minutes vs. 53.56 minutes, $p < 0.01$) No difference with other outcomes		RCT	1b
Ferrari, 2001[445]	158 women for CS	Closure vs. no closure of the visceral and parietal peritoneum at CS	Operating time, postoperative fever, number of sutures used	Operating time less with non closure (31.6 vs. 44.4, $p = 0.0001$) Fewer sutures used (3.6 vs. 6, $p = 0.001$) No difference in post operative morbidity		RCT	1b
Chanrachakul, 2002[446]	60 women for elective CS	Closure vs. no closure of the visceral and parietal peritoneum at CS	Postoperative pain using VAS, at rest, when moving in bed, while walking, measured twice daily from day 0 to 4 Use of analgesics	No difference in postoperative pain using VAS or consumption of analgesics Results given graphically	Controlled for indicators for CS, tubal ligation and epidural narcotics	RCT	1b
Rafique, 2002[447]		Closure vs. no closure of the visceral and parietal peritoneum at CS	Analgesic requirement assessed by morphine usage via PCA pump over first 24 hour period, oral analgesia, patient pain using VAS and verbal rating scale and patient satisfaction using verbal rating scale	In first 24 hours non closure group used less morphine that closure group (0.64 mg/kg body weight vs.0.82 mg/kg. $p = 0.04$) Satisfaction scores higher in non closure group Pain scores and other outcomes no difference		RCT	1b

Closure of the abdominal wall

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Van' t Riet, 2002[448]	15 studies of women with midline laparotomy incisions closed with different closure techniques	Closure with: – Continuous rapidly absorbable suture – Continuous slowly absorbable suture – Nonabsorbable suture	Primary: Incisional hernia Secondary: wound dehiscence; wound pain, wound infection, suture sinus formation	Closure by continuous rapidly absorbed suture was followed by more hernias than slowly absorbable ($p < 0.009$) or nonabsorbable ($p = 0.001$) More wound pain occurred with nonabsorbable sutures ($p < 0.005$) and more suture sinuses ($p = 0.02$)		Systematic review	1a
Weiland, 1998[449]	12,249 women with abdominal wound closure	Different methods of closure: continuous versus interrupted suture, absorbable versus nonabsorbable and mass versus layered closure	Hernias, dehiscence	Mass closures produced less hernias and dehiscence that layered closure ($p=0.002$).		Met analysis	1b

Closure of subcutaneous tissue

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Del valle, 1992[451]	438 women for CS	Closure of subcutaneous tissue (plain catgut) vs. no closure	Wound disruption	6/222 women who had subcutaneous suture and 16/216 with no suture had superficial wound disruption (p = 0.03)	Other risk factors described were more vaginal examinations during labour and higher BMI Emergency and elective CS included Randomisation not clearly described Physicians not blinded	RCT	1b
Chelmow, 2002[450]	327 women for CS	Closure of subcutaneous tissue (plain catgut) vs. no closure	Wound complications	Before discharge: Subcut group 4/162, 2.5% had complications vs. 12/165, 7.3% in control group, RR 0.34, 95% CI 0.11 to 1.0 Follow up complications: no difference Skin separation, seroma or haematoma formation: no difference	Emergency and elective CS included	RCT	1b
Cetin, 1997[453]	164 women, 70 women who had subcutaneous tissue thickness of < 2 cm and 94 with > 2 cm subcutaneous tissue	Each group was individually randomised to subcutaneous tissue closure or nonclosure	Wound complications	For group with > 2 cm subcutaneous tissue: Closure group (n = 47): Seroma: 3 Haematoma: 1 Infection: 1 Total: 5 Non-closure group (n = 44): Seroma: 6 Haematoma: 3 Infection: 3 Total: 12 (p = 0.041) For group with < 2 cm subcutaneous tissue there was no difference for any of the above parameters		RCT	1b

Use of superficial wound drains

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Ochsenbein-Imbof[456]	305 women undergoing CS (Switzerland) Exclusion criteria: refusal to participate, increased bleeding risk (e.g. HELLP), emergency CS, severe fetal deformity	Suction wound drainage (n = 151) vs. no wound drainage (n = 154)	Decrease in preoperative–postoperative Hb Fever > 38 degrees, at least 2 days No. of opiate injections 3-dimensional sonographic hematoma Complications requiring revision Operating time Length of hospital stay	Decrease in Hb: no significant difference Fever > 38, at least 2 days: no events in either group Opiate use: Suction group: 4.5 injections SD 2.8 No suction group: 2.8 injections SD 1.4 p = 0.0001 Sonographic hematoma: Suction group: 5 No suction group: 4 p > 0.05 Complications requiring revision: Suction group: 1 No suction group: 1 p > 0.05 Operating time: Suction group: 36.1 min SD 10.5 No suction group: 32.7 min SD 11.3 p = 0.007 Length of hospital stay: Suction group: 7.4 days SD 2.8 No suction group: 6.5 days SD 2.4 p = 0.006	Randomisation by opaque sealed envelopes All women received perioperative antibiotic prophylaxis	RCT	1a
Saunders[454]	200 women undergoing CS (UK) Exclusion criteria: cases where bleeding was severe enough to warrant elective drainage	Suction wound drainage (n = 100) vs. no wound drainage (n = 100)	Wound assessment using a scoring system	Moderate wound infection (score of at least 40): Suction wound drainage (n = 100): 4 (4%); RR 1.33 (95% CI 0.33 to 5.8) No wound drainage (n = 100): 3 (3%); RR 1.00	Randomisation using sealed envelopes Sample size calculation not included	RCT	1a
Allaire[452]	76 obese women undergoing elective CS (USA) Inclusion criteria: at least 2 cm subcutaneous layer	Suture closure of subcutaneous layer vs. subcutaneous closed suction drain vs. no suture and no drainage	Wound complications of either: Wound separation Wound infection Haematoma	Any wound complication: Subcutaneous suture closure (n = 26): 5 (19.6%); RR 0.45 (95% CI 0.18 to 1.12) Subcutaneous drain (n = 24): 1 (4.2%); RR 0.10 (95% CI 0.01 to 0.71) No intervention (n = 26): 11 (42.3%); RR 1.00	Randomisation was computer- generated, placed in opaque sealed envelopes All women given perioperative prophylactic antibiotics	RCT	1a

Use of superficial wound drains (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Maharaj[455]	440 women undergoing emergency CS (Durban) Exclusion criteria: midline incisions, clinical signs of intrauterine infection	Corrugated wound drainage vs. no wound drainage	Wound infection Duration of operation	Wound infection: Corrugated wound drainage (n = 217): 37 (17%); RR 1.09 (95% CI 0.71 to 1.66) No wound drainage (n = 223): 35 (16%); RR 1.00 Duration of operation: Corrugated wound drainage (n = 217): 44 minutes (SD 17.3) No wound drainage (n = 223): 34 minutes (SD 11.7) (p = 0.0001)	Randomisation was computer-generated, placed in opaque sealed envelopes All women given perioperative prophylactic antibiotics	RCT	1a

Closure of the skin

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Alderdice, 2002[458]	One trial included in the review, described below	Subcuticular suture vs. staples		See below		Systematic review	1a
Frishman, 1997[459]	66 women for CS, 50 available for analysis	Subcuticular suture vs. staples	Wound infection, wound pain (at discharge and 6 weeks follow up), wound appearance, time to close wound	Wound infection: Sutures: 0.0 Staples: 0.1 p = NS Pain scale at discharge: Sutures: 5.1 Staples: 6.6 p = 0.003 Pain scale at follow up: Sutures: 0.5 Staples: 2.0 p = 0.0001 Wound appearance: data not given, described as sutures found to be more attractive by patient and doctor Time to close wound: Sutures: 605 seconds Staples: 47 seconds p < 0.001		RCT	1b
16012	See 15.1 ET						

Use of antibiotics

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Smaill, 2002[463]	Women undergoing CS, elective and non elective (81 trials, 11,937 women)	Prophylactic antibiotics at CS	Fever Wound infection Endometritis Urinary tract infection Serious infections	Fever: ECS: RR 0.49 (95% CI 0.32 to 0.75) NECS: RR 0.40 (95% CI 0.31 to 0.51) All: RR 0.45 (95% CI 0.39 to 0.52) Wound infection: ECS: RR 0.73 (95% CI 0.53 to 0.99) NECS: RR 0.36 (95% CI 0.26 to 0.51) All: RR 0.41 (95% CI 0.35 to 0.48) Endometritis: ECS: RR 0.38 (95% CI 0.22 to 0.64) NECS: RR 0.39 (95% CI 0.34 to 0.46) All: RR 0.36 (95% CI 0.30 to 0.44) Urinary tract infection: ECS: RR 0.57 (95% CI 0.29 to 1.11) NECS: RR 0.43 (95% CI 0.30 to 0.60) All: RR 0.42 (95% CI 0.46 to 0.64) Serious infections: ECS: RR 1.01 (95% CI 0.04 to 24.21) NECS: RR 0.28 (95% CI 0.13 to 0.61) All: RR 0.42 (95% CI 0.28 to 0.65)		Systematic review	1a
Hopkins, 2001[464]	Women undergoing CS, elective and nonelective (31 trials)	Trials comparing at least 2 different prophylactic antibiotic regimens	Fever Wound infection Urinary tract infection Serious infections	Ampicillin vs. 1st generation cephalosporin: OR 1.27 (95% CI 0.84 to 1.93) Ampicillin vs. 2nd or 3rd generation cephalosporins: OR 1.21 (95% CI 0.97 to 1.51) Multiple dose vs. single dose: OR 0.92 (95% CI 0.7 to 1.23)		Systematic review	1a

Use of antibiotics (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Harrigill, 2003[465]	196 women undergoing routine CS	Intra-abdominal irrigation with normal saline after closure of the uterus but before abdominal wall closure	Maternal morbidity - one of the following: Infections (endometritis) Haemorrhage Anaemia Urinary retention Other secondary outcomes mentioned	Infections: Control group (n = 99): 7 Intervention group (n = 97): 9 p = 0.61 Haemorrhage: Control group (n = 99): 2 Intervention group (n = 97): 1 p > 0.999 Anaemia: Control group (n = 99): 2 Intervention group (n = 97): 3 p = 0.68 Urinary retention: Control group (n = 99): 0 Intervention group (n = 97): 0 p > 0.999	No difference in maternal morbidity for any of the outcomes RCT 1b		
Pitt, 2001[469]	224 women undergoing CS, > 24 weeks and no overt infection and no metronidazole allergy	Intravaginal metronidazole gel	Endometritis Febrile morbidity Wound infection Antibiotic use Postpartum stay	Endometritis: Intervention group (n = 112): 8 (7%) Control group (n = 112): 19 (17%) p = 0.04 Febrile morbidity: Intervention group (n = 112): 15 (13%) Control group (n = 112): 21 (19%) p = 0.28 Wound infection: Intervention group (n = 112): 5 (4%) Control group (n = 112): 3 (3%) p = 0.50 Antibiotic use: Intervention group (n = 112): 4 (3–5%) Control group (n = 112): 4 (3–5%) p = 0.50		RCT	1b

Use of antibiotics (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Reid, 2001[468]	Women having caesarean births	Vaginal preparation with povidone iodine	Fever Endometritis Use of iv antibiotics Wound separation	Intervention group (n = 217): Fever: 44 (20.3%) Endometritis: 19 (8.8%) Antibiotic use: (16.6%) Wound separation: 12 (5.5%) Control group (n = 213) Fever: 44 39 (18.3%) Endometritis: 12 (5.6%) Antibiotic use: (16.9%) Wound separation: 18 (8.4%) Fever: RR 1.1 (95% CI 0.8 to 1.6) Endometritis: RR 1.6 (95% CI 0.8 to 3.1) Wound separation: RR 0.6 (95% CI 0.3 to 0.3)	No difference in morbidity	RCT	1b
Magann,1993[467]	100 women undergoing CS, both elective and emergency (USA) Exclusion criteria: presence of chorioamnionitis at CS, emergency CS for fetal distress with inadequate time for skin preparation, patient refusal to participate in study	Standard skin preparation (povidone–iodine 7.5% scrub followed by povidone-iodine 10% solution) vs. 5-minute scrub with parachlorometaxylenol followed by povidone scrub and solution Intraoperative pelvic irrigation with physiological saline vs. 1-g cefazolin sodium in 500 ml physiological saline	Endometritis Wound infection	Endometritis: Special skin preparation (n = 50): 17 (34%) Standard skin preparation (n = 50): 24 (48%) RR (95% CI): 0.71 (0.44 to 1.48) Antibiotic irrigation (n = 50): 11 (22%) Physiological saline irrigation (n = 50): 30 (60%) RR (95% CI): 0.37 (0.21 to 0.65) Wound infection: Special skin preparation (n = 50): 1 (2%) Standard skin preparation (n = 50): 5 (10%) RR (95% CI): 0.2 (0.02 to 1.65) Antibiotic irrigation (n = 50): 2 (4%) Physiological saline irrigation (n = 50): 4 (8%) RR (95% CI): 0.5 (0.09 to 2.61)	Randomisation method: combination of random number tables and sealed opaque envelopes	RCT	1b

Use of antibiotics (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Kellum, 1985[666]	262 women undergoing emergency CS (USA) Inclusion criteria: Prolonged rupture of membranes, numerous pelvic examinations, intrauterine catheter placement, fetal distress, placenta praevia, prolonged labour for CPD, poor nutrition, poverty Exclusion criteria: Current use of antibiotics, known infection, elective CS with low risk of infection, allergy to cephalosporins	No intrauterine lavage V Uterine lavage with 2 g cefamandole + 800 ml physiological saline vs. uterine lavage with 800 ml physiological saline	Serious infection defined as either endometritis or wound infection	No intrauterine lavage (n = 92): Serious infection: 38 (41%), RR 1.00 Uterine lavage with 800 ml physiological saline (n = 86): Serious infection: 29 (34%), RR 0.82 (95% CI 0.56 to 1.20) Uterine lavage with 2 g cefamandole + 800 ml physiological saline (n = 84): Serious infection: 9 (11%), RR 0.26 (95% CI 0.13 to 0.50)	Randomisation determined by last digit of hospital number	RCT	1b

Use of antibiotics health economics

Note: Level of evidence is not relevant to economic models and therefore has not been included here

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Duff, 1987[470]	100 hypothetical high-risk women undergoing emergency CS	Antibiotics to treat emdomyometritis	Cost: Wholesale cost of antibiotic regimens totreat endomyometritis is assumed to be US$140 Outcome: Model assumes endomyometritis in 40 women. Prophylaxis reduces incidence by 50%, therefore 20 unnecessary infections	Total cost of treating 20 women US$2,800. Plus two days additional hospitalisation at US$441/day. Total cost US$17,640. Not including additional pharmacy preparation and medical personnel costs Total costs for 100 doses US$300–600. Net cost saving US$17,000 for every 100 emergency surgical procedures Two courses of antibiotics, net savings around US$16,000		Cost effectiveness with simple modelling	

Use of antibiotics health economics (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Ford, 1987[667]	Woman undergoing CS	Cost (including cost of failure) of prophylactic antibiotics during CS Piperacillin, cefotoxin, ceftazidime, cefazolin cefotaxime, ampicillin	Efficacy of antibiotic Costs of prophylactic failure based on mean inpatient stay (mother and baby). Laboratory tests, drugs costs, pharmacy preparation and intravenous equipment	Effectiveness of antibiotic: Piperacillin 98% Cefotoxin 91% Ceftazidime 82% Cefazolin 82% Cefotaxime 80% Ampicillin 77% Cost of failure of antibiotic US$7,442 Cost/woman associated with prophylactic failure by antibiotic: Piperacillin US$277 Cefotoxin US$811 Ceftazidime US$82% Cefazolin US$1,391 Cefotaxime US$1,695 Ampicillin US$1,820 Most effective (pipercillin) vs. least effective (ampicillin) £1418 savings/woman	These drugs are not used in the UK	Cost study using effectiveness data from prospective cohort studies undertaken in one institution Effectiveness studies not described in any detail, only results summarised	
Mugford, 1989[471]	7777 women undergoing CS	Use of prophylactic antibiotic at CS with either placebo or no treatment	Cost data derived from real cost data from a single institution and regional health authority. Activity/resource use data was derived from direct observation of clinical practice, pharmacy and microbiology departments	Estimation of mean cost of inpatient care (1986-87) with and without wound infection Women with wound infection: £163/day £1435/woman Mean length of stay of 8.8 days Women without wound infection: £107/day £719/woman with mean length of stay of 6.7 days Incremental cost for women with wound infection: £56/day £716/woman Chi-square test for difference between medians: p< 0.005 Assuming 70% effectiveness for ampicillin at £3/woman (1988 prices), average costs would reduce by £3,939/100 CS, at 50% £2,700/100 CS For cefoxitin at £17/woman (1988 prices), the cost at 70% effectiveness would be £2,543/100 CS and at 50% effectiveness, £1,300/100 CS	Cost differences accounted for by increased midwifery costs	Cost analysis based on review of 58 controlled trials	

Use of antibiotics: health economics (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Keane, 1993[668]	200 women undergoing CS	Introduction on a policy of routine antibiotic prophylaxis (100 in each group)	Hospital costs and regional health authority Retrospective analysis of effectiveness data from medical notes, reviewed blind for outcome	Incidence of wound infection, length of stay and administration of post natal antibiotics same in both groups Cost for care of 100 women (pharmacy and bacteriology only, since wound infection rates the same) Prophylaxis group: £580 Non-prophylaxis (control) £214 Antibiotics improve outcome but at greater cost Significant difference between groups in number of women undergoing labour prior to CS. Sub-group analysis of women who underwent labour showed no difference in infection rates between treatment and control group.	Hospital audit data. Small sample size for a study of rare events	Cost effectiveness	

Thromboprophylaxis after CS

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Gates, 2003[474]	649 women who were pregnant or recently delivered, included in 8 RCTs	Pharmacological: Unfractionated (UF) heparin Low molecular weight (LMW) heparin	Maternal death Symptomatic Thromboembolic events Symptomatic pulmonary embolism Symptomatic deep venous thromboembolic events Asymptomatic Thromboembolic events Blood transfusion Bleeding episodes Serious wound complications Side effects sufficient to stop treatment Side effects sufficient to stop treatment	LMW or UF vs. placebo: Maternal death: no data Symptomatic thromboembolic events: 2 studies; 126 participants; RR 2.85 (95% CI 0.12 to 67.83) Symptomatic pulmonary embolism: 1 study; 50 participants; effect size not estimable Symptomatic deep vein thrombosis: 2 studies; 126 participants; RR 2.85 (95% CI 0.12 to 67.83) Asymptomatic thromboembolic events: no data Blood transfusion: 2 studies; 126 participants; RR 0.24 (95% CI 0.03 to 2.13) Bleeding episodes: 1 study; 76 participants; effect size not estimable Serious wound complications: 2 studies; 126 participants; effect size not estimable Side effects sufficient to stop treatment: no data Side effects not sufficient to stop treatment: 1 study; 76 participants; effect size not estimable LMW vs. UF: Maternal death: no data Symptomatic thromboembolic events: 1 study; 17 participants; event size not estimable Symptomatic pulmonary embolism: 1 study; 17 participants; event size not estimable Symptomatic deep vein thrombosis: 1 study; 17 participants; event size not estimable Blood transfusion: no data Bleeding episodes: 1 study; 17 participants; event size not estimable Serious wound complications: no data Side effects sufficient to stop treatment: no data Side effects not sufficient to stop treatment: no data	Small studies, not of high methodological quality	Systematic review	1a

Need for further surgery (including hysterectomy)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Ashton, 1985[486]	29,488 women having obstetrical or gynaecological treatment in theatre between 1971 and 1982 in an Australian hospital	Observational study	Return to theatre after delivery	Further surgery by mode of delivery: CS: 31/6145 (0.5%); unadjusted RR 17.35 (95% CI 9.37 to 32.11) VD: 15/51576 (0.03%); unadjusted RR 17.35 (95% CI 9.37 to 32.11)		Cohort	2b
Stanco, 1993[482]	94,689 women delivering in a US hospital between January 1 1985 and July 1 1990	Observational study	Hysterectomy following delivery	1 Hysterectomy in 1300 deliveries Hysterectomy by mode of delivery: CS: 116/13996 (0.8) VD: 7/80693 (0.01) Unadjusted RR 95.5 (95% CI 67.7 to 136.9)	Unadjusted risk for hysterectomy was nearly 100 times for CS compared with vaginal delivery Study also gave risk of hysterectomy with prior CS adjusted for placenta praevia as 10.78 (95% CI 7.56 to 15.37)	Cohort	2b
Clark, 1984[484]	68,653 women delivering at a US hospital between 1978 and 1982	Observational study	Hysterectomy following delivery	1 hysterectomy/1373 deliveries Hysterectomy by mode of delivery: CS: 60/8243 (0.7) VD: 10/60410 (0.02) Unadjusted RR 43.97 (95% CI 22.52 to 85.85)	Unadjusted risk for hysterectomy was 40 times for CS compared with vaginal delivery For obstetric haemorrhage alone	Cohort	2b

7.2 Neonatal encephalopathy and cerebral palsy

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Scheller, 1994[505]	Term, singleton, vertex infants	Vaginal versus caesarean birth	Cerebral palsy	No RCT identified, no observational studies only epidemiological data available.	For breech and LBW births evidence available. CS vs. CP rates also compared: no impact of CS on CP rates	Systematic review	1a

7.3 Birth injuries

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Annibale, 1995[497]	11,702 women, uncomplicated pregnancies identified retrospectively from a perinatal database. VD = 10,871, CS = 831 (538 = elective CS)	CS performed electively, for cephalopelvic disproportion or for failure to progress	Neonatal mortality; 1 minute Apgar scores; mode of resuscitation; nursery of admission; highest level of nursery care required; type of respiratory support needed	VD: 12 deaths/10,871 CS: 1 death/831 p 0.93 Neonatal morbidity results shown in table below	Only vertex, term gestation pregnancies included.	Cohort	2a
Towner, 1999[507]	583,340 live infants, full term, weight 2500–4000 g, (breech excluded)		Mode of delivery and morbidity	CH BPI VD 2.9 7.7 CS 6.7 3.0 Ch = cerebral haemorrhage; BPI = brachial plexus injury	Incidence of all forms of cranial haemorrhage were higher with CS even when there was no labour	Audit	3
McFarland, 1986[508]	106 cases of Erb's palsy; 382 controls		Mode of delivery (and other outcomes)	CS: 4 (3.8%); OR 0.5, 95% CI 0.1 to 1.9) SVD: 47 (44.3%); OR 1.0	Study was unable to show any difference between CS and VD once controlled for birth weight and presentation	Case–control	3

7.5 Maternal contact (skin to skin)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Anderson, 2003[512]	Mothers and their babies after vaginal birth and CS	Early skin-to-skin contact	Breastfeeding: OR/WMD 2.15, 95% CI 1.1 to 4.22 Maintenance of infant temperature: OR/WMD 12.18, 95% CI 2.04 to 72.91 Infant blood glucose 1 OR/WMD 1.07, 95% CI 3.97 to 18.17 Infant crying: OR/WMD 21.89, 95% CI 5.19 to 92.3 Maternal affection scores: OR/WMD 0.73, 95% CI 0.36 to 1.11		Some benefit of skin to skin in terms of breastfeeding and infant crying	Systematic review	1a
McClellan 1979[513]	Women having a repeat CS (40)	Early skin-to-skin contact between mother's and babies post CS	Predesigned tools to evaluate neonatal perception and maternal satisfaction as an indirect a means of evaluating good mothering showed that early contact between mother and baby affect mothering butt this effect is only significant during the early postpartum period and by one month there is no difference			RCT	1b

7.6 Breastfeeding

Study	Population	Intervention	Outcomes	Morbidity events	Comments	Study type	EL
Hannah, 2002[514]	1596 women from 110 centres worldwide who responded to a follow up questionnaire three months after international randomised controlled trial of planned CS vs. vaginal delivery	Planned CS vs. planned vaginal delivery	Breastfeeding rates a few hours after birth and at three months	Breastfeeding rates few hours after birth: Planned CS: 571/779 (73.3%) Planned vaginal delivery: 602/776 (77.6%) RR 0.94 (95% CI 0.89 to 1.00) Breastfeeding rates at 3 months after birth: Planned CS: 533/781 (68.3%) Planned vaginal delivery: 539/776 (69.5%) RR 0.98 (95% CI 0.92 to 1.05)	There was no difference in breastfeeding rates at three months between the groups	RCT	1b
Penn, 1996[42]	13 women in preterm labour (defined as gestational age of 26 to 32 weeks) Women were randomised if in spontaneous preterm labour and when the decision about the mode of delivery would have been made Multicentre randomised controlled trial in 26 hospitals in England, UK Trial closed after 17 months (Nov 1989-June 1991) because of low recruitment Exclusion criteria: Known IUD Clear indication for vaginal delivery or CS Congenital malformation	Intention to deliver vaginally or intention to deliver by CS	Breastfeeding rates	Planned CS: 4/5 (80.0%) Planned vaginal delivery: 7/8 (87 5%)	Central telephone randomisation was used This analysis is by intention to treat	RCT	1b

7.6 Breastfeeding (continued)

Study	Population	Intervention	Outcomes	Morbidity events	Comments	Study type	EL
Lumley, 1984[40]	6 women in delivering a single live very low birthweight infants from 26 to 31 weeks inclusive (vertex or breech) Period of recruitment July to December 1980 Australian hospital Trial terminated December 1980 due to problems with recruitment Exclusion criteria-fetal abnormality on ultrasound	Immediate CS vs. observed labour	Breastfeeding	Breastfeeding rates at discharge: Elective CS: morbidity events 4/4 (100.0%) Vaginal delivery: morbidity events 1/2 (50.0%)	Unpublished data obtained from systematic review Unclear how allocation sequence was generated and how allocation sequence was concealed	RCT	1b
Leung, 2002[518]	7825 women who delivered in 1997 in Hong Kong	Observational study	Breastfeeding at any time and breastfeeding at 1 month after delivery	Breastfeeding rates by mode of delivery: VD: n = 5593; ever breastfed 1967 (35.2%); breastfeeding at 1 month: 1158 (20.7%) CS: n = 2084; ever breastfed 614 (29%); breastfeeding at 1 month: (15.5%)	Study adjusted for the potential confounders of Parental smoking status Maternal age Parental educational level, Parental education and employment Gender Birth weight and birth order of infant Gestational age at birth and Residential region of mother.	Cohort	2b
Ever-Hadani, 1994[517]	8486 women who delivered between Nov 1974 and December 1976, Jerusalem	Observational study	Initiation of breastfeeding Breastfeeding at 3 months	Initiation of breastfeeding: VD: n = 8114; initiating breastfeeding 6491 (80%) CS: n = 372; initiating breastfeeding 219 (60%) Breastfeeding at 3 months: VD: n = 6659; breastfeeding at 3 months: 3096 (46.5%) CS: n = 227; breastfeeding at 3 months: 103 (45.5%) Unadjusted RR 1.02 (95% CI 0.89 to 1.18)	Study adjusted for the potential confounders of: Maternal age Birth order Maternal education Social class Father orthodox or unorthodox Jew Occupation of mother Parent's age at marriage Maternal smoking Place of birth of mother Birth weight	Cohort	2b

7.6 Breastfeeding (continued)

Study	Population	Intervention	Outcomes	Morbidity events	Comments	Study type	EL
Bruce, 1991[515]	202 women who delivered in a UK hospital	Observational study	Breastfeeding status at 6 week interview	Breastfeeding rates at 6 weeks by mode of delivery: VD: n = 139; breastfeeding at 6 weeks: 105 (76%) CS: n = 23; breastfeeding at 6 weeks: 9 (39%)		Cohort	2b
Vestermark, 1990[519]	370 women who delivered between 1 April and 30 June 1986 in a Danish hospital.	Observational study	Initiation of breastfeeding Breastfeeding at 4 days, 3 months and 6 months	Initiation of breastfeeding: VD: n = 268; initiating breastfeeding: 258 (96%) CS: n = 100; initiating breastfeeding: 84 (82%) Breastfeeding at 4 days: VD: n = 268; breastfeeding at 4 days: 264 (98%) CS: n = 102; breastfeeding at 4 days: 96 (96%) Breastfeeding at 3 months: VD: n = 262; breastfeeding at 3 months: 195 (74%) CS: n = 72; breastfeeding at 3 months: 52 (72%) RR 0.97 (95% CI 0.84 to 1.11) Breastfeeding at 6 months: VD: n = 140; breastfeeding 6 months: 261 (54%) CS: n = 47; breastfeeding 6 months: 22 (47%) Unadjusted RR 1.15 (95% CI 0.83to 1.59)	Unadjusted RR	Cohort	2b
Samuels, 1985[520]	632 women who delivered live children between May and August 1980 California, USA	Observational study	Initiation of breastfeeding as assessed by case note records	Breastfeeding rates/mode of delivery: VD: n = 518; initiating breastfeeding: 357 (69%) CS: n = 114; initiating breastfeeding: 59 (52%)		Cohort	2b
Tamminen, 1983[516]	1701 women who delivered live children between October 1978 and March 31 1979 Finnish hospital	Observational study	Breastfeeding rates as assessed by case register	Breastfeeding rates/mode of delivery VD: n = 1465; initiating breastfeeding: 1433 (98%) CS: n = 109; initiating breastfeeding: 103 (94.5%)		Cohort	2b

8.1 HDU/ITU admission

Study	Population	Intervention	Outcomes	Morbidity events	Comments	Study type	EL
Panchal, 2000[522]	822,591 hospital admissions for delivery in a US state between January 1984 and December 1997 1023 cases admitted for delivery and subsequently admitted to ICU 1023 controls admitted for delivery without intensive care admission.	Observational study	ICU admission following delivery	Rate of ICU admission following delivery 0.12% ICU admission by mode of delivery: Delivery by CS: Cases: 742/1023 (72.5%) Controls: 234/1023 (22.9%) Adjusted OR 9.0 (95% CI 7.24 to 11.16) Deaths following ICU admission by mode of delivery: Delivery by CS: Deaths: 23/34 (67.6%) Survivors: 719/989 (72.7%) Adjusted OR 0.58 (95% CI 0.47 to 1.27)	CS was associated with a nine-fold increase in the risk of being admitted to ICU Women who were admitted to the ICU following CS were 40% less likely to die Adjusted for: Age Race Marital status Payment source Hospital type Source of admission	Case–control	3

8.2 Pain management after CS

This section was updated and replaced in 2020. Please see the NICE website for the updated guideline.

Nonsteroidal anti-inflammatory analgesia

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Lim, 2000[543]	48 ASA 1 or 2 women for elective CS under regional anaesthesia	Single dose of diclofenec suppository immediately post-CS vs. no suppository (all women used EPCA with bolus doses of local anaesthetic)	Use of EPCA, pain scores and satisfaction scores	Patients who received the suppository used 52.8 ml local anaesthetic while those with no suppository used 74 ml ($p < 0.005$) No difference between pain and satisfaction scores		RCT	1b
Bush, 1992[544]	50 women for elective CS under GA	Single dose of IM dicloenac (group A) after CS vs. placebo (group B) All women had PCA which gave bolus doses of 3–5 mg papaveratum	At 6,12 and 24 hours post op pain, nausea and sedation were assessed using scoring scales and injection site discomfort	Cumulative papaveratum consumption at 18 hours was more in group B, mean 91.4 (SD 23.4) than group A mean 61.4 (30.2),$p < 0.05$ Linear analogue scores for pain were less in group A at 0 to 6 hours ($p < 0.05$), no difference at 12 hours Sedation scores were lower in group A at 6 hours, no difference at 12 hours No difference in nausea scores at any time No difference in injection site pain	No individual patient data given	RCT	1b
Dennis,1995[542]	50 women undergoing elective CS with spinal anaesthesia	Rectal diclofenac 100mg immediately postoperative to study group	VAS for pain, mean time to first analgesia, side effects of nausea and vomiting	Mean time to first analgesia: Diclofenac group: 13 hours, 45 minutes Control group: 18 hours, 58 minutes ($p < 0.03$) No differences in other outcomes		RCT	1b

Health economics: pain management after CS

Note: level of evidence is not relevant to economic models and therefore not been included here

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Gerancher 1999[536]	40 women requesting spinal analgesia who underwent planned CS, and 15 women who had PCEA	Small doses of intrathecal morphine added to a regimen of oral analgesia and post-CS medication	Rate of pain relief (no need for additional units of iv morphine). Evidence for outcomes derived from one non-randomised historical cohort Costs included nursing time and drug costs derived from cost survey at one institution Cost and resources reported separately	Success rate 62.5%. No statistical difference between intervention and control group for pain or side-effects Cost: Intrathecal morphine US$15 (± 4.40) PCEA US$35 (± 15.55) Nursing time Intrathecal morphine 150 minutes (± 57) PCEA 148 minutes (± 61)	No synthesis of costs and benefits so not a full cost-effectiveness analysis No sensitivity analysis Small sample size Cost consequence study		

8.2 Early eating and drinking after CS

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Mangesi, 2002[549]	Women within the first 24 hours after CS (sis trials)	Early vs. delayed oral feeding	Time to first food intake; time to return of bowel sounds; postoperative stay; abdominal distension; nausea; vomiting; time to first bowel action; paralytic ileus and number of analgesic doses	Early oral feeding associated with: Reduced time to first food intake: 1 trial (118 women); WMD –7.2 hours (95% CI –13.26 to –1.14) Reduced time to return of bowel sounds: 1 trial (118 women); WMD-4.3 hours (95% CI –6.78 to –1.82) Reduced postoperative stay: 2 trials (220 women); WMD –0.75 days (95% CI 0.55 to 1.11) No difference in nausea; vomiting; time to first bowel action; paralytic ileus and number of analgesic doses		Systematic review	1a
Kubli, 2002[280]	60 women in early labour (cervical dilatation < 5 cm) in a UK hospital	Intervention: women received 'isotonic' sports drinks during labour (n = 30). Women were encouraged to drink 500 ml in the first hour and the a further 500 ml every 3 to 4 hours. The isotonic drink used contained 64 g/l of carbohydrate, sodium of 24 mmol/l and a tonicity of 300 mOsm/kg Control: women received water only during labour (n = 30). Women were encouraged to drink as much or as little water as they wanted	Primary outcomes: 1. Metabolic changes: measured using plasma beta hydroxybutyrate (BHB), NFEA's and glucose (G) levels in early labour and at the end of the first stage of labour 2. Gastric volumes: ultrasound measurement of gastric volume 3. Incidence and volume of vomiting Secondary outcomes: 1. Maternal outcomes: duration of labour, use of oxytocin, use of epidural analgesia 2. Baby outcomes: Apgar scores and umbilical gases	Primary: 1. Estimate of difference between early labour and end of first stage of labour between groups: BHB: –0.63 mmol/l; 95% CI –0.85 to –0.42 (p = 0.000) NFEA: –0.36 mmol/l; 95% CI –0.46 to –0.25 (p =0.000) G: 0.76 mmol/l; 95% CI 0.22 to 1.5 (p = 0.007) 2. Estimate of difference of gastric volumes and incidence and volume of vomiting between groups: Gastric volume (cm^2): -00.63; 95% CI –1.12 to 0.7 (p = 0.64) Numbers vomiting: 0.03; 95% CI –0.16 to 0.29 (p = 0.74) Volume vomited (ml): 65; 95% CI –141 to 271 (p = 0.42)	Women who requested IM meperidine were excluded No difference in any of the secondary maternal or baby outcomes	RCT	1b

8.3 Urinary catheter removal

Study	Population	Intervention	Outcomes	Results	Comments	Design	EL
Tangtrakul, 1994[552]	107 women undergoing CS under general anaesthesia in Thailand Urine specimen sent with initial catheterisation and 9 women were excluded due to initial positive culture Clean catch specimens were taken on day 3 post-CS	Group 1 (n = 51): intermittent catheterisation. Women were catheterised just before the CS and the catheter was removed at the end of the CS. Intermittent post-CS catheterisation if no urine voided for 6 hours when awake or unable to void in the presence of a full bladder Group 2 (n = 47): indwelling catheterisation. Indwelling catheter was placed just before the CS and then removed the day after the CS	Post-CS urinary tract infection Post-CS urinary retention	UTI: Group 1 (n = 51): yes 16, no 35 Group 2 (n = 47): yes 9, no 38 RR1.64, (95% CI 0.80 to 3.34, p > 0.05) 20 (39.2%) women in group 1 developed post-CS urinary retention. None in group 2 developed urinary retention		RCT	1b
Dunn, 2000[554]	78 women, 29 underwent CS, 11 abdominal hysterectomy and 38 vaginal hysterectomy in a US hospital	Foley catheter sited for the operation was removed either immediately postoperatively or on the first day postoperatively	Recatheterisation Febrile morbidity Symptomatic urinary tract infection Pain	Recatheterisation: NS Febrile morbidity: NS Symptomatic urinary tract infection: NS Less pain with immediate removal (p = 0.0001). For CS this was also significant (p = 0.001	Abstract only available, no data given	RCT	1b

8.4 Urinary catheter removal (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Ghoreishi, 2003[308]	270 women undergoing CS with general or regional anaesthesia in Iran	Urinary bladder catheterisation for CS (n = 135, 68 general anaesthetic, 67 regional anaesthetic) or no catheterisation (n = 135, 70 general anaesthesia, 65 regional anaesthesia)	Mean time to first void: 8–11 hours: Uncatheterised (n = 135): – Catheterised (n = 135): 54 (p < 0.05) 5–8 hours: Uncatheterised (n = 135): – Catheterised (n = 135): 52 (p < 0.05) Hospital stay (hours): Uncatheterised (n = 135): 46.5 ± 11.7 (p < 0.05) Catheterised (n = 135): 64 ± 10.7 (p < 0.05) Ambulation time (hours): Uncatheterised (n = 135): 6.8 ± 2.9 (p < 0.05) Catheterised (n = 135): 12.9 ± 3.4 (p < 0.05) Discomfort at first void: None: Uncatheterised (n = 135): 127 (p < 0.05) Catheterised (n = 135): 9 (p < 0.05) Mild: Uncatheterised (n = 135): 5 (p < 0.05) Catheterised (n = 135): 92 (p < 0.05) Severe: Uncatheterised (n = 135): 3 (p < 0.05) Catheterised (n = 135): 34 (p < 0.05) Catheterisation: In theatre: 6 (p < 0.05) On postpartum ward: 2.4 (p < 0.05)			RCT	1b
Kerr-Wilson, 1986[307]	50 women undergoing elective CS under epidural anaesthesia in Scotland	Group 1: Nelaton catheter inserted before the CS and removed at the end of the CS Group 2: Foley's catheter inserted before the CS and left in situ until the woman was ambulant after the CS	1. Recatheterisation 2. Volume of urine obtained 3. Time of spontaneous micturition 4. Significant bacteriuria: urine microscopy in women with indwelling catheters at time of insertion and removal	Catheter: In/out (n = 25): 1: 11 2: 0 4: 3 Indwelling (n = 25): 1: 0 2: 873 ± 108 4: 3		RCT	1b

8.5 Respiratory physiotherapy after CS

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Kaplan, 1994[555]	120 women undergoing CS under GA, Israel 1993	Respiratory physiotherapy on first 3 postoperative days vs. no postoperative physiotherapy	Chest auscultation Chest expansion Productive cough	Abnormal chest auscultation: Physiotherapy (n = 60): Postoperative D1: 9 Postoperative D2: 3 Postoperative D3: 0 Control (n = 60): Postoperative D1: 15 Postoperative D2: 3 Postoperative D3: 0 p > 0.05 Abnormal chest expansion: Physiotherapy (n = 60): Postoperative D1: 0 Postoperative D2: 0 Postoperative D3: 0 Control (n = 60): Postoperative D1: 9 Postoperative D2: 0 Postoperative D3: 3 p > 0.05 Productive cough: Physiotherapy (n = 60): Postoperative D1: 18 Postoperative D2: 6 Postoperative D3: 0 Control (n = 60): Postoperative D1: 24 Postoperative D2: 12 Postoperative D3: 0 p > 0.05	Randomisation not described Assessor blinded	RCT	1b

8.6 Debriefing for women after CS

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Small, 2000[558]	1041 women who had given birth by CS, forceps or vacuum extraction, Australia 2000	Debriefing before discharge from hospital	Depression: score of at least 13 on the Edinburgh postnatal depression scale 6 months after birth Assessment by postnatal questionnaire	Debriefing (n = 467): 81 depressed (17%); OR 1.24 (95% CI 0.87 to 1.77) Standard care (n = 450): 65 depressed (14%); OR 1.00	Telephone randomisation with allocation determined by a separate computer generated, adaptive biased coin randomisation schedule	RCT	1b
Gamble, 2003[560]	400 women recruited from an Australian antental clinic were interviewed 72 hours after birth. 103 women reported a distressing birth experience and were then randomised	An intervention to address psychological trauma following childbirth was developed and tested. Focus groups with women and midwives were used to develop the intervention and consisted of a counselling framework for use by midwives for debriefing women after childbirth. Women in the intervention group had the opportunity to de-brief at an initial post natal interview (less than 72 hours postpartum) and 4–6 weeks postpartum	Presence of post-traumatic stress disorder symptoms (PTSD)	PTSD was strongly associated with obstetric interventions including emergency CS. In the intervention group 34% (n = 17) had symptom profile PTSD, compared with 32% (n = 16) in the control group (RR 1.06 95% CI 0.61, 1.84). Fewer women in the intervention group had PTSD symptoms at 3 for months, although this was not statistically significant. However this is a small RCT had 2% power to detect a 2% difference in prevalence of symptoms of post traumatic stress disorder	Baseline studies of 400 women prior to the RCT reported a high prevalence of PTSD following childbirth, 9.6% of women meeting the diagnostic criteria for PTSD at 4–6 weeks postpartum	RCT	1b

8.7 Early discharge from hospital after CS

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Brooten, 1994[567]	122 women who had had an unplanned CS	Early discharge (discharged once 24 hours afebrile and no other complications) vs. usual discharge	Maternal satisfaction (using a score system); maternal and neonatal rehospitalisation	Mean satisfaction score: intervention: 187; control 164 ($p < 0.001$) No difference between rehospitalisations		RCT	1b

Chapter 9 Recovery following CS

Pain

Study	Population	Intervention	Outcomes	Morbidity events	Comments	Study type	EL
Hannah, 2002[514]	1596 women from 110 centres worldwide who responded to a follow-up questionnaire 3 months after being recruited into a trial to assess the maternal and baby outcomes for planned CS vs. planned vaginal delivery for term breech presentation	Planned CS vs. planned vaginal delivery	Pain	Site of pain in relation to intended mode of delivery: In back: CS: 90/796 (11.3%) VD: 97/797 (12.2%) RR 0.93 (95% CI 0.71 to 1.22) In head: CS: 38/796 (4.8%) VD: 34/797 (4.3%) RR 1.12 (95% CI 0.71 to 1/76) On outside of abdomen: CS: 79/796 (9.9%) VD: 45/797 (5.7%) RR 1.76 (95% CI 1.24 to 2.50) Deep inside abdomen: CS: 70/796 (8.8%) VD: 37/797 (4.6%) RR 1.89 (95% CI 1.29 to 2.79) In bottom or genital area: CS: 14/796 (1.8%) VD: 44/797 (5.50%) RR 0.32 (95% CI 0.18 to 0.58) In other location: CS: 13/796 (27.3%) VD: 16/797 (2.0%) RR 0.81 (95% CI 0.39 to 1.68) Any pain: CS: 217/796 (27.3%) VD: 199/797 (25.0) RR 1.09 (95% CI 0.93 to 1.29) Amount of pain: p = 0.30 Took pills or medicine for pain in last 24 hours: CS: 46/795 (5.8%) VD: 46/793 (5.8%) RR 1.00 (95% CI 0.67 to 1.48)	Women delivering by CS were 90% more likely to experience pain deep inside the abdomen but 70% less likely to experience pain in the bottom or genital area. Computer generated randomisation and central allocation. Analysis by intention-to-treat.	RCT	1b

Pain

Study	Population	Intervention	Outcomes	Morbidity events	Comments	Study type	EL
Thompson, 2002[564]	1295 women who gave birth to a live baby from March to October 1997	Observational study	Backache Perineal pain	Backache: 0–8 weeks by mode of delivery: CS: 116 (51%) Instrumental delivery: 91 (54%) Vaginal delivery: 452 (53%) p = 0.87 9–16 wks by mode of delivery: CS: 105 (47%) Instrumental delivery: 88 (53%) Vaginal delivery: 374 (45%) p = 0.15 17–24 weeks by mode of delivery: CS: 107 (57%) Instrumental delivery: 78 (47%) Vaginal delivery: 348 (43%) p = 0.19 Perineal pain: 0–8 weeks by mode of delivery CS: 4 (2%) Instrumental delivery: 86 (51%) Vaginal delivery: 187 (22%) p = < 0.0001 9–16 weeks by mode of delivery: CS: 2 (1%) Instrumental delivery: 25 (15%) Vaginal delivery: 52 (6%) p = < 0.00001 17–24 weeks by mode of delivery: CS: 2 (1%) Instrumental delivery: 20 (12%) Vaginal delivery: 27 (3%) p = < 0.00001	There was no difference in backache by mode of delivery	Cohort	2b
Brown, 1998[569]	1366 women who gave birth in a two-week period in September 1993 in 127 hospitals in an Australian region	Observational study	Backache at 6–7 months parity.	Backache during first 6–7 months postpartum by mode of delivery: Elective CS: 60 (48.0%) Emergency CS: 54 (45.8%) Instrumental delivery: 80 (48.8%) Vaginal delivery: 382 (41.3%) p = 0.2	There was no difference in backache by mode of delivery	Cohort	2b

Chapter 9 Recovery following CS (continued)

Pain

Study	Population	Intervention	Outcomes	Morbidity events	Comments	Study type	EL
Glazener, 1995[563]	1249 women who delivered in a Scottish region between June 1990 and May 1991	Observational study	Backache at 2–18 months postpartum Perineal pain at 0–13 days (hospital) Up to 8 weeks 2– 18 months	Backache 2–18 months postpartum by mode of delivery: CS:19/65 (29%) Instrumental delivery: 15/63 (24%) Vaginal delivery: 53/310 (17%) p = 0.058 Perineal pain: 0–13 days in hospital by mode of delivery: CS: 9/181 (5%) Instrumental delivery: 145/172 (84%) Vaginal delivery: 376/896 (42%) At home up to 8 weeks by mode of delivery: CS: 6/161 (4%) Instrumental delivery: 88/149 (59%) Vaginal delivery: 153/806 (19%) At home 2–18 months by mode of delivery: CS: 1/65 (2%) Instrumental delivery: 19/63 (30%) Vaginal delivery: 12/310 (7%)	There was no difference in backache by mode of delivery	Cohort .	2b
Lydon-Rochelle, 2001[570]	Primiparous women 7 weeks postpartum: all modes of delivery	Observational study	Bodily pain	Mode of delivery: CS Assisted vaginal Unassisted vaginal Health status score 66.4, 74.7, 78.3	Pain assessment was the extent to which pain interfered with usual activities. A 0–100 scale was used with: 10 “Yes, interfered a lot” 20 “Yes interfered a little” 30 “No, not interfered at all” Scale was SF-36 (four scales) There were worse scores for CS than for both vaginal routes of delivery. Potential confounders were accounted for including age, race social support and only primiparous women were included to exclude confounding from parity	Cohort	2b

Bladder/bowel/ureteric injury

Study	Population	Intervention	Outcomes	Morbidity events	Comments	Study type	EL
Rajasekar, 1997[578]	117,847 deliveries including 11,284 CS from 1976 to 1993 in the Grampian district of Scotland	Observational study	Urinary tract injuries following delivery by mode of delivery	Bladder: CS: 13/11,284 (0.115%) VD: 3/95279 (0.003%) Ureter: CS: 3/11,284 (0.027%) VD: 1/95279 (0.001%)	All women who sustained bladder and ureteric injury in the vaginal delivery group did so following Kjellands forceps deliveries	Case–control	3

Maternal morbidity and CS

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Hannah 2000[669]	2088 women with a singleton fetus in a frank or complete breech presentation International randomised trial at 121 centres in 26 countries (low perinatal mortality rate and high perinatal mortality rate countries) Trial stopped recruitment after reviewing results on first 1600 women randomised, since difference in rate of the primary outcome was significant Exclusion criteria: Evidence of feto-pelvic disproportion Clinically large fetus (≥ 4 kg) Hyperextension of head Fetal anomaly. Contraindication to labour or delivery, e.g. placenta praevia	Planned CS vs. planned vaginal delivery	Postpartum bleeding* Infection* Need for blood transfusion* Need for further surgery (D+C)* Hysterectomy* Length of hospital stay* Early postnatal depression Genital tract injury* Composite maternal morbidity defined as: death or one of above marked with *	Blood loss > 1000 ml: Planned CS: 4/1041 (0.4%) Planned vaginal delivery: 8/1041 (0.8%) RR 0.50 (95% CI 0.15 to 1.66) Blood loss >1500 ml: Planned CS: 2/1041 (0.2%) Planned vaginal delivery: 4/1042 (0.4%) RR 0.50 (95% CI 0.09 to 2.73) Need for blood transfusion: Planned CS: 4/1041 (0.4%) Planned vaginal delivery: 8/1041 (0.8%) RR 0.50 (95% CI 0.15 to 1.66) Infection: Planned CS: 32/1041 (3.1%) Planned vaginal delivery: 23/1041 (2.2%) RR 1.39 (95% CI 0.82 to 2.36) Bladder/bowel/ureteric injury: Planned CS: 0/1041 (0%) Planned vaginal delivery 0/1041 (0%) Genital tract injury: Planned CS: 6/1041 (0.6%) Planned vaginal delivery: 6/1041 (0.6%) RR 1.00 (95% CI 0.32 to 3.09) Need for further surgery (D&C): Planned CS: 3/1041 (0.3%) Planned vaginal delivery: 4/1041 (0.4%) RR 0.75 (95% CI 0.17 to 3.34) Hysterectomy: Planned CS: 0/1041 (0%) Planned vaginal delivery: 0/1041 (0%) Thromboembolic disease: Planned CS: 0/1041(0%) Planned vaginal delivery: 0/1041 (0%) Median length of hospital stay: 5th to 95th centile: Planned CS: 4.0 (95% CI 1.7 to 7.4) Planned vaginal delivery: 2.8 (95% CI 0.8 to 6.9) p < 0.0001 Postnatal depression: Planned CS: 3/1041 (0.3%) Planned vaginal delivery: 0/1042 (0.0%) Composite maternal morbidity: Planned CS: 41/1041 Planned vaginal delivery: 33/1042 RR 1.24 (0.79 to 1.95)	Adequate generation of allocation sequence and concealment of allocation sequence (central telephone randomisation) Non-blinded trial Intention-to-treat analysis Emergency CS rate in planned vaginal birth group was (451/1042) 43.5% Adequate generation of allocation sequence and concealment of allocation sequence (central telephone randomisation) Non-blinded trial Intention-to-treat analysis RCT 1b		

Maternal morbidity and CS (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Gimovsky, 1983[43]	105 women with non-frank breech presentations at term, defined as between 36 and 42 weeks Women randomised over a 13 month period: April 1981 to May 1982 Included those excluded from a trial of labour because of inadequate pelvic dimensions on X-ray examination Exclusion criteria: Severe PIH Previous CS History of stillbirth History of infertility Maternal diabetes Hyperextension of head Contraindication to labour IUGR Abnormal antepartum testing Abnormal amniotic fluid volume Multiple gestation	Trial of labour vs. elective CS	Need for blood transfusion Infection Length of hospital stay Febrile morbidity	Need for blood transfusion: Elective CS: 3/35 (8.6%) Vaginal delivery: 3/70 (4.3%) RR2.00 (95% CI 0.43 to 9.40) Infection: Elective CS: 2/35 (16.7%) Vaginal delivery: 0/70 (0.0%) Length of hospital stay: Planned/intended delivery: hospital stay in days (mean ± SD): Vaginal/vaginal: 2.2 ± 0.5 Vaginal/CS: 5.5 ± 1.9 CS/CS: 5.2 ± 2.0 CS/vaginal: 2.0 ± 0.5 Febrile morbidity: Elective CS: 18/35 (51.4%) Vaginal delivery: 23/70 (33.0%) RR 1.56 (95% CI 0.98 to 2.49)	Generation and concealment of allocation sequence unclear Emergency CS rate in planned vaginal delivery group was 55.7% (39/70)	RCT	1b

Maternal morbidity and CS (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Collea, 1980[44]	208 women with frank breech presentation at term Randomised over a 4-year period: July 1975 to May 1979 in a US hospital Exclusion criteria: Hyperextension of fetal head Congenital abnormalities Elderly primigravida Obstetric indications for CS Maternal diabetes Floating station Involuntary infertility Pelvic contracture by previous X-ray pelvimetry History of previous difficult/traumatic delivery	Trial of labour vs. elective CS	Blood loss Need for blood transfusion Infection Bladder/bowel or ureter injury Hysterectomy	Blood loss > 1000 ml: Planned CS: 2/93 (2.15%) Planned vaginal delivery: 0/115 (0.0%) Blood loss > 1500 ml: Planned CS: 3/93 (3.2%) Planned vaginal delivery: 0/115 (0.0%) Need for blood transfusion: Planned CS: 7/93 (7.5%) Planned vaginal delivery: 8/115 (7.0%) RR 1.08 (95% CI 0.41 to 2.87) Infection: Planned CS: 39/93 (42.0%) Planned vaginal delivery: 37/115 (32.2%) RR 1.30 (95% CI 0.91 to 1.86) Bladder/bowel/ureteric injury: Planned CS: 1/93 (1.1%) Planned vaginal: 0/115 (0%) Hysterectomy: Planned CS: 1/93 (1.1%) Planned vaginal delivery: 0/115 (0.0%)	Generation and concealment of allocation sequence unclear Emergency CS rate in planned vaginal delivery group was (60/115) 52.2%	RCT	1b
Penn, 1996[42]	13 women in preterm labour (defined as gestational age of 26 to 32 weeks) Multicentre randomised controlled trial in 26 hospitals in England, UK Women were randomised if in spontaneous preterm labour and when the decision about the mode of delivery would have been made Exclusion criteria: Known IUD Clear indication for vaginal delivery or CS Congenital malformation	Intention to deliver vaginally or intention to deliver by CS	Maternal stay > 10 days Maternal puerperal pyrexia	Maternal stay > 10 days: Planned CS: 1/5 (20%) Planned vaginal delivery: 1/8 (12.5%) RR 1.60 (95% CI 0.13 to 20.22) Maternal puerperal pyrexia: Planned CS: 2/5 (40.0%) Planned vaginal delivery: 0/8 (0.0%)	Central telephone randomisation was used This analysis is by intention to treat Trial closed after 17 months (Nov 1989 to June 1991) because of low recruitment Emergency CS rate in planned vaginal birth group was (2/8) 25%	RCT	1b

Maternal morbidity and CS (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Zlatnik, 1993[39]	38 women in premature labour with a breech presentation Premature labour defined as 28–36 weeks of gestation Women randomised over a 52 month (October 1978 to January 1983) study period in a single US hospital Exclusion criteria: Contraindications to additional labour Contraindications to CS Fetal distress in labour Lethal anomaly	Immediate CS vs. observed labour	Infection Length of hospital stay > 10 days Maternal puerperal pyrexia	Infection: Elective CS: 1/18 (5.6%) Vaginal delivery: 0/20 (0.0%) Length of hospital stay > 10 days: Elective CS: 1/18 (5.6%) Vaginal delivery: 2/20 (10.0%) RR 0.56 (95% CI 0.05 to 5.62) Maternal puerperal pyrexia: Elective CS: 9/18 (50.0%) Vaginal delivery: 4/20 (20.0%) RR 2.50 (95% CI 0.93 to 6.73)	Adequate generation of allocation sequence. Adequate concealment of allocation sequence (sealed envelopes). The emergency CS rate in the planned vaginal delivery group was (7/20) 35%	RCT	1b
Lumley, 1984[40]	6 women in delivering a single live very low birthweight infants from 26 to 31 weeks inclusive (vertex or breech) in Australia Period of recruitment July to December 1980 Trial terminated December 1980 due to problems with recruitment Exclusion criterion fetal abnormality on ultrasound	Immediate CS vs. observed labour	Infection Need for blood transfusion Maternal puerperal pyrexia	Infection Elective CS: 1/4 (25.0%) Vaginal delivery: 2/2 (100.0%) RR 0.25 (95% CI 0.05 to 1.36) Need for blood transfusion: Elective CS: 0/4 (0.0%) Vaginal delivery: 2/2 (100.0%) Maternal puerperal pyrexia: Elective CS: 3/4 (75.0%) Vaginal delivery: 2/2 (100.0%)	Unpublished data obtained from systematic review Unclear how allocation sequence was generated and how allocation sequence was concealed There is no information on emergency CS rate in planned vaginal birth rate	RCT	1b

Maternal morbidity and CS (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Wallace, 1984[41]	38 women with very-low-birthweight infants (< 1500 g) Vertex presentation Enrolled over a 6-month period in a US hospital Exclusion criteria: Multiple gestation Known congenital anomaly Malpresentation Amnionitis Advanced labour (> 7 cm) Cord prolapse Vaginal haemorrhage Previous CS	Attempted vaginal birth vs. attempted CS	Maternal morbidity not defined	No maternal morbidity events occurred (data from systematic review, Grant and Glazener)	No description of randomisation given Trial terminated because of an unacceptably high frequency of infants consistently weighing in excess of 1500 g Emergency CS rate in planned vaginal delivery group was (9/20) 45%	RCT	1b
Viegas, 1985[38]	23 women with preterm breech babies Preterm defined as < 37 weeks of pregnancy Women enrolled over a 20 month period in 4 Singaporean hospitals Randomised on admission in established labour Exclusion criteria: Contraindications for CS or vaginal delivery Maternal diseases Severe congenital malformation Severe pre-eclampsia or IUGR	CS vs. vaginal delivery	Infection Length of hospital stay > 10 days	Infection: Elective CS: 2/12 (16.7%) Vaginal delivery: 0/15 (0.0%) RR 6.15 (95% CI 0.32 to 117.21) Length of hospital stay > 10 days: Elective CS: 2/12 (16.7%) Vaginal delivery: 1/15 (6.7 %%) RR 2.50 (95% CI 0.26 to 24.38)	Generation and concealment of allocation sequence unclear There is no information on emergency CS rate in the planned vaginal delivery group	RCT	1b

Maternal morbidity and CS (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Rabinovici, 1987[45]	60 women in spontaneous or induced labour with twin pregnancy; both twins alive, first twin vertex, 2nd twin breech/transverse lie Gestational age 35–42 weeks Exclusion criteria: Fetal anomaly Signs of abruption or acute placental insufficiency Indication for CS or vaginal delivery Cervix > 7 cm dilated	CS for birth of non-vertex 2nd twin vs. vaginal birth	Need for blood transfusion Length of hospital stay Maternal febrile morbidity	Need for blood transfusion: Elective CS: 3/27 (11.1%) Vaginal delivery: 2/27 (7.4%) RR 1.50 (95% CI 0.27 to 8.28) Length of hospital stay in days (mean ± SD): Elective CS: 8 ± 2 Vaginal delivery: 4.9 ± 2.9 Patients discharged on schedule: Elective CS: 13/27 (48.2%) Vaginal delivery: 18/27 (66.7%) RR 0.72 (95% CI 0.45 to 1.16) Maternal febrile morbidity: Elective CS: 11/27 (40.7%) Vaginal delivery: 3/27 (11.1%) RR 3.67 (95% CI 1.15 to 11.69)	Unclear how allocation sequence was generated and how allocation sequence was concealed The emergency CS rate in the planned vaginal delivery group was (2/33) 6.1%	RCT	1b

Urinary incontinence

Study	Population	Intervention	Outcomes	Morbidity events	Comments	Study type	EL
Hannah, 2002[514]	1596 women from 110 centres worldwide who responded to a follow up questionnaire three months after international randomised controlled trial of planned CS vs. vaginal delivery	Planned CS vs. planned vaginal delivery	Urinary incontinence 3 months after delivery assessed by questionnaire concerning loss or leakage of urine in the previous 7 days	Urinary incontinence Planned CS: 36/798 (4.5%) Planned vaginal delivery: 58/798 (7.3%) RR 0.62 (95% CI 0.41 to 0.93)	There was a 40% reduction in the CS group compared with the vaginal delivery group in women indicating that they had lost or leaked urine	RCT	1b
Farrell, 2001[575]	690 primiparae recruited in a Canadian hospital from Jan 1996 to Dec 1998 Inclusion criteria: Nulliparity No history of UTI or pelvic surgery No significant medical illness No medication that would alter urinary function	Observational study	Incidence and relative risk of urinary incontinence/mode of delivery as assessed by questionnaire in the antepartum period, at 6 weeks and 6 months after delivery	Comparison groups at 6 weeks postpartum: RR of urinary incontinence: SVD vs. CS: 2.8 (95% CI 1.5 to 5.3) Forceps vs. SVD: 1.5 (95% CI 1.1 to 2.2) Forceps vs. CS: 4.3 (95% CI 2.2 to 8.2) Comparison groups at 6 months postpartum: RR of urinary incontinence: SVD vs. CS: 2.1 (95% CI 1.1 to 3.7)) Forceps vs. SVD: 1.5 (95% CI 1.0 to 2.3) Forceps vs. CS: 3.1 (95% CI 1.7 to 5.9)	Study showed a 2- to 3-fold increased risk of urinary incontinence at 6 weeks and 6 months postpartum from spontaneous vaginal delivery compared with delivery by CS The increased risk of vaginal delivery to CS was 3 to 4 fold if vaginal delivery was by forceps Follow up rate was 70%	Cohort	3

Urinary incontinence (continued)

Study	Population	Intervention	Outcomes	Morbidity events	Comments	Study type	EL
Meyer, 1998[577]	149 white nulliparae recruited in a Swiss hospital Exclusion criteria: Pregnancy complications Onset of labour History of UTI	Observational study	Urinary incontinence as assessed by: History Examination Urodynamic testing of urethral sphincter function 9 weeks after delivery	Comparison groups at 9 weeks postpartum (unadjusted): RR of urinary incontinence: SVD vs. CS: 0.15 (95% CI 0.02 to 1.11) Forceps vs. SVD: 1.72 (95% CI 0.89 to 3.33)	Study did not show any significant difference in the incidence of urinary incontinence/mode of delivery	Cohort	3
Wilson, 2000[576]	1505 women who were 3 months postpartum resident in an area in New Zealand	Observational study	Urinary incontinence as assessed by leakage of urine and the use of a pad	Urinary incontinence at 3 months postpartum by mode of delivery: All women (n = 1505): SVD: OR for any urinary incontinence: 1.0 Forceps: OR for any urinary incontinence: 1.1 (95% CI 0.8 to 1.6) CS: OR for any urinary incontinence: 0.4 (95% CI 0.3 to 0.6) All women with no previous incontinence (n = 667): SVD: OR for any urinary incontinence: 1.0 Forceps: OR for any urinary incontinence: 1.3 (95% CI 0.8 to 2.3) CS: OR for any urinary incontinence: 0.3 (95% CI 0.1 to 0.6) All primiparae (n = 607): SVD: OR for any urinary incontinence: 1.0 Forceps: OR for any urinary incontinence: 1.1 (95% CI 0.7 to 1.7) CS: OR for any urinary incontinence: 0.4 (95% CI 0.2 to 0.7) Primiparae with no previous incontinence (n = 345): SVD: OR for any urinary incontinence: 1.0 Forceps: OR for any urinary incontinence: 1.0 (95% CI 0.5 to 1.9) CS: OR for any urinary incontinence: 0.2 (95% CI 0.0 to 0.6)	Study showed no significant risk of urinary incontinence following instrumental delivery compared with spontaneous delivery, but a 60–80% decreased risk of urinary incontinence following delivery by CS compared with vaginal delivery Confounding factors accounted for in logistic regression included: History of incontinence Pelvic floor exercises Parity BMI Response rate was 70%	Cross-sectional	3

Urinary incontinence (continued)

Study	Population	Intervention	Outcomes	Morbidity events	Comments	Study type	EL
Viktrup, 1992[572]	300 primigravidae interviewed during pregnancy, at 3–5 days postpartum, 3 months postpartum and 1 year postpartum (for those with symptoms of stress incontinence) in a Danish city Median age 26 years	Observational study	Stress incontinence as assessed by questions concerning leakage of urine Stress incontinence defined as International Continence Society	Stress incontinence in women with no prior history by mode of delivery: 3–5 days postpartum: VD: 21/167 (13%) CS: 0/35 RR 4.53 (95% CI 0.63 to 32.58) 3 months postpartum: VD: OR for any urinary incontinence: 6/167 (4%) CS: OR for any urinary incontinence: 0/35 RR 1.29 (95% CI 0.16 to 10.42)	Study did not show a significant difference in urinary incontinence comparing vaginal to caesarean delivery These figures are unadjusted	Cohort	3
Persson, 2000[573]	1942 women who had surgery for urinary incontinence between 1987–1996 in Sweden Exclusion criteria: Women born outside Sweden Women who had their first delivery before 1973 Women with surgery prior to pregnancy Unknown birth weight Erroneous year of delivery	Observational study.	Urinary incontinence as assessed by the need for operation	Surgery for urinary incontinence by mode of delivery: CS vs. VD: 0.34 (95% CI 0.23 to 0.52)	Study showed a 70% reduction in the need for surgery for urinary incontinence if delivery was by CS compared with vaginal delivery Confounding factors analysed for included: Year of delivery Maternal age at first and last delivery Parity at last delivery	Cohort	3
Rortveit, 2003[574]	15,307 women under 65 years of age who were either nulliparous, or had CS only or vaginal births only	Observational study	Urinary incontinence ascertained by questionnaire with questions about involuntary loss of urine, frequency, circumstances and amount of leakage and how much of a problem leakage was perceived to be	Odds ratios for any incontinence according to mode of delivery: CS vs. no deliveries: OR 1.5 (95% CI 1.2 to 1.9)* Vaginal deliveries vs. no deliveries: OR 2.3 (95% CI 2.0 to 2.6)* Vaginal deliveries vs. CS: OR 1.7 (95% CI 1.3–2.1)** * adjusted for age **adjusted for age, parity, years since last delivery and body mass index	Attributable risk: the proportion of any incontinence among women who delivered vaginally that would be preventable by CS was 35%	Cohort	3

Faecal incontinence

Study	Population	Intervention	Outcomes	Morbidity events	Comments	Study type	EL
Hannah, 2002[514]	1596 women from 110 centres worldwide who responded to a follow up questionnaire three months after international randomised controlled trial of planned CS vs. vaginal delivery	Planned CS vs. planned vaginal delivery.	Faecal incontinence 3 months after delivery assessed by questionnaire.	Faecal incontinence: Planned CS: 5/619 (0.8%) Planned vaginal delivery: 9/607 (1.5%) RR 0.54 (95% CI 0.18 to 1.62) Incontinence of flatus: Planned CS: 66/616 (10.7%) Planned vaginal delivery: 59/606 (9.7%) RR 1.10 (95% CI 0.79 to 1.54)	Study did not show any difference between groups in terms of incontinence to faeces or flatus	RCT	1b
Abramowitz, 2000[670]	259 women who delivered in a hospital in France	Observational study	New anal incontinence 3 months after delivery as assessed by questionnaire Anal incontinence defined as incontinence to flatus or liquid or solid stools for at least once a week	Anal incontinence by mode of delivery 6–8 weeks postpartum: New anal incontinence: CS vs. No CS: 0.0% vs. 10.1% (p = 0.001) Forceps vs. no forceps: 22.9% vs. 6.5% (p = 0.001)	There is a significant reduction in the risk of anal incontinence with CS and a significant increase in the risk of anal incontinence with forceps delivery Possible confounders corrected for included Baby anterior or posterior presentation Age Parity Anal sexual intercourse Delivery characteristics.	Cohort	2b
Groutz, 1999[584]	300 women who delivered in an Israeli hospital in November 1997 Mean age 30.1 years	Observational study	Prevalence of anal incontinence 3 months after delivery as determined by telephone interview Anal incontinence defined as any involuntary leakage of solid or liquid faeces or gas	Anal incontinence by mode of delivery 3 months postpartum: SVD: 9/235 (3.8%); unadjusted RR 1.00 Vacuum: 10/40 (25%); unadjusted RR 6.53 (95% CI 2.83 to 15.06) Forceps: 1/3 (33%); unadjusted RR 8.70 (95% CI 1.55 to 48.79) CS: 1/22 (4.5%); unadjusted RR 1.18 (95% CI 0.16 to 8.94)	There was no adjusting for possible confounders.	Cohort	2b
Fynes, 1998[587]	234 women who attended the antenatal clinic in the National Maternity Hospital, Dublin between June 1993 and December 1994	Observational study	Anal incontinence as assessed by questionnaire 6 weeks postpartum	Faecal incontinence postpartum: CS (n = 15): 0 (0%) SVD (n = 200): 38 (19%)	Study shows a higher percentage of women with spontaneous vaginal delivery had anal incontinence postpartum No clear controlling for confounders	Cohort	2b

Faecal incontinence (continued)

Study	Population	Intervention	Outcomes	Morbidity events	Comments	Study type	EL
Donnelly, 1998[586]	184 primiparous women who attended the antenatal clinic in the National Maternity Hospital between June 1993 and July 1994	Observational study Exclusion criteria: Diabetes mellitus Anorectal disease Previous anorectal surgery Irritable bowel syndrome	Anal incontinence assessed at postpartum follow up by questionnaire	Fecal incontinence postpartum: CS (n =16): 0 (0%) SVD (n = 146): 2 (1.4%) Instrumental vaginal delivery (n = 22): 5 (23%) Instrumental delivery vs. SVD adj OR 7.2 (95% CI 2.8 to 18.6)	Study shows that vaginal and especially instrumental vaginal delivery is associated with a higher risk of fecal incontinence postpartum. Confounders adjusted for included length of labour and second stage, mode of delivery, epidural use and episiotomy.	Cohort	2b
MacArthur, 1997[585]	906 women who delivered in a maternity hospital in Birmingham, UK, between April and September 1992	Observational study Women assessed before and 6 weeks after delivery	Faecal incontinence as assessed by home-based interviews and hospital case-notes	Faecal incontinence by mode of delivery (unadjusted figures): Primiparae: SVD: new 5; none 184 CS: new 5; none 67; RR 0.38 (95% CI 0.11 to 1.28) Forceps: new 5; none 81; 2.20 (95% CI 0.65 to 7.39) Vacuum: new 3; none 11; 8.10 (95% CI 2.15 to 30.46) Multiparae: SVD: new 13; none 366 CS: new 1; none 100; RR 0.29 (95% CI 0.04 to 2.18) Forceps: new 3; none 21; RR 3.64 (95% CI 1.11 to 11.93) Vacuum: new 1; none 3; RR 7.29 (95% CI 1.23 to 43.20)	Study failed to show in primiparous women an association between delivery by CS and forceps and faecal incontinence compared with spontaneous delivery. It showed an increase in risk of 8 times with vacuum delivery compared with spontaneous delivery In multiparae, forceps delivery and vacuum delivery were associated with a 3- and 7-fold increase respectively in faecal incontinence compared with spontaneous delivery. There was no increase or decrease in the risk of faecal incontinence with CS compared with vaginal delivery	Cohort	2b

Sexual intercourse

Study	Population	Intervention	Outcomes	Morbidity events	Comments	Study type	EL
Hannah, 2002[514]	1596 women from 110 centres worldwide who responded to a follow up questionnaire three months after international randomised controlled trial of planned CS vs. vaginal delivery	Planned CS vs. planned vaginal delivery	Sexual function as assessed by questionnaire on No sex since the birth and pain during sex on most recent occasion	No sex since the birth: Planned CS: 129/795 (16.2%) Planned vaginal delivery: 115/796 (14.5%) RR 1.12 (95% CI 0.89 to 1.42) Pain during sex on most recent occasion: Planned CS: 111/655 (17.0%) Planned vaginal delivery: 325/798 (40.7%) RR 1.03 (95% CI 0.91 to 1.16)	Study did not show any difference between the two groups in terms of no sex since the birth or pain during sex on the most recent occasion	RCT	1b
Lydon-Rochelle, 2001[570]	971 primiparous women who delivered a singleton infant between August and December 1991 in the US Washington State	Observational study	Sexual activity as measured by questionnaire 7 weeks postpartum Reported as a general health status score with a higher score as indicative of a better health status	Mode of delivery and health status score: CS: 56.2 Assisted vaginal: 47.9 Unassisted vaginal: 54.1 Differences by delivery mode: CS–unassisted vaginal: p NS Assisted vaginal–unassisted vaginal: $p < 0.05$	Study did not demonstrate any significant differences between sexual function of women delivered by CS and women with unassisted vaginal delivery postpartum but women with assisted vaginal delivery had significantly poorer scores than their counterparts with unassisted vaginal delivery Maternal, hospital and newborn characteristics were adjusted for as potential confounders	Cohort	2b
Hyde, 1996[590]	570 women recruited in the in the US for a maternity leave and health project	Observational study	Resumption of intercourse one month after delivery	Resumption of intercourse: VD: 82/455 (18%) CS: 25/93 (27%) $p < 0.05$	Study did not correct for instrumental delivery or episiotomy	Cohort	2b
Goetcsh, 1991[591]	62 women attending postnatal clinics at 2 and 8 weeks in the US in May to December 1989	Observational study	Postpartum nonfocal introital dyspareunia assessed by history and swab touch test examination	Postpartum dyspareunia by mode of delivery: VD: 20/48 (42%) CS: 4/14 (29%) $p > 0.5$	Study was unable to demonstrate any difference between women with a CS and vaginal delivery in terms of postpartum nonfocal introital dyspareunia	Cohort	2b

Sexual intercourse (continued)

Study	Population	Intervention	Outcomes	Morbidity events	Comments	Study type	EL
Barrett, 2000[589]	796 primiparous women delivered of a live birth in a 6 month period at a London teaching hospital 61% response rate	Observational study	Self-reported sexual behaviour and sexual problems	89% of respondents had resumed sexual activity within 6 months of birth Pre pregnancy prevalence of sexual problems was 38% Sexual morbidity increased in the first three months after birth to 83%, declining to 64% at 6 months after birth Dyspareunia was significantly associated with vaginal deliveries and previous experience of dyspareunia in the first 3 montsin the first At six months there was no significant association between dyspareunia and mode of delivery		Cohort	2b

Postnatal depression

Study	Population	Intervention	Outcomes	Morbidity events	Comments	Study type	EL
Johnstone, 2001[592]	490 women who delivered in 2 health regions in Australia between Sept 1995 and Jan 1996 and Nov 1995 and March 1996 Mean age 28 years	Observational study	Depression status assessed at 8 weeks using the Edinburgh Postnatal Depression Scale	Incidence of puerperal depression 13.1% Puerperal depression by mode of delivery: Forceps delivery: OR 2.51 Elective CS: OR 2.03 Emergency CS: OR 1.40 (all 3 not statistically significant) Only p values and not 95% CI were reported in the paper; there was not enough information to enable its calculation	No association between mode of delivery and post natal depression at 8 weeks	Cohort	2b
Fisher, 1997[594]	272 nulliparous pregnant women assessed at a mean of 33 weeks of gestation and 5 weeks post-delivery Mean age 28.25 years	Observational study	Self-esteem and depression status as assessed by the Rosenberg Self-Esteem questionnaire and Profile of Mood States. Scores in groups were compared before and after delivery	Mean change in depression score by mode of delivery: Mode of delivery p value CS (n = 42); mean change in scores +2.58; $p < 0.05$ Vaginal delivery (n = 200): mean change in scores –0.26	Women in the vaginal delivery group reported a reduction in symptoms of anxiety and depression	Cohort	2b

Postnatal depression (continued)

Study	Population	Intervention	Outcomes	Morbidity events	Comments	Study type	EL
Glazener, 1995[563]	1249 women who delivered in a Scottish region between June 1990 and May 1991	Observational study	Self reported tearfulness, depression	Tearfulness, depression in hospital at 0–13 days: CS vs. all vaginal deliveries: CS: 53/181 (29%); unadjusted RR 2.02 (95% CI 1.54 to 2.64) All vaginal delivery: 155/1068 (15%) CS vs. spontaneous vaginal deliveries: CS: 53/181 (29%); unadjusted RR 2.24 (95% CI 1.69 to 2.79) SVD: 117/896 (13%) Instrumental delivery vs. spontaneous deliveries: IVD: 38/172 (22%); unadjusted RR 1.69 (95% CI 1.22 to 2.35) SVD: 117/896 (13%) Tearfulness, depression at home (0–8 weeks): CS vs. all vaginal deliveries: CS: 39/161 (24%); unadjusted RR 1.19 (95% CI 0.88 to 1.61) All VD: 194/955 (20%) CS vs. spontaneous vaginal deliveries: CS: 39/161 (24%); unadjusted RR 1.16 (95% CI 0.85 to 1.57) SVD: 169/806 (21%) Instrumental delivery vs. spontaneous deliveries: IVD: 25/149 (17%); unadjusted RR 0.83 (95% CI 0.56 to 1.22) SVD: 169/806 (21%) Tearfulness, depression at home (2–18 months): CS vs. all vaginal deliveries: CS: 10/65 (15%); unadjusted RR 0.90 (95% CI 0.49 to 1.65) All VD: 64/373 (17%) CS vs. spontaneous vaginal deliveries: CS: 10/65 (15%); unadjusted RR 0.90 (95% CI 0.48 to 1.67) SVD: 53/310 (17%) Instrumental delivery vs. spontaneous deliveries: IVD: 11/63 (18); unadjusted RR 1.02 (95% CI 0.57 to 1.84) SVD: 53/310 (17)	Although in the first 2 weeks following delivery, a higher proportion of mothers who had CS or assisted vaginal delivery reported tearfulness, depression compared with those who had spontaneous vaginal delivery, there was no difference between the groups at 18 months after delivery	Cohort	2b

Postnatal depression (continued)

Study	Population	Intervention	Outcomes	Morbidity events	Comments	Study type	EL
Culp, 1989[596]	80 women who delivered at a US hospital 24 delivered by CS 56 delivered vaginally	Observational study	Postnatal depression assessed by a scale from Center for Epidemiological studies	Levels of maternal depression in two separate analyses of variance (ANOVA) were not significantly different between the two groups at 3 months postpartum For those clinically depressed (based on depression scores) two chi-square analyses indicated no significant differences in mothers who were clinically depressed according to mode of delivery	No absolute numbers or percentages given therefore RR cannot be calculated	Cohort	2b
Saisto, 2001[597]	211 women assessed at 17 and 36 weeks of pregnancy and 71 days post-delivery	Observational study	Disappointment with delivery and puerperal depression Depression assessed by a revised version of Beck's Depression inventory (BDI)	Emergency CS associated with disappointment with delivery but not puerperal depression	Study assessed psychosocial predictors of disappointment with delivery and puerperal depression	Cohort	2b
Boyce, 1992[595]	188 primiparous women recruited at the antenatal clinic of an Australian hospital Mean age 26.7 years	Observational study	Postnatal depression as measured by the EPDS at 1, 3 and 6 months postpartum.	Postnatal depression (EPDS scores above 12.5) by method of delivery at 1, 3 and 6 months postpartum: Follow-up (months) by emergency CS (%) VD (%) RR (95% CI) 1/12: CS 4/17 (23.5%); VD: 15/140 (10.7%); RR 2.2 (95% CI 0.82 to 5.86) 3/12: CS 6/13 (46.2%); VD 9/133 (6.8%); RR 6.82 (95% CI 2.85 to 16.15) 6/12: CS 2/18 (11.1%); VD 10/146 (6.8%); RR 1.62 (95% CI 0.39 to 6.83)	Comparison of the groups indicated a significant difference at 3 months postpartum only Emergency CS is associated with a 6-fold increase in the risk of PND compared with vaginal delivery	Cohort	2b

Post-traumatic stress disorder

Study	Population	Intervention	Outcomes	Morbidity events	Comments	Study type	EL
Ryding, 1998[599]	326 women who delivered at a Swedish hospital between January 1992 and 31 March 1993 Mean age 29 years	Observational study	Post-traumatic stress as assessed by Impact of Event Scale	Post-traumatic stress assessed at 2 days and 1 month postpartum: 2 days postpartum: Emergency CS vs. elective CS: p = 0.001 Emergency CS vs. instrumental VD: p NS Emergency CS vs. SVD: p NS 1 month postpartum: Emergency CS vs. elective CS: p = 0.01 Emergency CS vs. 9instrumental VD: p NS Emergency CS vs. SVD: p < 0.05		Cohort	2b
Soderquist, 2002[598]	1550 women who delivered in a Swedish hospital in 1994	Observational study	Post-traumatic stress as assessed by Traumatic Event Scale	Post-traumatic stress assessed between 1 and 2 years postpartum: Elective CS: OR NS Emergency CS: OR 6.3 (95% CI 2.0 to 20.2) Instrumental VD: OR 4.8 (95% CI 1.5 to 15.2) SVD: OR 1.00	Absolute numbers not reported Not clear if odds ratios are crude or adjusted		

Prolapse

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Parazzini, 2000[601]	21,449 women who attended first-level outpatient menopause clinics in Italy from 1997 to 1999 268 centres	Observational study	Uterovaginal prolapse defined according to the Baden-Walker classification	Genital prolapse by mode of delivery: CS: no prolapse 1705 (9.8%); prolapse 66 (5.9%); OR 0.6 (95% CI 0.5 to 0.9) VD: no prolapse 15,650 (90.2%); prolapse 1048 (94.1%)	Delivery by CS was associated with a 40% reduction in the risk of developing genital prolapse Adjusted for age, education, BMI and parity	Case–control	3
Carley, 1999[602]	178 women who underwent corrective surgery for genital prolapse between September 1992 and August 1994 Controls: women who underwent routine screening mammography US hospital	Observational study	Genital prolapse as assessed by need for surgery	Genital prolapse by mode of delivery: At least 1 CS: 7/178 (3.9%) At least 1 VD: 168/178 (94.0%)		Case–control	3

Maternal mortality

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
CEMD[95]	Women in UK	Observational study	Maternal death	All maternities: 2,124,000; death rate/million 30 VD: 1,710,000; death rate/million 16.9; RR 1.0 All CS: 413,000; death rate/million 82.3; RR4.9 (95% CI 2.96 to 7.97) Emergency CS: 69,000; death rate/million 202.9; RR 12.0 (95% CI 6.32 to 22.65) Urgent CS: 137,000; death rate/million 102.2; RR 6.0 (95% CI 3.18 to 11.40) Scheduled CS: 78,000; death rate/million 12.8; RR 0.8 (95% CI 0.10, 5.55) Elective CS: 130,000; death rate/million 38.5; RR 2.3 (95% CI 0.88 to 5.86)	Unadjusted relative risks		3

Chapter 10 Pregnancy and childbirth after CS

10.1 Implications for future pregnancies

Infertility

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Hemminki, 1996[671]	7 cohort studies conducted in Northern Europe and USA.	Observational study	Lowered fertility following CS in women with: At least one pregnancy (A) At least one live birth (B) All pregnancies (C) All live births (D) Fecundity (apparently able to have further children) (E)	CS and subsequent lowered fertility: studies, outcomes and risk ratios: Study no A B C D E 1 0.94* 0.95* 0.90* 0.91* – 2 1.0 1.0 0.89 0.88 0.77* 3 – 0.91* – 0.87* – 4 – 0.91* – 0.88* – 5 0.84* – – – – 6 0.80* – – – – 7 0.83* 0.90* – – –	* indicates statistically significant risk ratios 95% CI not given	Systematic review of cohort studies 2b	
Jolly, 1999[164]	Exposed: 250 women who had a CS in their first pregnancy Non-exposed (two groups): Group 1: 250 women who had normal vaginal deliveries in their first pregnancy Group 2: 250 women who had instrumental deliveries in their first pregnancy. UK health district	Observational study	Fertility rates	Women with no children in the five years after the birth of the first child: Normal: 43/148 (29.1%) Instrumental: 57/163 (35.0%) CS: 70/165 (42.4%) RR for having no more children following primary CS compared with normal deliveries was 1.46 (95% CI 1.07 to 1.99)	There is an increased risk of 46% of having no more children five years after having a primary CS compared with normal delivery Questionnaire response rate was 64% There is no clear controlling for confounders	Cohort	2b

Placenta praevia

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Lydon-Rochelle, 2001[606]	Population Exposed (CS at first delivery): 19,875 Non-exposed (vaginal birth at first delivery): 75,755 Women delivering in a US state between 1987 and 1996	Observational study	Placenta praevia associated with second births No mention of method of assessing-taken from records	Placenta praevia in 2nd pregnancy by mode of delivery in first pregnancy: 1st pregnancy VD (n = 75,755): placenta praevia in 2nd pregnancy 356(0.7%) 1st pregnancy CS (n = 19,875): placenta praevia in 2nd pregnancy 137 (0.5%) Adjusted OR 1.4 (95% CI 1.1 to 1.6)	There is an increased risk of 40% in the incidence of placenta praevia in a 2nd pregnancy if delivery was by CS compared with vaginal delivery OR was adjusted for maternal age	Cohort	2b
Rasmussen, 2000[605]	Based on all births in Norway from 1967 through 1992: 779,642 women 370,374 women elig1ble Exclusion criteria: Women with only one delivery First delivery before1967 Multiple births Women without information on the first day of the last menstrual period in at least one pregnancy	Observational study	Placenta praevia	Placenta praevia in 2nd pregnancy by mode of delivery in first pregnancy: 1st pregnancy VD (n = 346,530): 746 (0.2%) 1st pregnancy CS (n = 23,018): 80 (0.4%) Adjusted OR 1.32 (95% CI 1.04 to 1.68)	There is an increased risk of 32% in the incidence of placenta praevia in a 2nd pregnancy if delivery was by CS compared with vaginal delivery Confounding factors controlled for included: Gestational age Birth weight Placental abruption Pregnancy induced hypertension Perinatal death Interpregnancy interval	Cohort	2b
Rageth, 1999[607]	Exposed: 29,046 women who had a CS in their first birth Unexposed: 255,453 women who had not had a CS and parity > 1 128 women in exposed had the outcome of interest 484 in unexposed had the outcome of interest Data from Swiss database	Observational study	Bleeding due to placenta praevia during pregnancy Method of diagnosing placenta praevia not stated	1st pregnancy VD (n = 226,407): 1137 (0.5%) 1st pregnancy VD (n = 29,046): 238 (0.8%) Unadjusted OR 1.63 (95% CI 1.41to 1.87)	There is an increased risk of 60% in the incidence of placenta praevia in a 2nd pregnancy if delivery was by CS compared with vaginal delivery No adjustment for confounding in the analysis	Cohort	2b

Placenta praevia (continued)

Study	Population	Intervention	Outcomes	Results	Comments	Study type	EL
Ananth, 1997[672]	8 cohort studies from USA and other countries	Observational study	Placenta praevia as stated in primary research paper.	Fixed-effects OR 2.9 (95% CI 2.8 to 3.0) Random-effects OR 2.4 (95% CI 2.1 to 2.8)	Only MEDLINE database searched Studies limited to English language Criteria used to assess quality of individual studies not stated Studies heterogeneous	Systematic Review of cohort studies	2b

10.2 Childbirth following CS

Study	Population	Outcomes	Results	Comments	Study type	EL
Blanchette, 2001[620]	1481 women with at least one previous CS, delivering at a community hospital in USA, 1996 to 1999 Included all mothers with at least 1 previous CS, for whom VBA not medically contraindicated	Uterine rupture Maternal complications Neonatal outcomes including Apgar score	Incidence of uterine rupture: All mothers with previous CS: 8/1000 Elective CS: 0 TOL group: 16/1000 Elective CS (n = 727): Uterine rupture: 0 Perinatal mortality: 0 Maternal mortality: 0 1-minute Apgar score < 7: 47/737 (6.4%); RR 1.0 5-minute Apgar score < 7: 11/737 (1.5%); RR 1.0 TOL (n = 754): Uterine rupture: 12 (1.6%) Perinatal mortality: 2 (0.3%) Maternal mortality: 0 1-minute Apgar score < 7: 93/755 (12.3%); RR 1.9 (95% CI 1.4 to 2.7) 5-minute Apgar score < 7: 12/755 (1.6%); RR 1.1 (95% CI 0.5 to 2.4) Neonatal outcomes: Elective CS (n = 727): Transfer to NICU: 31/737 (4.2%); 1.00 Respiratory distress syndrome: 13/737 (1.8%); 1.00 Seizure: 2/737 (0.3%); 1.00 Sepsis: 2/737 (0.3%); 1.00 Transient tachypnoea newborn: 3/737 (0.4%); 1.00 TOL (n = 754): Transfer to NICU: 36/755 (4.8%); RR 1.1 (95% CI 0.7 to 1.8) Respiratory distress syndrome: 16/755 (2.1%); RR 1.2 (95% CI 0.6 to 2.5) Seizure: 2/755 (0.3%); RR 1.0 (95% CI 0.1 to 6.9) Sepsis: 5/755 (0.7%); RR 2.4 (95% CI 0.5 to 12.5) Transient tachypnoea newborn: 1/755 (0.1%); RR 0.3 (95% CI 0.0 to 3.1) Maternal complications: Elective CS (n = 727): Endometritis: 9 (1.2%); 1.00 Abdominal wound infection: 14 (1.9%); 1.00 Transfusion: 2 (0.3%); 1.00 Postpartum haemorrhage: 2 (0.3%); 1.00 TOL (n = 754): Endometritis: 11 (1.4%); RR 1.2 (95% CI 0.5 to 2.8) Abdominal wound infection: 1 (0.1%); RR 0.1 (95% CI 0.01 to 0.5) Transfusion: 3 (0.4%); RR 1.4 (95% CI 0.2 to 8.6) Postpartum haemorrhage: 3 (0.4%); RR 1.4 (95% CI 0.2 to 8.6)	Elective CS rate: 49% Emergency CS rate in TOL group: 23%	Prospective cohort	3

10.2 Childbirth following CS (continued)

Study	Population	Outcomes	Results	Comments	Study type	EL
Bais, 2001[623]	252 women with at least one previous CS delivering at a Dutch hospital over a 5 year period 1990–94 Included mothers with singleton pregnancies, at least 20 weeks of gestation	Uterine rupture Maternal morbidity Apgar scores Perinatal mortality	Incidence of uterine rupture: All mothers with previous CS: 4/1000 Elective CS: 0 TOL group: 5/1000 Elective CS (n = 68): Uterine rupture: 0 Maternal mortality: 0 Perinatal mortality: 0 5-minute Apgar score < 7: 0 Blood loss > 1000 ml: 6 (8.8%); 1.00 Blood transfusion: 4 (5.9%); 1.00 TOL (n = 184): Uterine rupture: 1 (0.5%) Maternal mortality: 0 Perinatal mortality: 3 (1.6%) 5-minute Apgar score < 7: 6 (3.3%) Blood loss > 1000 ml: 9 (4.9%); RR 0.5 (95% CI 0.2 to 1.5) Blood transfusion: 8 (4.3%); RR 0.7 (95% CI 0.2 to 2.4)	Elective CS rate: 27% Emergency CS rate in TOL group: 23%	Prospective cohort	3
Hook, 1997[637]	989 women with at least 1 previous CS delivering term singleton cephalic in 3 U.S. hospitals during a 1 year period.	Neonatal mortality Neonatal morbidity Maternal morbidiy	Incidence of uterine rupture: All mothers with previous CS: 8/1000 Elective CS: 2/1000 TOL group: 14/1000 Elective CS (n = 497): Uterine rupture: 1 (0.2%); 1.00 Neonatal mortality: 0 1-minute Apgar score < 7: 20 (4.0%); 1.00 5-minute Apgar score < 7: 3 (0.6%) TOL (n = 492): Uterine rupture: 7 (1.4%); RR 7.1 (95% CI 0.9 to 52.3) Neonatal mortality: 1 (0.2%) 1-minute Apgar score < 7: 111 (22.6%); RR 5.6 (95% CI 3.5 to 8.9) 5-minute Apgar score < 7: 14 (2.8%); RR 4.7 (95% CI 1.4 to 16.3)	Elective CS rate: 50% Emergency CS rate in TOL group: 31%	Prospective cohort	3

10.2 Childbirth following CS (continued)

Study	Population	Outcomes	Results	Comments	Study type	EL
Flamm, 1994[627]	7229 mothers with at least one previous CS delivering at 10 hospitals in Southern California. Time period of study began 1990, not known for how long Excluded known prior classical or low vertical uterine incisions	Uterine rupture Transfusion Hysterectomy Perianatal mortality Apgar scores	Incidence of uterine rupture: TOL group: 8/1000 Incidence of uterine rupture in elective CS group not reported Elective CS (n = 2207): Maternal mortality: 0 Transfusion: 38 (1.73%); 1.00 Hysterectomy: 6 (0.27%); 1.00 Perinatal mortality: 0 5-minute Apgar score < 7: 15 (0.7%) TOL (n = 5022): Uterine rupture: 39 (0.8%); RR 0.4 (95% CI 0.3 to 0.6) Maternal mortality: 0 Transfusion: 36 (0.72%); 1.00 Hysterectomy: 6 (0.12%); RR 0.4 (95% CI 0.1 to 1.4) Perinatal mortality: 0 5-minute Apgar score < 7: 74 (1.5%); RR 2.2 (95% CI 1.2 to 3.8)	Elective CS rate: 16%–41% Emergency CS rate in TOL group: 18–30%	Prospective cohort	3
Granovsky, 1994[673]	52 women with at least 1 previous CS, delivered in a maternity hospital in Israel Included previous low segement transverse uterine incisions, singleton cephalic pregnancies presenting in labour	Maternal mortality Maternal morbidity Perinatal mortality	Incidence of uterine rupture: Elective CS group (n = 26): 0 TOL group (n = 26): 0 Maternal morbidity (both groups): 0 Perinatal mortality (both groups): 0	26 women in each group. Unclear whether these are results of a complete cohort	Prospective cohort	3
Miller, 1992[638]	318 consecutive patients with at least one previous CS delivering at a Sydney Teaching hospital, over a 1 year period.	Uterine rupture Maternal complications Neonatal outcomes including Apgar score	Incidence of uterine rupture: All women with previous CS: 3/1000 Elective CS: 0 TOL group: 8/1000 Elective CS (n = 193): Uterine rupture: 0 Maternal mortality: 0 Neonatal mortality: 1 (0.5%); 1.00 1-minute Apgar score < 7: 24 (12.4%); 1.00 5-minute Apgar score < 7: 4 (2.1%); 1.00 Neonatal seizures: 1 (0.5%); 1.00 TOL (n = 125): Uterine rupture: 1 (0.8%) Maternal mortality: 0 Neonatal mortality: 2 (1.6%); RR 3.1 (95% CI 0.3 to 33.7) 1-minute Apgar score < 7: 29 (23.2%); RR 1.9 (95% CI 1.1 to 3.0) 5-minute Apgar score < 7: 6 (4.8%); RR 2.3 (95% CI 0.7 to 8.0) Neonatal seizures: 2 (1.6%); RR 3.1 (95% CI 0.3 to 33.7)	Elective CS rate: 61% Emergency CS rate in TOL group: 36%	Prospective cohort	3

10.2 Childbirth following CS (continued)

Study	Population	Outcomes	Results	Comments	Study type	EL
Abitbol, 1993[674]	312 women with at least 1 previous CS who were part of the VBAC programme at a New York hospital Excluded unknown type of uterine scar, fetal weight estimated to be greater than 4000 g on USS, nonvertex presentations, gestational diabetes, contraindications to vaginal delivery	Maternal mortality Perinatal mortality Patient satisfaction	Incidence of uterine rupture: All women with previous CS: 3/1000 Elective CS: 0 TOL group: 5/1000 Elective CS (n = 125): Uterine rupture: 0 Maternal mortality: 0 Perinatal mortality: 0 5-minute Apgar score < 7: 1 (0.8%) 1.00 TOL (n = 187): Uterine rupture: 1 (0.5%) Maternal mortality: 0 Perinatal mortality: 2 (1.1%) 5-minute Apgar score < 7: 8 (4.3%); RR 5.3 (0.7 to 42.2)	Study aimed primarily at looking at patient views and satisfaction with VBAC Elective CS rate: 40% Emergency CS rate in TOL group: 35%	Prospective cohort	3

10.2 Childbirth following CS (continued)

Study	Population	Outcomes	Results	Comments	Study type	EL
Roumen, 1990[622]	249 women with at least 1 previous CS (low transverse uterine incision) who delivered over a 10-year period in a Dutch maternity unit 1977–87	Uterine rupture Maternal morbidity Apgar score Cord pH	Incidence of uterine rupture: All women with previous CS: 4/1000 Elective CS: 0 TOL group: 5/1000 Elective CS (n = 57): Uterine rupture: 0 Maternal mortality:0 Perinatal mortality:0 1 min Apgar score < 7: 4/58 (6.9%); 1.00 5 min Apgar score < 7: 0/58 UApH < 7.2: 4/58 (6.9%); 1.00 TOL (n = 192): Uterine rupture: 1 (0.5%) Maternal mortality:0 Perinatal mortality: 5 (2.6%) 1-minute Apgar score < 7: 26/195 (13.3%); RR 1.9 (95% CI 0.7 to 5.3) 5-minute Apgar score < 7: 8/195 (4.1%) UApH < 7.2: 52/195 (26.7%); RR 3.9 (95% CI 1.5 to 10.2) Elective CS (n = 57): Blood loss > 1000ml: 7 (8.8%); 1.00 Blood transfusion: 13 (22.8%); 1.00 Pneumonia: 1 (1.7%) Endometritis: 3 (5.3%); 1.00 Wound infection: 1 (1.7%); 1.00 UTI: 5 (8.8%); 1.00 TOL (n = 192): Blood loss > 1000ml: 17 (12.2%); RR 0.7 (95% CI 0.3 to 1.6) Blood transfusion: 15 (7.8%); RR 0.3 (95% CI 0.2 to 0.7) Pneumonia: 0 Endometritis: 5 (2.6%); RR 0.5 (95% CI 0.1 to 2.0) Wound infection: 9 (4.7%) RR 2.7 (95% CI 0.3 to 20.6) UTI: 5 (8.8%); 25 (13.0%) RR 1.5 (95% CI 0.6 to 3.7)	Elective CS rate 23% Emergency CS rate in TOL group 21%	Prospective cohort	3

10.2 Childbirth following CS (continued)

Study	Population	Outcomes	Results	Comments	Study type	EL
Phelan, 1989[629]	1088 women with 2 previous CS who delivered singleton cephalic pregnancies over a 4-year period in a US teaching hospital Excluded known previous classical scars, multiple gestations, malpresentation	Uterine rupture Maternal morbidity Apgar score Perinatal mortality	Incidence of uterine rupture: All women with previous CS: 1/1000 Elective CS: 2/1000 TOL group: 0 Elective CS (n = 587): Uterine rupture: 1 (0.2%) Maternal mortality: 0 Perinatal mortality: 5 (0.8%); 1.00 1-minute Apgar < 7: 70 (11.9%) 1.00 5-minute Apgar < 7: 8 (1.4%) 1.00 Hysterectomy: 7 (1.2%); 1.00 TOL (n = 501): Uterine rupture: 0 Maternal mortality: 1 (0.2%) Perinatal mortality: 6 (1.2%); RR 1.4 (95% CI 0.4 to 4.6) 1-minute Apgar < 7: 87 (17.4%); RR 1.4 (95% CI 1.1 to 1.9) 5-minute Apgar < 7: 13 (2.6%); RR 1.9 (95% CI 0.8 to 4.5) Hysterectomy: 1 (0.2%); RR 5.97 (95% CI 0.7 to 48.4)	Entry criteria differed from year to year Uterus explored in all vaginal deliveries to determine incidence of uterine rupture TOL rate increased over the 4 year period from 10% to 60% Elective CS rate 54% Emergency CS rate in TOL group was 31%	Prospective cohort	3
Raynor, 1993[675]	67 women with at least 1 previous CS, delivered at a small (< 1000 annual delivery rate) rural maternity centre, level 1 nursery care in the US, 1988–1991	Maternal morbidity Apgar scores	No cases of uterine rupture TOL group: n = 51 El CS: n = 8 Not elig1ble for TOL: n = 8	Small descriptive study, aimed at demonstrating that high VBAC rates are achievable in rural hospitals Results not given according to intended mode of delivery	Retro-spective cohort	3

10.2 Childbirth following CS (continued)

Study	Population	Outcomes	Results	Comments	Study type	EL
Lydon–Rochelle, 2001[621]	20,095 women with 1 previous CS (no previous vaginal deliveries) over a 10 year period in the US	Uterine rupture	Incidence of uterine rupture: All women with 1 previous CS, no previous vaginal deliveries: 4/1000 Women who have elective CS: 2/1000 Women with spontaneous onset of labour: 5/1000 Women with IOL (non-prostaglandin): 8/1000 Women with IOL (prostaglandin): 24/1000 Uterine rupture: Elective CS (n = 6980): 11; 1.00 Spontaneous onset labour (n = 10789): 56; 3.3 (95% CI 1.8 to 6.0) IOL (non-prostaglandin) (n = 1960): 15; 4.9 (95% CI 2.4 to 9.7) IOL (prostaglandin) (n = 366): 9; 15.6 (95% CI 8.1 to 30.0) NNT = 277 elective CS to prevent 1 uterine rupture (based on absolute risk for women in spontaneous labour) Postpartum complication: no uterine rupture (n = 20,004): Severe post haemorrhagic anaemia 4.8% Major puerperal infection 1.2% Bladder injury 1.2% Paralytic ileus 0.4% Hysterectomy 0.1% Surgical and anaesthetic complication 0.7% Maternal hospital stay > 5 days 4.2% Death of infant 0.5% Postpartum complication: uterine rupture (n = 91) Severe post haemorrhagic anaemia 10% Major puerperal infection 8.8% Bladder injury 7.7% Paralytic ileus 3.3% Hysterectomy 4.4% Surgical and anaesthetic complication 35.2% Maternal hospital stay > 5 days 26.4% Death of infant 5.5% p< 0.05 for all these outcomes		Retro-spective cohort	2b

10.2 Childbirth following CS (continued)

Study	Population	Outcomes	Results	Comments	Study type	EL
McMahon, 1996[618]	6138 women in Nova Scotia, with one previous CS (low transverse uterine incision), 1986–92 Excluded non vertex presentation, multiple gestations, previous CS with vertical or T shaped incision, placenta praevia, maternal herpes simplex infection, previous uterine surgery e.g. myomectomy)	Uterine rupture Major morbidity Minor morbidity Perinatal mortality	Incidence of uterine rupture: All women with one previous CS: 2/1000 Elective CS: 0.3/1000 TOL group: 3/1000 Elective CS (n = 2889): Uterine rupture: 1 (0.03%); 1.00 Maternal mortality: 0 Perinatal mortality: 14 (0.5%); 1.00 Hysterectomy: 6 (0.2%); 1.00 Operative injury: 18 (0.6%); 1.00 Blood transfusion: 39 (1.3%); 1.00 Abdominal wound infection: 63 (2.2%); 1.00 TOL (n = 3249): Uterine rupture: 10 (0.3%); RR 8.9 (95% CI 1.1 to 69.4) Maternal mortality: 0 Perinatal mortality: 29 (0.9%); RR 1.8 (95% CI 1.0 to 3.5) Hysterectomy: 5 (0.1%); RR 0.7 (95% CI 0.2 to 2.4) Operative injury: 41 (1.3%); RR 2.0 (95% CI 1.2 to 3.5) Blood transfusion: 36 (1.1%); RR 0.8 (95% CI 0.5 to 1.3) Abdominal wound infection: 43 (1.3%) RR 0.6 (95% CI 0.4 to 0.9) NNT: 366 elective CS to prevent 1 uterine rupture	Women self selected into groups Elective CS rate 47% Emergency CS rate in TOL group 40% No difference in perinatal mortality and Apgar scores (absolute numbers not shown)	Retro-spective cohort	3
Troyer, 1992[676]	567 women with at least 1 previous CS, delivered at a teaching hospital in USA, 1990–91 Singleton cephalic pregnancies, at least 36 weeks with documented transverse lower uterine scar Excluded undocumented, low vertical, classical uterine scars, multiple gestations, malpresentations and gestation under 36 weeks	Maternal morbidity Perinatal deaths Apgar scores	Incidence of uterine rupture: All women with previous CS: 9/1000 Elective CS: 7/1000 TOL group: 11/1000 Elective CS (n = 303): Uterine rupture: 2 (0.7%); 1.00 Maternal mortality: 0 Perinatal mortality: 0 5-minute Apgar < 7: 3 (1.0%) TOL (n = 264): Uterine rupture: 3 (1.1%); RR 1.7 (95% CI 0.3 to 10.2) Maternal mortality: 0 Perinatal mortality: 0 5-minute Apgar < 7: 0 NNT: 210 elective CS to prevent 1 uterine rupture	Study was designed to look at variables that predict successful TOL	Retro-spective cohort	3

10.2 Childbirth following CS (continued)

Study	Population	Outcomes	Results	Comments	Study type	EL
Obara, 1997[624]	310 women with at least one previous CS, delivering term (at least 36 weeks gestation) singleton infants at a Japanese hospital between 1990 to 1995 Excluded cases of placenta praevia	Uterine rupture Maternal death Hysterectomy Blood loss > 1500 ml Perinatal death Apgar scores	Incidence of uterine rupture: All women with at least 1 previous CS: 6/1000 Elective CS: 0 TOL group: 9/1000 Elective CS (n = 96): Uterine rupture: 0 Maternal mortality: 0 Hysterectomy: 0 Blood loss: 4 (4.2%); 1.00 Perinatal mortality: 0 5-minute Apgar < 7: 0 TOL (n = 214): Uterine rupture: 2 (0.9%) Maternal mortality: 0 Hysterectomy: 1 Blood loss: 3 (1.4%) RR 0.3 (95% CI 0.1 to 1.5) Perinatal mortality: 0 5-minute Apgar < 7: 5 (2.3%)	Elective CS rate: 31% Emergency CS rate in TOL group: 57% All women underwent Xray pelvimetry, those with contracted bony pelvis were recommended elective repeat CS, as were those who were not delivered after 41 weeks.	Retro-spective cohort	3
Swaim, 1998[636]	295 women with at least 1 previous CS, delivered at a US hospital between 1994–95 Excluded fetal deaths, unclear if these were antepartum or intrapartum, estimated fetl weight below 10th centile for gestational age, major congenital abnormalities, severe isoimmunisation	Umbilical cord pH Apgar scores	Incidence of uterine rupture: All women with previous CS: 3/1000 Elective CS: 0 TOL group: 5/1000 Elective CS (n = 113): Uterine rupture: 0 UA pH < 7.2: 29/110 (26.4%); 1.00 5-minute Apgar < 7: 2/113 (1.8%) 1.00 TOL (n = 193): Elective CS (n = 113): Uterine rupture: 1 (0.5%) UA pH < 7.2: 48/185 (25.9%); RR 1.0 (95% CI 0.7 to 1.5) 5-minute Apgar < 7: 4/193 (2.1%); RR 1.2 (95% CI 0.2 to 6.3)	Elective CS rate: 37% Emergency CS rate in TOL group: 30%	Retro-spective cohort	3

10.2 Childbirth following CS (continued)

Study	Population	Outcomes	Results	Comments	Study type	EL
Rageth, 1999[607]	29046 with at least 1 previous CS, with births registered on a Swiss database 1983 to 1996 Excluded multiple pregnancies	Maternal death Maternal morbidity Uterine rupture Perinatal death	Incidence of uterine rupture: All women with at least 1 previous CS: 3/1000 Elective CS: 2/1000 TOL group: 4/1000 Elective CS (n = 11,433): Uterine rupture: 22 (0.2%); 1.00 Maternal mortality: 0 Perinatal mortality: 10 (0.1%); 1.00 Neonatal transfer: 949 (8.3%) 1.00 Hysterectomy: 52 (0.45%); 1.00 Febrile morbidity: 262 (2.3%;) 1.00 Thromboembolic complications: 49 (0.4%); 1.00 TOL (n = 17,613) Uterine rupture: 70 (0.4%); RR 2.1 (95% CI 1.3 to 3.3) Maternal mortality: 1 (0.01%) Perinatal mortality: 33 (0.2%); RR 2.1 (95% CI 1.1 to 4.3) Neonatal transfer: 1075 (6.1%); RR 0.7 (95% CI 0.7 to 0.8) Hysterectomy: 29 (0.16%); RR 0.4 (95% CI 0.2 to 0.6) Febrile morbidity: 264 (1.5%); RR 0.6 (95% CI 0.5 to 0.8) Thromboembolic complications: 39 (0.2%); RR 0.5 (95% CI 0.3 to 0.8) NNT: 488 elective CS to prevent 1 uterine rupture	Elective CS rate: 39% Emergency CS rate in TOL group: 26% Also reports relative risk of uterine rupture for women with previous CS compared with women with no previous CS, para > 1: RR 42.18 (95% CI 31.09 to 57.24)	Retro-spective cohort	3
Neuhaus, 2001[677]	1086 women with at least one previous CS delivering at a German teaching hospital between 1979 to 1995.	Uterine rupture	Incidence of uterine rupture: All women with at least 1 previous CS: 4/1000 Elective CS: 2/1000 TOL group: 6/1000 Uterine rupture: Elective CS (n = 603): 1 (0.2%); 1.00 TOL (n = 483): 3 (0.6%); RR 3.7 (95% CI 0.4 to 35.9)	Overall: Elective CS rate: 55% Emergency CS rate in TOL group: 14%	Retro-spective cohort	3
Gregory, 1999[619]	All delivery discharges (n = 536,785) in California over a 1 year period (1995)	Uterine rupture	Incidence of uterine rupture: All women giving birth: 0.7/1000 All women with no previous CS: 0.2/1000 All women with previous CS: 4/1000 Elective CS: 3/1000 TOL group: 5/1000 Uterine rupture: Elective CS (n = 27760): 79 (0.3%); 1.00 TOL (n = 66856): 288 (0.4%); 1.88 (95% CI 1.45 to 2.43) NNT = 400 elective CS to prevent 1 uterine rupture	Elective CS rate: 42% Emergency CS rate in TOL group: 38%	Retro-spective cohort	3

10.2 Childbirth following CS (continued)

Study	Population	Outcomes	Results	Comments	Study type	EL
Asakura, 1995[617]	1641 women with at least one previous CS, delivering at a teaching hospital in the U.S. over a 5-year period (1987 to 1992)	Uterine rupture Neonatal death 1-minute Apgar < 3	Incidence of uterine rupture: All women with previous CS: 5/1000 Elective CS: 0/1000 TOL group: 6/1000 Elective CS (n = 229): Uterine rupture: 0 Maternal mortality: 0 Perinatal mortality: 6 (2.6%); 1.00 1-minute Apgar < 3: 3/242 (4.2%); 1.00 TOL (n = 1412): Uterine rupture: 8 (0.6%) Maternal mortality: 0 Perinatal mortality: 8 (0.6%); RR 0.2 (95% CI 0.07 to 0.62) 1-minute Apgar < 3: 61/1435 (1.2%); RR 3.4 (95% CI 1.1 to 10.8)	Elective CS rate:13% Emergency CS rate in TOL group: 36%	Retro-spective cohort	3
Hibbard, 2001[626]	1756 women with at least one previous CS delivering in a US hospital over a 10-year period 1989–1998 Included no more than two previous low tranverse or low vertical CS, no previous additional uterine surgeries, cephalic or breech presentations, no active herpes infections and adequate pelvis.	Uterine rupture Hysterectomy Blood loss Blood transfusion Chorioamnionitis Endometritis	Incidence of uterine rupture: All women with previous CS: 6/1000 Elective CS: 0/1000 TOL group: 8/1000 Elective CS (n = 431): Uterine rupture: 0 Hysterectomy: 0 Blood loss > 1000 ml: 32 (97.4%);1.00 Blood loss > 2000 ml: 5 (1.2%); 1.00 Blood transfusion: 6 (1.4%); 1.00 Chorioamnionitis: 18 (12.8%); 1.00 Endometritis: 38 (8.8%); 1.00 TOL (n = 1324): Uterine rupture: 10 (0.7%) Hysterectomy: 6 (0.5%) Blood loss > 1000 ml: 46 (3.5%) RR 0.5 (95% CI 0.3 to 0.7) Blood loss > 2000 ml: 8 (0.6%) RR 0.5 (95% CI 0.3 to 0.7) Blood transfusion: 11 (0.8%); RR 0.6 (95% CI 0.2 to 1.6) Chorioamnionitis: 169 (4.2%) RR 3.1 (95% CI 1.9 to 4.9) Endometritis: 108 (8.1%); RR 0.9 (95% CI 0.6 to 1.3)	Elective CS rate:24% Emergency CS rate in TOL group: 31%	Retro-spective cohort	3

10.2 Childbirth following CS (continued)

Study	Population	Outcomes	Results	Comments	Study type	EL
Iglesias, 1991[678]	All 1161 mothers delivering at a 44-bed rural hospital in Canada between 1985 and 1989. 136 mothers had previous CS	CS rates Uterine rupture	Incidence of uterine rupture: All women with previous CS: 15/1000 Elective CS: 0/1000 TOL group: 28/1000 Elective CS (n = 65): Uterine rupture: 0 Maternal mortality: 0 Perinatal mortality: 0 TOL (n = 72): Uterine rupture: 2 (2.8%) Maternal mortality: 0 Perinatal mortality: 1 (1.4%)	Elective CS rate:47% Emergency CS rate in TOL group: 19%	Retro-spective cohort	3
Eriksen, 1989[639]	141 mothers with previous CS delivering at a U.S. military hospital 1985–1987 Included only confirmed low transverse previous CS, singleton cephalic pregnancies Excluded those with more than 2 previous CS or history of wound infection or endomyometritis	Maternal morbidity including uterine rupture Neonantal morbidity Neonatal death	Incidence of uterine rupture: All women with previous CS: 7/1000 Elective CS: 0/1000 TOL group: 14/1000 Elective CS (n = 68): Uterine rupture: 0 Maternal mortality: 0 Perinatal mortality: 0 Transient tachypnoea newborn: 6 (8.8%); 1.00 Transfer to NICU: 11 (16.2%); 1.00 Maternal blood transfusion: 0 Maternal endomyometritis: 1 (1.5%); 1.00 TOL (n = 71): Uterine rupture: 1 (1.4%) Maternal mortality: 0 Perinatal mortality: 0 Transient tachypnoea newborn: 3 (4.2%); RR 0.5 (95% CI 0.1 to 1.8) Transfer to NICU: 5 (7.0%); RR 0.4 (95% CI 0.1 to 1.2) Maternal blood transfusion: 0 Maternal endomyometritis: 2 (2.8%); RR 1.9 (95% CI 0.2 to 20.6)	Elective CS rate:48% Emergency CS rate in TOL group: 20%	Retro-spective cohort	3
Paterson, 1991[679]	36,727 singleton births in 17 maternity units, North West region, London during 1988 Incuded singleton cephalic pregnancies at least 37 weeks of gestation, only one previous CS and no previous vaginal deliveries	Mode of delivery Maternal mortality Neonatal death	Elective CS (n = 395): perinatal deaths 0 TOL (n = 664): perinatal deaths 1 (1.6%)	Elective CS rate 37% Emergency CS rate in TOL group: 29%	Retro-spective cohort	3

10.2 Childbirth following CS (continued)

Study	Population	Outcomes	Results	Comments	Study type	EL
Smith, 1997[635]	Registry data (SMR2) for all births in Scotland 1992–97 Excluded multiple pregnancies, non cephalic presentation, delivery outside range of 37–43 weeks gestation, perinatal deaths due to congenital anomaly, antepartum stillbirths	Perinatal death	Perinatal mortality: Elective CS (n = 9014): 1 (0.01%); 1.00 TOL (n = 15,515): 20 (0.1%); RR 11.6 (95% CI 1.6 to 86.6)		Retro-spective cohort	3
Stone, 2000[680]	Registry data for all births in 1995 in Victoria, Australia. Included 4663 mothers whose penultimate birth was by CS and who had a singleton birth in both deliveries	Uterine rupture Perinatal mortality	Incidence of uterine rupture: All women with previous CS: 0.6/1000 Elective CS: 0/1000 TOL group: 2/1000 Elective CS (n = 3181): Uterine rupture: 0 Perinatal mortality: 1 (0.03%); 1.00 TOL (n = 1482): Uterine rupture: 3 (0.2%) Perinatal mortality: 1 (0.07%); RR 2.1 (95% CI 0.1 to 34.3)	Elective CS rate 68% Emergency CS rate in TOL group 44%	Retro-spective cohort	3
Saldana, 1979[681]	226 women with previus CS, delivering in a U.S.A teaching hospital between 1974–77	Uterine rupture Maternal mortality Perinatal mortality	Incidence of uterine rupture: All women with previous CS: 4/1000 Elective CS: 12/1000 TOL group: 0/1000 Uterine rupture: Elective CS (n = 81): 1 (1.2%) TOL (n = 145): 0 Maternal and perinatal mortality: 0 (both groups)	Elective CS rate 36% Emergency CS rate in TOL group 61%	Cohort study	3

10.2 Childbirth following CS (continued)

Study	Population	Outcomes	Results	Comments	Study type	EL
Chattopadhyay, 1988[633]	1847 women with a previous CS delivering in Saudi Arabia 1983–84	Uterine rupture Maternal mortality Blood transfusion Infection	Incidence of uterine rupture: All women with previous CS: 9/1000 Elective CS: 5/1000 TOL group: 10/1000 Elective CS (n = 401): Uterine rupture: 2 (0.5%); 1.00 Maternal mortality: 0 Blood transfusion: 24 (6.0%); 1.00 Infection: 89 (22.2%); 1.00 TOL (n = 1446): Uterine rupture: 15 (1.0%); RR 2.1 (95% CI 0.5 to 9.0) Maternal mortality: 0 Blood transfusion: 176 (15.6%); RR 2.6 (95% CI 1.7 to 3.9) Infection: 226 (15.2%) RR 0.7 (95% CI 0.5 to 0.8)	Elective CS rate 20% Emergency CS rate in TOL group 49% Incidence of uterine ruptures among women with no previous CS in this hospital was 2/10,000	Retro-spective cohort	3
Novas, 1987[628]	69 women with more than one previous CS delivering in a hospital in USA	Uterine rupture Hysterectomy Perinatal mortality	Incidence of uterine rupture: All women with previous CS: 14/1000 Elective CS: 0/1000 TOL group: 28/1000 Elective CS (n = 33): Uterine rupture: 0 Hysterectomy: 2 (6.1%) Maternal mortality: 0 Perinatal mortality: 2 (6.1%);1.00 TOL (n = 36): Elective CS (n = 33): Uterine rupture: 1 (2.8%) Hysterectomy: 0 Maternal mortality: 0 Perinatal mortality: 1 (2.8%); RR 0.4 (95% CI 0.0to 4.8)	Elective CS rate 48% Emergency CS rate in TOL group 20%	Retro-spective cohort	3

10.2 Childbirth following CS (continued)

Study	Population	Outcomes	Results	Comments	Study type	EL
Hansell, 1990[616]	170 women with at least 2 previous CS deliveringin USA, 1983 to 1987	Uterine rupture Apgar scores Maternal blood transfusion	Incidence of uterine rupture: Women with at least 2 previous CS: 6/1000 Elective CS: 7/1000 TOL group: 0/1000 Elective CS (n = 135): Uterine rupture: 1 (0.7%) 1-minute Apgar score < 5: 5 (3.7%); 1.00 5-minute Apgar score < 5: 0 Maternal Blood transfusion: 11 (8.1%); 1.00 TOL (n = 35): Uterine rupture: 0 1-minute Apgar score < 5: 3 (8.6%); RR 2.3 (95% CI 0.6 to 9.2) 5-minute Apgar score < 5: 0 Maternal Blood transfusion: 1 (2.8%); RR 0.3 (95% CI 0.05 to 2.6)	Elective CS rate 79% Emergency CS rate in TOL group 23%	Retro-spective cohort	3
Stronge, 1996[682]	239 women with 1 previous CS, no other previous pregnancies delivering in a teaching hospital in Dublin, 1992–94	Uterine rupture Perinatal mortality	Incidence of uterine rupture: All women with 1 previous CS: 0/1000 Elective CS: 0/1000 TOL group: 0/1000 Uterine rupture: Elective CS (n = 44): 0 TOL (n = 195): 0 Perinatal mortality: Elective CS (n = 44): 0 TOL (n = 195): 3 (1.5%)	Elective CS rate 19% Emergency CS rate in TOL group 23%	Retro-spective cohort	3
Bombelli, 1998[683]	231 women with at least 1 previous CS delivering in Italy 1996–97	Uterine rupture Apgar score Umbilical vein Ph Base excess	Incidence of uterine rupture: All women with 1 previous CS: 0/1000 Elective CS: 0/1000 TOL group: 0/1000 Elective CS (n = 149): Uterine rupture: 0 1-minute Apgar score < 7: 11 (7.4%); 1.00 5-minute Apgar score < 7: 0 Umbilical vein Ph < 7: 0 Base excess < –12: 0 TOL (n = 82): Uterine rupture: 0 1-minute Apgar score < 7: 9 (11.0%); RR 1.5 (95% CI 0.6 to 3.4) 5-minute Apgar score < 7: 0 Umbilical vein Ph < 7: 2 (2.4%) Base excess < –12: 2 (2.4%)	Elective CS rate 21% Emergency CS rate in TOL group 32%	Prospective cohort	3

10.2 Childbirth following CS (continued)

Study	Population	Outcomes	Results	Comments	Study type	EL
Phelan, 1989[630]	2643 women with at least 1 previous CS delivering in USA 1982 to 1984 Inclusion criteria: Patient acceptance Unknown type of scar Exclusion criteria: Known classical scar Multiple gestation Malpresentation	Uterine rupture Febrile morbidity Hysterectomy	Incidence of uterine rupture: All women with previous CS:9/1000 Elective CS: 5/1000 TOL group: 3/1000 Uterine rupture: Elective CS (n = 847): 4 (0.5%); 1.00 TOL (n = 1796): 5 (0.3%); RR 0.6 (95% CI 0.1 to 2.2) Febrile morbidity: Elective CS (n = 847): 163 (19.2%); 1.00 TOL (n = 1796): 159 (8.8%); RR 0.5 (95% CI 0.4 to 0.6) Hysterectomy: Elective CS (n = 847): 14 (1.6%); 1.00 TOL (n = 1796): 5 (0.3%); RR 0.2 (95% CI 0.1 to 0.5)	Elective CS rate 32% Emergency CS rate in TOL group 18%	Prospective cohort	3
Paul, 1985[684]	1209 women with at least 1 previous CS delivering at a US hospital 1982 to 1984 Exclusion criteria: Multiple gestation Unknown intent for trial of labour	Uterine rupture Maternal febrile morbidity	Incidence of uterine rupture: All women with previous CS: 4/1000 Elective CS: 4/1000 TOL group: 4/1000 Uterine rupture: Elective CS (n = 458): 2 (0.4%); 1.00 TOL (n = 751): 3 (0.4%); RR 0.9 (95% CI 0.1 to 5.4) Febrile morbidity: Elective CS (n = 458): 74 (16.1%); 1.00 TOL (n = 751): 51 (6.8%); RR 0.4 (95% CI 0.3 to 0.6) Hospital stay: 2–4 days (both groups)	Elective CS rate 38% Emergency CS rate in TOL group 18%	Prospective cohort	3
Ngu, 1989[685]	1022 women with at least 1 previous CS delivering in Australia 1978 to 1981	Uterine rupture	Incidence of uterine rupture: All women with previous CS: 0/1000 Elective CS: 0/1000 TOL group: 0/1000 Elective CS (n = 566) TOL (n = 456) Uterine rupture: 0 (both groups)	Elective CS rate 55% Emergency CS rate in TOL group 40%	Retro-spective cohort	3
Molloy, 1987[686]	2176 women with at least 1 previous CS delivering in Dublin 1979 to 1984	Uterine rupture	Incidence of uterine rupture: All women with previous CS: 2/1000 Elective CS: 0/1000 TOL group: 2/1000 Uterine rupture: Elective CS (n = 395): 0 TOL (n = 1781): 4 (0.2%)	Elective CS rate 55% Emergency CS rate in TOL group 9%	Retro-spective cohort	3

10.2 Childbirth following CS (continued)

Study	Population	Outcomes	Results	Comments	Study type	EL
Meehan, 1989[687]	2434 women with at least 1 previous CS delivering in Ireland 1972 to 1987	Uterine rupture	Incidence of uterine rupture: All women with previous CS: 4/1000 Elective CS: 4/1000 TOL group: 4/1000 Uterine rupture: Elective CS (n = 1084): 4 (0.4%); 1.00 TOL (n = 1350): 6 (0.4%); 1.2 (95% CI 0.3 to 4.2)	Elective CS rate 44% Emergency CS rate in TOL group 29%	Prospective cohort	3
Martin, 1983[625]	717 women with at least 1 previous CS delivering in USA, 1981 to 1982 Exclusion criteria: Prior classical uterine incision Suspected macrosomia Fetal malpresentation Multiple gestation	Uterine rupture Neonatal death	Incidence of uterine rupture: All women with previous CS: 4/1000 Elective CS: 4/1000 TOL group: 6/1000 Uterine rupture: Elective CS (n = 555): 2 (0.4%); 1.00 TOL (n = 162): 1 (0.6%); RR 1.7 (95% CI 0.1 to 18.8) Neonatal death: Elective CS (n = 555): 5 (0.9%) TOL (n = 162): 0 Elective CS (n = 555): Endometritis: 42 (7.6%); 1.00 Wound infection: 12 (2.2%); 1.00 Haemorrhage: 57 (10.3%);1.00 Pulmonary: 31 (5.6%); 1.00 TOL (n = 162): Endometritis: 8 (4.7%); RR1.61 (95% CI 0.77 to 3.36) Wound infection: 3 (1.8%); RR 1.17 (95% CI 0.3 to 4.1) Haemorrhage: 15 (9.2%); RR 1.1 (95% CI 0.6 to 1.9) Pulmonary: 6 (0.4%); RR 1.5 (95% CI 0.6 to 3.5)	Elective CS rate 77% Emergency CS rate in TOL group 38%	Prospective cohort	3

10.2 Childbirth following CS (continued)

Study	Population	Outcomes	Results	Comments	Study type	EL
Hadley, 1986[631]	75 women with 1 previous CS delivering in USA, 1982 to 1983 Inclusion criteria: No complications of pregnancy One previous low transverse CS Singleton fetus vertex presentation 37 weeks gestational age	Uterine rupture Apgar scores Postpartum endometritis UTI Wound infection	Incidence of uterine rupture: All women with previous CS: 13/1000 Elective CS: 0/1000 TOL group: 25/1000 Elective CS (n = 35): Uterine rupture: 0 1-minute Apgar score < 7: 4 (11.4%) 5-minute Apgar score < 7: 2 (5.7%) Postpartum endometritis: 7 (0.2%); 1.00 UTI: 1 (0.03%); 1.00 Wound infection: 1 TOL (n = 40): Uterine rupture: 1 (2.5%) 1-minute Apgar score < 7: 0 5-minute Apgar score < 7: 0 Postpartum endometritis: 6 (0.15%); RR 0.75 (95% CI 0.3 to 2.0) UTI: 2 (0.05%); RR 1.75 (95% CI 0.2 to 18.5) Wound infection: 0	Elective CS rate 53% Emergency CS rate in TOL group 20%	Retro-spective cohort	3
Jarrell, 1985[632]	604 women with at least 1 previous CS delivering in USA, 1978 to1982	Uterine rupture Apgar score Maternal febrile morbidity requiring antibiotics Wound infection UTI	Incidence of uterine rupture: All women with previous CS: 15/1000 Elective CS: 15/1000 TOL group: 14/1000 Elective CS (n = 388): Uterine rupture: 6 (1.5%); 1.00 5-minute Apgar score < 6: 1 (0.2%); 1.00 Febrile morbidity: 19 (2.6%); 1.00 Wound infection: 2 (0.5%); 1.00 UTI: 7 (1.8%); 1.00 TOL (n = 216): Uterine rupture: 3 (1.4%); RR 0.9 (95% CI 0.2 to 3.5) 5-minute Apgar score < 6: 7 (3.2%) RR12.6 (95% CI 1.5 to 101.5) Febrile morbidity: 6 (2.8%); RR 1.1 (95% CI 0.4 to 2.9) Wound infection: 2 (0.9%); RR 1.8 (95% CI 0.2 to 12.7) UTI: 6 (2.8%); RR 1.5 (95% CI 0.5 to 4.5)	Elective CS rate 53% Emergency CS rate in TOL group 34%	Retro-spective cohort	3

10.2 Childbirth following CS (continued)

Study	Population	Outcomes	Results	Comments	Study type	EL
Eglington, 1984[688]	836 women with at least 1 previous CS delivering in USA, 1980	Uterine rupture	Incidence of uterine rupture: All women with previous CS: 4/1000 Elective CS: 4/1000 TOL group: 3/1000 Uterine rupture: Elective CS (n = 528): 2 (0.4%); 1.00 TOL (n = 308): 1 (0.3%); RR 0.8 (0.1,9.4) Febrile morbidity: Elective CS (n = 528): 178 (33.7%); 1.00 TOL (n = 308): 33 (10.7%); RR 0.3 (0.2, 0.4)	Elective CS rate 63% Emergency CS rate in TOL group 22%	Retro-spective cohort	3
NSCSA, 2000[4]	14,104 women with at least 1 previous CS delivering in all maternity units in England and Wales May–July 2000	Uterine rupture Stillbirth	Incidence of uterine rupture: All women with previous CS: 2/1000 Elective CS: 3/1000 TOL group: 1/1000 Uterine rupture: Elective CS (n = 6904): 8/6358 TOL (n = 7110): 24/6917 Stillbirth: Elective CS (n = 6904): 16/6899 TOL (n = 7110): 48/7104	Elective CS rate 49% Emergency CS rate in TOL group 36%	Cohort study	3

Evidence tables for 2011 Update

Caesarean Section (update)

What are the risks and benefits of planned CS compared with planned vaginal birth for both women and babies?

This section was updated in 2020. Please see the NICE website for the updated guideline.

Caesarean Section (update)

What is the accuracy of imaging techniques (colour-flow ultrasound and MRI) for diagnosis of a morbidly adherent placenta in pregnant women who have had a previous caesarean section and are currently diagnosed with placenta praevia?

Bibliographic details	Number of Participant Participant Characteristics	Test characteristics	Outcome measures to be used	Results	Reviewer comment
Authors Shih,J.C., Palacios Jaraquemada,J.M., Su,Y.N., Shyu,M.K., Lin,C.H., Lin,S.Y., Lee,C.N. **Year of publication** 2009 **Country of publication** Taiwan **Ref ID** 77821 **Sub-type** **Aim of study** To introduce additional criteria for the diagnosis of placenta accreta using 3 dimensional (3D) power Doppler complementary to grey scale and colour Doppler techniques, and to compare their diagnostic performance based on receiver-operative characteristics (ROC) curve analysis.	**Inclusion Criteria** Pregnant women diagnosed with placenta praevia who had complete imaging using all diagnostics techniques (grey scale, colour Doppler, and 3D power Doppler), and had full availability of delivery information **Exclusion Criteria** Not reported **Demographics - Total** Total N = 170, had at least one CS n=72 **Cases** Pregnant women with persistent placenta praevia (after 28 weeks gestation) between December 2000 and September 2007 were prospectively enrolled for the study. For each woman the placenta was scanned using both grey scale ultrasound and colour flow mapping. All women participating in the study gave birth by CS. Definite	**Index Test** Grey scale criteria Colour Doppler criteria Power Doppler sonography criteria **Reference Test** Operative findings +/or histology reports/lab findings and post CS examination	Sensitivity (detection rate) Specificity Positive Predictive value (PPV) Negative predictive value (NPV) Positive Likelihood Ratio (+LR) Negative likelihood Ratio (-LR)	Total N= 170 n = 72/170 had at least one previous CS n = 39/170 had confirmed placenta accreta at the time of CS The mean gestational age at sonographic diagnosis of placenta accreta and delivery was 30 ± 2.2 and 34.3 ± 1.7 weeks respectively. Caesarean delivery was performed in 38/39 women who had antenatal confirmed placenta accreta. <u>Diagnostic accuracy for placenta accreta and placenta praevia (at least one criterion) (women with prior CS)</u> <u>Grey-scale criteria</u> Total n = 72	**Funding** Supported by a grant from National Science Council of Taiwan **Limitations** Not clear if the same sonographer performed the three different ultrasounds and whether he/she was blinded to the result of grey scale or colour Doppler when interpreting the result of the 3D power Doppler. Withdrawals from the study were not explained **Other information** Ultrasound examinations were performed using a 3D ultrasound system equipped with a 4 - 8 MHz transabdominal transducer (Voluston 730, GE Medical Systems, Zipf, Austria)

	diagnosis of placenta accreta was made at birth when myometrium was seen to be invaded by the placenta and the pathological examination of the removed uterus showed the villi attached to the myometrioum without intervening decidua (accreta), invading into the myometrium (increta) or reaching the serosa (percreta)			True positive = n = 36* True negative = n = 26* False negative = n = 2* False positive = n = 8* Sensitivity (detection rate %) = 95 (95% CI 87 to 101)* Specificity % = 76 (95% CI 62 t0 90)* +PPV % = 81 (95% CI 70 to 93)* -NPV % = 92 (95% CI 83 to 102)* +LR % = 402 (95% CI 218 to 741)* -LR % = 6.8 (95% CI 1.7 to 26)* <u>Colour Doppler criteria</u> True positive = n = 35 True negative = n = 24 False negative = n = 3 False positive = n = 11 Sensitivity (detection rate %) = 92 (95% CI 83 to 100)*	

				Specificity % = 68 (95% CI 53 to 83)* +PPV % = 76 (95% CI 63 to 88)* -NPV % = 89 (95% CI 77 to 100)* <u>3D power colour sonography criteria</u> True positive = 38 True negative = 29 False negative = 0 False positive = 5 Sensitivity (detection rate %) = 100 (95% CI 100 to 100)* Specificity % = 85 (95% CI 73 to 97)* +PPV % = 88 (95% CI 78 to 97)* -NPV % = 100 (95% CI 100 to 100)* +LR = 6.80 (95% CI 3.02 to 15.27)* -LR = NC	

Bibliographic details	Number of Participant Participant Characteristics	Test characteristics	Outcome measures to be used	Results	Reviewer comment
Authors Warshak,C.R., Eskander,R., Hull,A.D., Scioscia,A.L., Mattrey,R.F., Benirschke,K., Resnik,R. **Year of publication** 2006 **Country of publication** USA **Ref ID** 77841 **Sub-type** Retrospective cohort study **Aim of study** To determine the precision and reliability of ultrasonography and magnetic resonance imaging (MRI) in diagnosing placenta accreta	**Inclusion Criteria** Pregnant women with anterior, low anterior placenta and placenta praevia who had at least one previous CS. Inclusion was limited to those for whom complete information was available regarding the clinical and pathological diagnosis. Pelvic sonography scans were preformed by registered sonographers using both Grey Scale and colour Doppler ultrsonography, and perinatal or radiology department interpreted all scans. **Exclusion Criteria** Women with posterior and fundal placenta were excluded **Demographics - Total** Total =453 **Cases** Pregnant women with a diagnosis of placenta praevia and low lying placenta who had a previous CS were identified from an obstetrics and radiology database between January 2000 and 2005 at the University of California, San Diego Medical Centre. During that period n = 42 women were referred for	**Index Test** Colour Doppler and Grey scale ultrasonography. Magnetic Resonance Imaging (MRI) scans All studies considered to be suggestive but not inclusive underwent MRI evaluation. **Reference Test** Operative findings +/or histology reports/lab findings and post CS examination	Sensitivity (detection rate) Specificity Positive Predictive value (PPV) Negative predictive value (NPV) Positive Likelihood Ratio (+LR) Negative likelihood Ratio (-LR)	<u>Diagnostic accuracy for placenta accreta:</u> <u>MRI</u> The mean gestational age at diagnosis with MRI was 28 weeks (range 18-37 weeks ± SEM = 0.71) n = 40 Sensitivity (detection rate) = 88.46% (95% CI 80 to 100) Specificity = 100% (95% CI 76 to 100) +PPV = 100% (95% CI 85 to 100) -NPV = 82.35% (95% CI 56 to 96) +LR = infinity -LR = 0.115 (95% CI 0.039 to 0.33) Total no = 40 True positive = 23 False positive = 0 True negative = 14	**Funding** Not reported **Limitations** Both scans performed by registered sonographers and members of the perinatal or radiological faculty interpreted all scans. Not clear if they were blinded to the results of the other scan. **Other information** The equipment used included Siemens Sonoline Elegra (Siemens, Issaqua, WA) and GE Voluson 730 (GE Electronic Medical systems, Milwauke, WI) with 3.5 or 5 MHz curvilinear, sector, and endovaginal transducers. Magnetic resonance imaging scans were performed on Siemens Magnetom Symphony 1.5 Tesla scanner (Siemens Medical Solutions, Malvern, PA) equipped with high performance gradients and phase-array coils. Women were placed on the scan table head first in whatever position they found most comfortable or turned toward a left lateral position. If the appearance of the placenta was suspected for

	MRI scans to further evaluate a positive ultrasound scan or because the ultrasound findings were not conclusive for placenta accreta. Two (n = 2) women who were unable to tolerate the procedure because of claustrophobia were excluded from study.			False negative = 03 <u>Ultrasonography (colour Doppler or Grey Scale)</u> The mean gestational age at diagnosis with ultrasound was 25 weeks (range 11-37 weeks ± SEM = 0.84) Sensitivity (detection rate)= 76.92% (95% CI 60 to 88) Specificity = 96.13% (95% CI 93 to 97) +PPV = 65.21% (95% CI 49 to 78) -NPV = 97.78% (95% CI 95 to 98) +LR = 19.9 (95% CI 11.94 to 33.15) -LR = Ultrasonography = 0.24 (95% CI 0.135 to 0.42) Total no = 453 True positive = 30 False positive = 16 True negative = 9 False negative = 398	placenta accreta, a gadolinium enhanced MR series was then required. The dose of the gadolinium used was up to 0.1 mM/kg.

Bibliographic details	Number of Participant Participant Characteristics	Test characteristics	Outcome measures to be used	Results	Reviewer comment
Authors Twickler,D.M., Lucas,M.J., Balis,A.B., Santos-Ramos,R., Martin,L., Malone,S., Rogers,B. **Year of publication** 2000 **Country of publication** USA **Ref ID** 77837 **Sub-type** **Aim of study** To evaluate the use of Doppler colour flow mapping (CFM) in pregnant women with prior CS to predict myometrial invasion when the implantation site was in potential proximity to a hysterectomy scar.	**Inclusion Criteria** Women with diagnosis of anterior low lying placenta and placenta praevia who had a previous CS were included in the study **Exclusion Criteria** Pregnant women with posterior or fundal placenta were excluded **Demographics - Total** Total N = 215, Women with placenta praevia and prior CS n = 20 **Cases** Women with a history of previous caesarean section who had third trimester bleeding or who were scheduled for repeat CS (whose placenta was anterior, or praevia or low lying based on transvesical pelvic real time grey scale imaging) were included in the study. Using CFM, measurements of smallest myometrial thickness (SMT) were obtained. The presence of smallest myometrial thickness (SMT) <1 mm or placental sonolucency was predictive of all cases of invasion.	**Index Test** Real time grey scale imaging Colour flow mapping (CFM) **Reference Test** Pathology findings	Sensitivity (detection rate) Specificity Positive Predictive value (PPV) Negative predictive value (NPV) Positive Likelihood Ratio (+LR) Negative likelihood Ratio (-LR)	Pathologic and US (CFM) findings in women with prior CS and placenta praevia n=20 CFM diagnosis of placenta invasion (SMT < 1) True positive = n = 9* True negative = n = 8* False positive = n = 3* False negative = n = 0* Sensitivity (detection rate %) = 100 (95 % CI 100 to 100)* Specificity % = 72 (95 % CI 46 to 99)* +PPV % = 75* (95 % CI 50 to 99)* -NPV % = 100 (95 % CI 100 to 100)* +LR = 3.60 (95 % CI 1.39 to 9.26)* -LR = NC	**Funding** Not reported **Limitations** No explanation given about how women were identified and recruited for the study. Study period is unknown **Other information** Colour flow mapping (CMP) was performed using Acuson 12XP (Mountainview, CA) 3.5 or 5 MHz curved linear transducers.

	The CFM evaluations were not included in the ultrasound reports to the clinicians therefore the results were not used in the clinical management of the women. All women except one who were evaluated with CFM gave birth at the Parkland Memorial Heathand Hospital System. All women with placenta praevia had repeat CS.				

Bibliographic details	Number of Participant Participant Characteristics	Test characteristics	Outcome measures to be used	Results	Reviewer comment
Authors Masselli,G., Brunelli,R., Casciani,E., Polettini,E., Piccioni,M.G., Anceschi,M., Gualdi,G. **Year of publication** 2008 **Country of publication** Italy **Ref ID** 77785 **Sub-type** **Aim of study** To compare the value of pelvic ultrasound (US) with colour Doppler and MRI in: 1) the diagnosis of placental adhesive disorders (PADs) 2) the definition of the degree of placenta invasiveness 3) determining the topographic correlation between the diagnosis images and the surgical result	**Inclusion Criteria** Women with a high risk of abnormal placental implantation due to placenta praevia and at least one previous CS **Exclusion Criteria** Not reported **Demographics - Total** Total N = 50 **Cases** Cases = Women referred for detailed colour Doppler and MRI between March 2006 to June 2007 with a diagnosis of placenta praevia and at least one previous CS (n=56). Fifty (n = 50) women, who had all information regarding clinical and pathological diagnosis available, were included in the study All pelvic ultrasonography scans were performed by registered sonographers. Images were interpreted prospectively by two reviewers who were blinded to result of the US and pathological examination. Inter-observer agreement was assessed using K - statistics.	**Index Test** MRI Ultrasound (colour Doppler) **Reference Test** Pathological examinations	Sensitivity Specificity Positive Predictive value (PPV) Negative predictive value (NPV) Positive Likelihood Ratio (+LR) Negative likelihood Ratio (-LR)	Total n= 50 Normally attached placenta n = 38 Clinical and pathological confirmation of PAD n= 12 Identification of placenta accreta: Mean gestational age at the diagnosis =30 weeks (range of 20 - 37 weeks) MRI True positive = n = 12 True negative = n = 38 False positive = n = 0 False negative = n = 0 Sensitivity (detection rate) = 100% (n = 12/12, 95% CI 86 to 100) Specificity = 100% (n = 38/38, 95% CI 90 to 100) +PPV = 100% (n = 12/12, 95% CI 88 to 100)	**Funding** Not reported **Limitations** **Other information** All ultrasonography scans were performed using Siemens Sonoline Elegra (Siemens, Issaqua, Wash.) US equipment. MRI was performed on a Siemens Magneton Avanto 1.5 T scanner (Siemens Medical Solusion, Malvern, Pa) equipped with high performance gradients and phase array coils. Women were supine, with feet entering the magnet bore first to minimize feeling of claustrophobia

	A second interpretation was performed by the same reviewers, who reached a consensus in evaluation of invasion. The consensus evaluation (degree of placenta penetration and its specific topography) was compared to findings in the operating room according to clinical and anatomical criteria. <u>True positive and negative diagnosis:</u> Placenta was considered accreta if firmly attached to endometrium, increta when requiring surgical curettage to remove invasive tissue deeply implanted in the myometrium and percreta when extending through the myometrium and into the neighbouring organs. An uncomplicated placental removal without excessive bleeding after CS was defined as true negative. All true positive and negative diagnoses were confirmed by pathologic examination. The US Doppler and MRI			-NPV = 100% (n = 38/38, 95% CI 89 to 100) <u>US Doppler</u> True positive = n = 11 True negative = n = 38 False positive = n = 0 False negative = n = 1 Sensitivity (detection rate) = 91% (n = 11/12, 95% CI 68 to 94) Specificity = 100% (n = 38/38, 95% CI 85 to 100) +PPV = 100% (n = 11/11, 95% CI 87 to 100) -NPV = 97% (n = 38/39, 95% CI 75 to 100) <u>Evaluating the degree of invasion (placenta accreta, increta, percreta):</u> <u>Diagnosis of PAD (placental adhesive disorders) using US Doppler and MRI</u> <u>US Doppler</u> Negative n = 39	

	were performed in the same day for all women.			accreta n=8 increta n = 1 percreta n = 2 <u>MRI</u> Negative n = 38 accreta n=7 increta n = 2 percreta n = 3 <u>Surgery and pathology</u> Negative n = 38 accreta n= 7 increta n = 2 percreta n = 3 <u>Evaluating of topographic areas of placenta invasion (S1 is the uterine sector bordering the upper posterior bladder wall and S2 is the uterine sector adjacent to the lower posterior wall) using US Doppler and MRI:</u>	

				<u>US Doppler</u> S1 = 8 S2 = 4 <u>MRI</u> S1 = 5 S2 = 7 <u>Surgery and pathology</u> S1 = 5 S2 = 7	

Bibliographic details	Number of Participant Participant Characteristics	Test characteristics	Outcome measures to be used	Results	Reviewer comment
Authors Comstock,C.H., Love,J.J.,Jr., Bronsteen,R.A., Lee,W., Vettraino,I.M., Huang,R.R., Lorenz,R.P. **Year of publication** 2004 **Country of publication** USA **Ref ID** 106230 **Sub-type** Prospective cohort study **Aim of study** To determine whether ultrasonography can detect placenta accreta reliably in at-risk patients.	**Inclusion Criteria** All women with a previous caesarean delivery and an anterior placenta or placenta praevia. **Exclusion Criteria** Not reported **Demographics - Total** Total n = 2002 with prior CS, and with either placenta praevia or low anterior placenta. In n = 33/2002 cases ultrasound findings were suspicious for placenta accreta (noted on at least 1 scan) **Cases** All women with a previous CS who were seen for a fetal ultrasound examination between March 1990 and August 2002 were asked to participate in the study. Participating women were evaluated prospectively at each visit for sonographic signs of placenta accreta Diagnostic criteria that suggested placenta accreta, increta, or percreta included ≥ 1 of the following situations: interruption of the posterior bladder wall-uterine interface, absence of the	**Index Test** Transvaginal ultrasound, all examinations were recorded on videotape **Reference Test** Pathological findings in a hysterectomy specimen that demonstrated trophoblast directly in contact or invading myometrium		<u>Diagnostic accuracy of transvaginal ultrasound in diagnosis of placenta accreta at 15 to 20 weeks gestation</u> Ultrasound examinations performed between 15 and 20 weeks of gestation <u>Any criteria</u> Sensitivity = 86% (n = 12/14) Positive predictive value = 63% (12/19) <u>Diagnostic accuracy of transvaginal ultrasound in diagnosis of placenta accreta at 15 to 40 weeks gestation</u> Ultrasound examinations performed between 15 and 40 weeks of gestational age <u>Any criteria</u> Sensitivity = 100% PPV = 48% (15/31) <u>Sensitivity and positive</u>	**Funding** Not reported **Limitations** No information is provided for negative cases (true negative and false negative) therefore the diagnostic accuracy of ultrasound cannot be fully evaluated. **Other information** The equipments included scanners (Acuson 128 XP and Sequoia, Acuson Corporation, Mountainview, Calif), (Voluson 730 and 530D; General Electric Medical Systems, Milwaukee Wis), (Aloka 650; Corometrics Ultrasound Medica Systems, Wallingford, Conn), and (Phillips platinum; Phillips Medical Systems, Santa Ana, Calif)

	retroplacental clear zone, and placental lacunae. If the possibility of placenta accreta was raised in at least 1 scan, that case was labelled as positive even if on subsequent scans the suggestions were revoked. Study period: 12 years Transvaginal ultrasound examinations were performed for most women with placenta accreta in the first trimester. Scans were performed by registered sonographers under the direction of 6 obstetricians who were specialists in fetal imaging. Data were analysed in 5 weeks intervals starting at 15 weeks gestation.			predictive value of ultrasound diagnostic criteria for placenta accreta at 15 to 20 weeks gestation ≥ 2 Criteria Sensitivity = 57 % PPV = 89% Lacunae Sensitivity = 79% PPV = 89% Clear space (isolated) Sensitivity = 7% PPV = 14% Clear space (with other) Sensitivity = 50% PPV = 88% Bladder serosa wall Sensitivity = 21% PPV = 100% Sensitivity and positive predictive value of ultrasound diagnostic criteria for placenta accreta at 15 to 40	

				weeks gestation ≥ 2 Criteria Sensitivity = 80% PPV = *86% Lacunae Sensitivity = 93% PPV = 93% Clear space (isolated) Sensitivity = 7% PPV = 6% Clear space (with other) Sensitivity = 73% PPV = 85% Bladder serosa wall Sensitivity = 20% PPV = 75%	

Bibliographic details	Number of Participant Participant Characteristics	Test characteristics	Outcome measures to be used	Results	Reviewer comment
Authors Woodring,T.C., Klauser,C.K., Bofill,J.A., Martin,R.W., Morrison,J.C. **Year of publication** 2011 **Country of publication** USA **Ref ID** 109386 **Sub-type** Retrospective cohort study **Aim of study** To determine the accuracy of ultrasound and colour flow Doppler to diagnose placenta accreta	**Inclusion Criteria** Women with obsteric sonography or colour flow Doppler suspicious for placenta accreta or its variants were reviewed for a 64 month period. **Exclusion Criteria** Not reported **Demographics - Total** 12 cases with suspected placenta accreta **Cases** The ultrasound images of all women consistent with signs of placenta accreta (concomitant praevia, numerous vascular lacunae, absent lower uterine segment between bladder-placenta, turbulent or complicated blood flow at the uteroplacental interface) were reviewed for clinical characteristics. In addition, data regarding neonatal outcomes was collected. Over a 64 month period there were 15,420 birth and 26 were coded as ICD-9 (International Classification of Diseases) criteria. Of the 12 cases the mean maternal age was 27 ± 5.6	**Index Test** Sonography or colour flow Doppler **Reference Test** The gold standard for the diagnosis of placenta accreta was the clinical findings at the time of the surgery and the analysis of specimens submitted for pathological examination.		Over 64 months, 12 cases with suspected placenta accreta by ultrasound were studied. The median gestational age at first diagnosis was 25 weeks and 92% had a praevia, while all had at least one previous caesarean delivery. At surgery, 83% (10/12) had an adherent placenta requiring hysterectomy (eight accreta, one increta, and one percreta). There were two false positives (one complete praevia, one low-lying placenta with vasa praevia). n = 9/12 women (75%) required blood transfusions due to a mean hematocrit nadir of 22.7 ± 4.6% (range 18 - 32%). The mean number of packed red blood cell units transfused was 4.9 ± 4.7 units (range 2 - 17 units). <u>Neonatal outcomes:</u> Mean birthweight (g) = 2423 ± 482 Mean 5 min Apgar score = 8.7 ± 0.5	**Funding** **Limitations** Only ultrasounds coded with suspicion of placenta accreta were reviewed, hence no information is provided for negative cases (true negative and false negative). Therefore, diagnostic accuracy of ultrasounds cannot be fully evaluated. **Other information** The ultrasound and colour flow assessments were performed by one of the three Antenatal Diagnostic Unit physicians and neither the criteria nor the physicians changed over the study period.

	years (mean ± SD), mean gravidity was 4.4 ± 1.6, and mean parity was 2.8 ± 0.9. All 12 women had at least one CS. The mean gestational age at diagnosis of suspected placenta accreta was 25 weeks, with most being < 24 weeks. The mean gestational age at birth was 35.1 ± 2.2 weeks. n= 11/12 with antenatal suspician of placenta accreta also had a concomitant placenta praevia.			Mean cord pH = 7.25 ± 0.05 Need for hysterectomy: 10/12 (83%) <u>Sonographic/colour flow doppler findings n= 12</u> Placenta accreta: True positive = 10 False positive = 2 Positive Predictive Value = 83 % (95% CI 62% to 100%) <u>Placenta praevia :</u> The findings of concomitant praevia were predictive of an associated accreta in all cases (10/10) when accreta was found at surgery and confirmed pathologically. Likewise, there was replacement of lower uterine segment by complicated blood flow in all 10 cases where accreta was confirmed.	

Caesarean Section (update)

Does a diagnosis of morbidly adherent placenta using imaging techniques lead to improved outcomes in pregnant women with a previous caesarean section who are currently diagnosed with placenta praevia?

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
Full Citation Wong,H.S., Hutton,J., Zuccollo,J., Tait,J., Pringle,K.C., The maternal outcome in placenta accreta: The significance of antenatal diagnosis and non-separation of placenta at delivery, New Zealand Medical Journal, 121, 30-38, 2008 **Ref ID** 61152 **Country/ies where the study was carried out** New Zealand **Study type** Retrospective cohort study **Aim of the study** To examine the effects of an antenatal diagnosis and the subsequent non separation of the placenta during the third stage on maternal outcomes in confirmed cases of placenta accreta. **Study dates** 1st January 2000 to 31st December 2006 **Source of funding**	**Sample size** Total women identified as having confirmed placenta accreta in 7 year period n =16 (n= 15 had histological confirmation n=1 had clinical confirmation by laparotomy) **Characteristics** Total population n = 16 Women with antenatal diagnosis of placenta accreta n = 7 Women with no antenatal diagnosis of placenta accreta n= 9 12/16 had previous CS 11/16 had placenta praevia in their current pregnancy **Inclusion Criteria** **Exclusion Criteria**	NA	Women with a diagnosis of placenta accreta or postpartum haemorrhage or hysterectomy, were identified from a perinatal database at Wellington Hospital (New Zealand). Antenatal diagnosis of placenta accreta was made by ultrasound and/or magnetic resonance imaging (MRI). The postnatal diagnosis of placenta accreta in those women identified was checked against the histological findings by the Pathology Department.	Women with antenatal diagnosis n = 7 (n = 6 had elective CS and n = 1 had preterm emergency CS because of haemorrhage) Women with no antenatal diagnosis n = 9 Attempted placenta separation With antenatal diagnosis n= 2/7 No antenatal diagnosis n= 9/9 P = 0.005 Total blood loss (litres mean ± SD) With antenatal diagnosis = 1.4 ± 1.0 No antenatal diagnosis = 3.6 ± 1.3 P = 0.003	**Limitations** Small sample size **Other information**

Not reported	Women who delivered in the second and third trimester with a diagnosis of placenta accreta or postpartum haemorrhage or hysterectomy who gave birth at Wellington Hospital between 2000 and 2006. Not reported			<u>Number of units of blood transfused (mean ± SD)</u> With antenatal diagnosis = 2.3 ± 2.9 No antenatal diagnosis = 5.1 ± 2.9 P = 0.07 <u>Emergency hysterectomy</u> With antenatal diagnosis n = 1/7 No antenatal diagnosis n = 9/9 P = 0.001 <u>Bladder injury</u> With antenatal diagnosis n = 1/7 No antenatal diagnosis n = 1/9 P = 1.0 <u>ICU admission</u> With antenatal diagnosis n = 1/7 No antenatal diagnosis n =	

				1/9 P = 1.0 <u>Length of postnatal stay (days mean ± SD)</u> With antenatal diagnosis = 8.6 ± 4.9 No antenatal diagnosis = 9.9 ± 9.3 P = 0.92	

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
Full Citation Warshak,C.R., Ramos,G.A., Eskander,R., Benirschke,K., Saenz,C.C., Kelly,T.F., Moore,T.R., Resnik,R., Effect of predelivery diagnosis in 99 consecutive cases of placenta accreta, Obstetrics and Gynecology, 115, 65-69, 2010 **Ref ID** 77842 **Country/ies where the study was carried out** USA **Study type** Retrospective cohort study **Aim of the study** To compare outcomes in women with a pre-delivery diagnosis of placenta accreta with those in whom a pre-delivery diagnosis was not made **Study dates** January 1990 to April 2008 **Source of funding** Not reported	**Sample size** Group 1: women with diagnosis of placenta accreta before birth n = 62 Group 2: women without diagnosis of placenta accreta before birth n = 37 **Characteristics** Total population n = 99 No prior CS n = 15/99 (15%) ≥ 2 prior CS n = 52/99 (53%) <u>One prior CS</u> Pre delivery diagnosis n=19/62 (31%) No pre delivery diagnosis n= 12/37 (33%) p = 0.82 <u>Two prior CS</u> Pre delivery diagnosis n=21/62 (34%) No pre delivery diagnosis n= 7/37 (19%)	NA	Pre delivery diagnosis of placenta accreta was made following the identification of suspicious characteristics on ultrasonography in women with risks factors. If the ultrasound findings were considered definite, magnetic resonance imaging (MRI) was performed. Once the prenatal diagnosis of placenta accreta was made, all women were offered a planned caesarean hysterectomy without attempted removal of placenta. The CS was scheduled for 34- 35 weeks gestation, after a 48 hour course of betamethasone (to enhance fetal lung maturity). A multidisciplinary team was involved, consisting of perinatology, gynaecologic oncology, anaesthesiology, interventional radiology and neonatology.	<u>Maternal Outcomes</u> Pre delivery diagnosis n = 62 (n=22 required emergency intervention before the scheduled caesarean hysterectomy) No pre delivery diagnosis n = 37 <u>Estimated blood loss (ml ± SD)*</u> Pre delivery diagnosis = 2,344 ± 1.7* No pre delivery diagnosis = 2951 ± 1.8* p = 0.34 *1.7ml and 1.8 ml was reported in the paper, the technical team believe the correct figures are 1700 ml and 1800 ml. <u>Units of packed red blood cell (PRBCs ± SD)</u> Pre delivery diagnosis = 4.7 ± 2.2 No pre delivery diagnosis =	**Limitations** Information regarding blood loss was obtained from operating report Long study period (18 years) considering the advance of imaging techniques **Other information**

	p = 0.17 <u>Three or more prior CS</u> Pre delivery diagnosis n=19/62 (31%) No pre delivery diagnosis n= 6/37 (15%) p = 0.15 <u>Placenta praevia</u> Pre delivery diagnosis n= 52/62 (84%) No pre delivery diagnosis n= 19/37 (53%) p = 0.002 <u>Placenta percreta</u> Pre delivery diagnosis n= 32/62 (52%) No pre delivery diagnosis n= 2/37 (6%) p <0.001 No significant differences were observed between the two groups in age, mymectomy and number of previous caesarean sections. **Inclusion Criteria** **Exclusion Criteria**			6.9 ± 1.8 p = 0.02 <u>ICU admission n (%)</u> Pre delivery diagnosis n = 43/62 (72%) No pre delivery diagnosis n = 22/37 (65%) p = 0.49 <u>Length of hospital stays (days ± SD)</u> Pre delivery diagnosis = 7.4 ± 1.8 No pre delivery diagnosis = 5.5 ± 1.6 p = 0.01 <u>Surgical complication (bladder injury) n (%)</u> Pre delivery diagnosis n = 14/62 (23%) No pre delivery diagnosis n = 3/37 (9.8%) p = not reported * Log transferred data were transformed. Values shown are retransformed data ± SD.	

	All women with placenta accreta confirmed pathologically after having given birth at the University of California, San Diego Medical Centre. All cases were examined by a single pathologist. Cases of clinically suspected placenta accreta that were not subsequently confirmed with pathologic examination of the placenta and uterus.			<u>Neonatal outcomes:</u> <u>NICU admissions n (%)</u> Pre delivery diagnosis n = 50/62 (86%) No pre delivery diagnosis = 19/37 (60%) p = 0.005 <u>NICU length of stay (days)</u> Pre delivery diagnosis = 9.8 ± 2.5 No pre delivery diagnosis = 6.3 ± 3.5 p = 0.13	

Caesarean Section (update)

What is the effectiveness of planned caesarean section compared with planned vaginal birth at the decreasing the mother to child transmission of the virus in pregnant women with HIV, for both low and higher viral load?

Study details	Participants	Interventions	Outcomes	Results	Comments
Authors Islam,S., Oon,V., Thomas,P. **Year of publication** 2010 **Country** UK **Ref ID** 53216 **Design** Retrospective cohort study **Aim of study** To investigate the maternal outcome of planned vaginal birth as well as the rate of MTCT	**Inclusion Criteria** HIV infected women opting for planned vaginal birth. The offer of the option of vaginal birth was based upon viral load < 50 cells/ml around 36 weeks gestation **Exclusion Criteria** Not reported **Demographics - Total** <u>Population:</u> n=144 HIV infected women attending for antenatal care between June 2004 and June 2006	**Experimental** <u>Intervention</u> n= 23/144 selected to have elective vaginal birth and the rest n=121/144 opted for elective caesarean section. <u>Methods</u> The maternal viral load obtained closest to birth and up to 7 days postpartum was recorded. All babies had antiretroviral therapy and none were breast fed. Polymerase chain reaction (PCR) tests were done at 1 month and 3 month and an ELISA test was done at 18 months. <u>Mode of birth definition</u> Planned vaginal birth includes those started vaginally but	**Dichotomous** Mother to child transmission rate **Continuous**	Mother to child transmission rate <u>Elective vaginal birth (n=23)</u> 0/23 <u>Plasma viral load at birth (RNA/ copies /ml)</u> < 50 copies/ml=14/23 (61%) 50-999 copies/ml =7/23(31%) >1000 copies/ml= 2/23 (8%) <u>Antiretroviral therapy</u> HAART = 18/23 Dual therapy = 2/23 Mono therapy = 3/23 In 10 women retroviral	**Funding** Not reported **Limitations** Retrospective study Very small numbers (underpowered) Non-randomised mode of birth **Other information**

		finished as CS. <u>Data analysis:</u> Descriptive statistics <u>Other Details:</u> Data were collected from maternity and medical records. All women received retroviral therapy (mono therapy, dual therapy or HAART). **Comparator** Elective caesarean section		therapy was started at or before 28 weeks gestation and in 13 women after 28 weeks gestation. <u>Actual vaginal birth</u> 15/23 (65%) 8 women had caesarean section, mainly for fetal distress and failure to progress. 22/23 had spontaneous onset of labour and n=1 had induction of labour. n=21 delivered at term (>37 weeks), n= 2 delivered around 36 weeks. No results reported for women allocated to have elective CS. In 10 women retroviral therapy was started at or before 28 weeks gestation and in 13 women after 28 weeks gestation. <u>Actual vaginal birth</u>	

				15/23 (65%) 8 women had caesarean section, mainly for fetal distress and failure to progress. 22/23 had spontaneous onset of labour and n=1 had induction of labour. n=21 delivered at term (>37 weeks), n= 2 delivered around 36 weeks. No results reported for women allocated to have elective CS.	

Study details	Participants	Interventions	Outcomes	Results	Comments
Authors Townsend,C.L., Cortina-Borja,M., Peckham,C.S., de,Ruiter A., Lyall,H., Tookey,P.A. **Year of publication** 2008 **Country** UK **Ref ID** 53245 **Design** Retrospective cohort study **Aim of study** To explore the impact of different strategies to prevent mother-to-child transmission at a population level	**Inclusion Criteria** Singleton birth between 2000 and 2006, to women diagnosed with HIV infection before birth and reported to NSHPC (National Study of HIV in Pregnancy and Childhood) by June 2007. **Exclusion Criteria** Multiple birth **Demographics - Total** <u>Population:</u> Total n = 5930 <u>Study Dates:</u> 2000 to 2006 <u>Ethnic origin (n = 5875)</u> Black African n = 4630 (78.8%) White n = 775 (13.2%) Other n = 470 (8.0%) <u>Antiretroviral therapy (n = 5760)</u> None (declined, diagnosed late or delivered prematurely < 37 weeks) n= 186 (3.2%) Monotherapy n = 712 (12.4%)	**Experimental** <u>Investigation:</u> Factors associated with transmission were explored for singleton births between 2000 and 2006 <u>Comparisons:</u> Vaginal birth Elective CS Emergency CS Viral load Antenatal antiretroviral therapy (ART) - <u>Methods:</u> Paediatric and obstetric information on HIV-infected pregnant women in the UK and Ireland were collected through comprehensive, population-based surveillance (National Study of HIV in Pregnancy and Childhood;	**Dichotomous** Mother to child transmission rate (MTCT) **Continuous**	<u>MTCT rate for women on HAART (all viral loads)</u> - <u>Elective CS</u> 17/2286 (0.7%) <u>Planned vaginal birth</u> 4/559 (0.7%) AOR 1.24 (95% CI -0.34 to 4.52), p=0.746 (adjusted for sex and viral load) <u>Emergency CS</u> 15/877 (1.7%) (significantly higher compared to elective CS, p=0.027) <u>Unplanned vaginal birth</u> 4/122 (3.3%) (significantly higher compared to planned vaginal birth, p=0.019) - <u>MTCT rate for women on HAART with no detectable viral</u>	**Funding** NSHPC Funded by Health Protecting Agency **Limitations** Observational study Relatively small numbers (rare event) Incomplete paediatric follow-up data **Other information** Pregnancies in diagnosed HIV-infected women in the UK and Ireland are notified to the National Study of HIV in Pregnancy and Childhood. The infant's infection status is subsequently reported. British HIV Association (BHIVA) guideline at the time of the study advocated the zidovudine mono therapy and planned caesarean section as an alternative to HAART for women with CD4 cell counts and pre treatments viral load of less than 6000-10000 copies/ml.

	Dual therapy n = 136 (2.4%) HAART n = 4726 (82.1%) <u>Age at giving birth</u> Median 29.8 years, range (26.2 - 33.6 years) <u>Mode of birth n = 5901</u> Elective CS n = 3368 (57.7%) Emergency CS n = 1223 (20.7%) Vaginal birth total n = 1310 (22.2%) Planned vaginal birth n = 745 (12.6%) Unplanned vaginal birth n = 176 (3%) Unspecified n = 389 (6.6%) <u>Gestational age</u> n = 5760 At least 37 weeks n = 5029 (87.3%) 35-36 weeks n = 360 (6.2%) 32-34 weeks n = 218 (3.8%)	NSHPC). The surveillance scheme ran under the sponsorship of the Royal College of Obstetricians and Gynaecologists. "uninfected" if PCR test result was negative after one month and 3 months of age, or they had a negative HIV antibody test after 18 months of age. Infants were confirmed "infected" if two positive PCR tests were reported or they had a positive antibody test after 18 months of age. The antepartum maternal HIV plasma viral load closest to the birth and seven days postpartum were used. Viral load was classified as less than 50 (undetectable). For logistic regression analysis, viral load was $\log_{10}$ transformed. - <u>Mode of birth definition</u> Mode of birth was classified as an elective CS (performed		<u>load (<50 copies/ml)</u> - n=3/2117 (0.1%, 95% CI 0.0 to 0.4%) <u>Elective C/S</u> 2/1135 (0.2%) <u>Planned vaginal birth</u> 1/417 (0.2%). Two of the infants (one born vaginally) had positive PCR result within 72 hours of birth, suggesting possible in utero transmission. <u>MTCT rate for women on HAART with detectable viral load (≥50 and <1000 copies/ml)</u> - <u>Elective C/S</u> 4/417 (0.8%) <u>Planned vaginal birth</u> 2/81 (2.5%) p=0.215 Two of the infected infants,	

	Less than 32 weeks n = 153 (2.7%)	before rupture of membranes or onset of labour), emergency CS (performed after rupture of membranes or onset of labour, or for obstetric indication) and vaginal delivery (no definition provided). <u>Data Analysis</u> Categorical variables were compared using χ2 test or Fisher's exact tests, means using t-test and medians using Kruskal Wallis test. Logistic regression models were used to obtain odd ratios and 95% confidence interval. **Comparator**		both born by elective CS, had a positive PCR within 72 hours of birth (both born by elective CS). <u>MTCT (gestational age) (univariate analysis)</u> - <u>At least 37 weeks</u> 45/4383 (1%) • Crude OR 1.00 <u>35-36 weeks</u> 3/315 (1%) Crude OR 0.93 (95% CI 0.29 to 3.00) <u>32-34 weeks</u> 4/189 (2.1%) Crude OR 2.08 (95% CI 0.74 to 5.86) <u>Less than 32 weeks</u> 7/115 (6.1%) Crude OR 6.25 (95% CI 2.75 to 14.17)	

				MTCT (gestational age) (multivariate analysis, OR adjusted for viral load) - At least 37 weeks (n=4383) • Adjusted OR 1.00 35-36 weeks (n=306) Adjusted OR 0.49 (95% CI 0.11 to2.23), p=0.359 32-34 weeks (n=185) Adjusted OR 1.17 (95% CI 0.32 to 4.29), p=0.816 Less than 32 weeks (n=113) Adjusted OR 6.25 (95% CI 0.77 to 7.20), p=0134 In the multivariate analysis (n=4084) controlling for ART, mode of birth, gestational age and sex, each log10 increase in viral load was associated with a 2.4-fold increase in risk of transmission (AOR=2.41,	

				p<0.001). In this model, lack of ART (AOR=3.17, p=0.023) and vaginal birth (AOR=2.40, p=0.033) were strongly associated with transmission, but gestational age and sex were not. In the multivariable model (n=4892) vaginal birth was associated with a non-significant 1.8-fold increased risk of transmission compared with elective CS (AOR=1.82, p=0.076). After adjusting for ART, gestational age and sex, unplanned vaginal birth was strongly associated with transmission (AOR=4.16, 95% CI 1.66-10.41, p=0.002) when compared with elective caesarean section, but planned vaginal birth was not (AOR=1.56, 95% CI 0.65-3.72 , p=0.319) Incomplete data Infection status was not reported for n=779/5930 (13.01%) of infants, for various reasons	

				(paediatric notification not received or pending [82.4%], lost to follow up [11.4%], left UK/Ireland [3.5%] and death [2.7%]). No significant difference was observed between children with unreported infection status and those with known infection status, in terms of maternal HIV exposure, clinical status or mode of birth. More children with unreported infection status were born at less than 32 weeks (p<0.001) to women with a viral load of at least 1000 copies (p=0.061)	

Study details	Participants	Interventions	Outcomes	Results	Comments
Authors Warszawski,J., Tubiana,R., Le,Chenadec J., Blanche,S., Teglas,J.P., Dollfus,C., Faye,A., Burgard,M., Rouzioux,C., Mandelbrot,L., NRS French,Perinatal Cohort **Year of publication** 2008 **Country** France **Ref ID** 53250 **Design** Prospective cohort study **Aim of study** To identify factors associated with mother to child HIV- 1 transmission (MTCT) from women receiving antenatal antiretroviral therapy	**Inclusion Criteria** All HIV-1- infected women who delivered French Perinatal Cohort study sites (mainland France) between January 1997 and 31 December 2004. Women were included if they received at least one antenatal ART at any time during pregnancy, did not breastfeed and the child's infection status was documented. **Exclusion Criteria** Not reported **Demographics - Total** <u>Population:</u> The study population consisted of 5271 women from 77 sites, who received antiretroviral therapy during pregnancy, delivered from 1997 to 2004 and did not breastfeed. <u>Other Details:</u> Infants were confirmed "infected" if two separate positive PCR or HIV RNA or 9PBMC were reported or they had a positive antibody test after 18 months of age. Infants confirmed "uninfected" if	**Experimental** <u>Investigation:</u> MTCT of HIV: n=5540 women who received ART and did not breastfeed, 269 were excluded for various reasons (incomplete virological data, stillbirths, neonatal deaths), for 117 multiple pregnancies only the first born was included. Overall n=5271 mother-child pairs were enrolled in analysis. <u>Methods :</u> No specific HIV treatment and obstetric care were recommended for the women included in the cohort. The last combination of ART prescribed before birth and the level of plasma HIV1 RNA and CD4 cell count nearest to the time of birth and no more than 7 days after birth, was considered for analysis. **Comparator**	**Dichotomous** Mother to child transmission rate (MTCT) **Continuous**	<u>MTCT rate: univariate analysis of all births (term and preterm)</u> 67/5271 (1.3%) 95% CI 1.0 to 1.6 <u>MTCT rate HIV-1 RNA at birth in all births (term and preterm)</u> <u><400 copies/ml</u> 19/3256 (0.6) 95% CI 0.4 to 0.9 <u>400-999 copies/ml</u> 3/440 (0.7%) <u>1000-9999 copies/ml</u> 14/938 (1.5%) 95% CI 0.8 to 2.5 <u>≥10000 copies/ml</u> 30/440 (6.85%) 95% CI 4.6 to 9.6 p<0.001 <u>MTCT rate: mode of birth all</u>	**Funding** Supported by the French National Agency for AIDS Research (ANRS), Paris **Limitations** Observational study Relatively small numbers Management policy in place that could influence the results **Other information** Based on French national policy, HAART was recommended to pregnant women with viral load >10000 copies/ml in 2002, and to all pregnant women in 2004. Since 2002, elective CS was not recommended for those delivered under HAART with viral load below 400 copies/ml. <u>Data analysis</u> First viral load and prematurity and their relation to transmission were studied independently of one another. The interaction between prematurity and viral load was investigated in stratified

	virology test result was negative on two separate samples (of which at least one taken after termination of neonatal prophylactic treatment) or if serological testing was negative after 18 months. The last combination of ART prescribed before birth was considered for analysis. It was categorised into one of three classes: Mono therapy (NRTI, almost exclusively zidovudine) Dual therapy (two NRTI, almost mostly zidovudine-lamivudine) HAART (three or more drugs of any class)			births (term and preterm) (univariate analysis) Elective CS n=23/2438 (0.9%) Emergency Caesarean Section: 18/1046 (1.7%) Vaginal birth 25/1758 (1.4%) p=0.13 MTCT rate: women received ART all births (term and preterm) HAART 30/2513 (1.2%) Dual-drug therapy 22/1745 (1.3%) Mono therapy 15/1003 (1.5%) p=0.77 (chi-squared)	analysis. The assessment made for all births, term births, term birth with viral load of < 400 copies/ml and the validity of linear assumption between transmission rate and duration of ART. A backward stepwise logistic regression was performed, with child's HIV status as dependent variable. Mode of birth definition - Mode of birth was classified as vaginal birth (no definition provided), elective CS (no definition provided) and emergency CS (caesarean performed after rupture of membranes or onset of labour).

				Viral load < 400 copies/ml (term births) HAART 9/1585 (0.6%) Dual-drug therapy 6/938 (0.6%) Mono therapy 2/328 (0.6%) p=0.94 (chi-squared) Viral load ≥10000 copies/ml (term births) HAART 13/155 (8.4%) Dual-drug therapy 6/105 (5.7%) Mono therapy 5/104 (4.8%) p=0.48 (chi-squared) No significant difference in transmission risk observed	

				according to the mode of birth among women who delivered with < 400 copies/ml (crude OR 0.83; 95% CI, 0.29-2.39; p=0.37) <u>MTCT rate gestational age all birth (term and preterm)</u> <u><33 weeks</u> 8/122 (6.6%; 95% CI 2.9-12.5) <u>33-36 weeks</u> 7/563 (1.2%; 95% CI 0.8-1.5) <u>≥37 weeks</u> 52/4583 (1.1%; 95% CI 0.5-2.5) p<0.001 (Fisher's Exact Test) No significant interaction between viral load and prematurity observed, however among severe premature birth MTCT rate passed from 1.7% below 400 copies /ml to more	

				than 11% for other categories with viral load over 400 copies/ml. <u>MTCT rate viral load < 50 copies/ml (term birth)</u> 5/1338 (0.4%, 95% CI 0.1-0.9) All five (5) infant's mothers started therapy late, between 32 and 33 weeks of pregnancy. <u>MTCT rate viral load < 400 copies/ml (term birth) n=2856</u> <u>Elective CS</u> 7/1296 (0.5%) <u>Emergency CS</u> 3/464 (0.7%) <u>Vaginal birth</u> 7/1083 (0.7%) p= 0.90 (chi-squared) Viral load ≥10000 copies/ml (term birth)	

				Elective CS 10/203 (4.9%) Emergency CS 8/86 (9.3%) Vaginal birth 5/72 (6.9%) p=0.37 (chi-squared) MTCT in women receiving antiretroviral therapy during pregnancy stepwise logistic regression analysis: (Child's HIV status as the dependent variable, independent variables included gestational age at birth, maternal viral load at birth, maternal CD4 cell count at birth, gender of neonate, mode of birth, ART) All births n=4713 (multivariate analysis) Elective CS	

				OR 0.49 (95% CI 0.26 to 0.89) <u>Emergency CS</u> OR 0.81 (95% CI 0.42 to1.56) <u>Vaginal birth</u> OR 1 p=0.059 <u>Maternal viral load at birth < 400 copies/ml n=2659</u> <u>Elective CS</u> OR 0.72 (95% CI 0.24 to 2.16) <u>Emergency Caesarean</u> OR 0.95 (95% CI 0.23 to 3.89) <u>Vaginal birth</u> OR 1 NS <u>Maternal viral load at</u>	

				birth ≥ 10000 copies/ml n=340 Elective CS Adjusted OR 1.46 (95% CI 0.37 to 5.80) Emergency CS Adjusted OR 2.59 (95% CI 0.65 to 10.32) Vaginal birth OR 1 The duration of ART was a risk factor that was significant in the initial and final models. The OR for each increment week was OR 0.94 (95% CI 0.90 to 0.99), p=0.031. The time at initiation of ART or duration of last ART was also correlated with transmission rate (p=0.011, p=0.013 respectively). Intrapartum therapy was associated with four fold lower MTCT (p.0.04 in case of viral load > 1000 copies/ml).	

Study details	Participants	Interventions	Outcomes	Results	Comments
Authors Boer,K., England,K., Godfried,M.H., Thorne,C. **Year of publication** 2010 **Country** Eight Western European countries (Italy, Spain, Belgium, Netherlands, UK, Germany, Denmark and Sweden) **Ref ID** 121777 **Design** Prospective cohort study **Aim of study** To examine temporal and geographical patterns of mode of birth in the Western European centres of European Collaborative study (ECS), to identify factors associated with likelihood of elective CS birth in the HAART era and to explore the association between mode of birth and mother to child transmission (MTCT).	**Inclusion Criteria** Pregnant HIV infected women enrolled into the study from January 1985 to May 2007. **Exclusion Criteria** Women with elective or emergency CS for maternal indication or premature rupture of membranes (PROM) **Demographics - Total** Population: Total n = 5238 mother-child pairs Study Dates: January 1985- May 2007	**Experimental** Investigation: Association of caesarean section with reduction in risk of MTCT - Comparison: Vaginal birth - Method: was collected at enrolment and during the pregnancy. Laboratory test were performed locally. Maternal CD4 cell count and HIV RNA levels obtained closest to birth were used in the analysis. Maternal HIV RNA measurements have been routinely collected since 1998. Children with a positive virological marker of infection and/or children aged >18 months with persistence of antibody were defined as	**Dichotomous** Mother to child transmission rate (MTCT) **Continuous**	MTCT rate among all mother-child pairs (MCPs) with HAART and viral load < 50 copies/ml (n=559) - Elective CS 1/238 (0.42%) p=0.48 Infected infant's mother had HAART treatment started 2 months prior to birth and infant was born at 37 weeks gestation Vaginal birth and emergency CS 1/321 (0.31%) Infected infant's mother had HAART treatment started before pregnancy and infant was born vaginally at < 34 weeks gestation. (Note: vaginal birth and emergency CS were combined for this finding; number of women who gave birth vaginally not reported)	**Funding** Funding: The ECS is co-ordination action of the European commission. CT is supported by Wellcome Trust Research Career Development Fellowship. - **Limitations** Observational study Low numbers Vaginal birth definition includes women who gave birth by CS having planned a vaginal birth and laboured , however these numbers are not reported **Other information** Guidelines in Western Europe generally advocate the application of HAART and in the case of measurable pre-labour HIV RNA (>50 copies/ml) an elective CS is generally recommended.

		infected. Child who had never been detected with HIV antibody, virus or antigen, were classified as uninfected. The child was recorded as provisionally uninfected if he/she had a negative polymerase chain reaction (PCR) test at > 12 weeks postnatally. In the analysis, provisionally uninfected children were regarded as uninfected. <u>Mode of birth definition</u> Elective caesarean section birth was classified in this study as a CS performed before commencement of contractions or rupture of membranes (included some CS undertaken for urgent medical reasons). Emergency CS birth was classified as a CS performed after commencement of contractions or rupture of membranes. Vaginal birth was defined as actual vaginal birth plus those births where labour started		<u>MTCT among all MCPs with viral load < 400 copies/ml (n=960) (HAART status not reported)</u> <u>Vaginal birth</u> 11/242 (4.6%) <u>Emergency CS</u> 2/147 (1.4%) <u>Elective CS</u> 4/571 (0.7%) Odds ratio (95% CI), p value <u>Vaginal birth</u> OR 1.00 <u>Emergency CS</u> OR 0.29 (0.06 to1.33), p=0.11 <u>Elective CS</u> OR 0.15 (0.05 to 0.47), p=0.001 - Adjusted odd ratio (95% CI), p	

		vaginally but baby was born by CS. <u>Data Analysis</u> Univariable comparisons were performed with the χ2 test. Logistic regression analysis was used to obtain adjusted and unadjusted odds ratios. <u>Other Details:</u> The European Collaborative Study is an ongoing prospective cohort study of HIV infected pregnant women and their infants. It was set up in 1985 and includes 29 centres in 10 European countries. **Comparator**		value (adjusting for antenatal HAART and prematurity) <u>Vaginal birth</u> Adjusted OR 1.00 - <u>Emergency CS</u> Adjusted OR 0.19 (0.03 to 1.02), p=0.05 <u>Elective CS</u> Adjusted OR 0.20 (0.05 to 0.65), p=0.008 - <u>MTCT rate among all MCPs with viral load < 400 copies/ml (n=960) with and without HAART (all modes of birth)</u> - <u>No antenatal HAART</u> 12/227 (5.3%) <u>With antenatal HAART</u> 5/733 (0.7%)	

				Odd ratio (95% CI), p value <u>No antenatal HAART</u> OR 1.00 <u>With antenatal HAART</u> OR 0.12(0.04 to 0.35), p < 0.001 - Adjusted odd ratio (95% CI), p value <u>No antenatal HAART</u> adjusted OR 1.00 <u>With antenatal HAART</u> adjusted OR 0.15 (0.05 to 0.45), p < 0.001 - <u>MTCT among all MCPs with viral load < 400 copies/ml (n=960) (all modes of birth)</u> - <u>Gestational age</u> <u>≥ 37 weeks</u>	

				9/730 (1.2%) 34-36 weeks 4/179 (2.2%) <34 weeks 5/51 (7.8%) Odd ratio (95% CI), p value ≥ 37 weeks OR 1.00 34-36 weeks 1.83 (0.56 to 6.02), p=0.32 <34 weeks 6.82 (2.03 to 23.0), p=0.002 Adjusted odd ratio (95% CI), p value Term ≥ 37 weeks Adjusted OR 1 34-36 weeks	

				2.21 (0.64 to 7.59), p=0.21 <u><34 weeks</u> 8.47 (1.99 to 36.1), p=0.004 <u>MTCT rate in a subgroup of women on HAART with viral load < 1000 copies/ml</u> - <u>Elective CS</u> 3/424 (0.7%) (95% CI 0.15 to 2.05) - <u>Not elective CS (women started labour and gave birth either vaginally or by CS)</u> 0/155 - <u>MTCT rate in women on HAART viral load ≥ 1000 copies/ml</u> - <u>Vaginal birth (including vaginal births converted</u>	

				to emergency CS) 2/310 (0.65%) Elective caesarean section 11/822 (1.3%) p=0.64 * Viral load measurement was available 30 MTCT rate in a subgroup of women on HAART with viral load < 1000 copies/ml - Elective CS 3/424 (0.7%) (95% CI 0.15 to 2.05) - Not elective CS (women started labour and gave birth either vaginally or by CS)	

				0/155 - <u>MTCT rate in women on HAART viral load ≥</u> 1000 copies/ml - <u>Vaginal birth (including vaginal births converted to emergency CS)</u> 2/310 (0.65%) <u>Elective caesarean section</u> 11/822 (1.3%) p=0.64 * Viral load measurement was available 30 days before birth or one day postpartum	

Caesarean Section (update)

What is the appropriate care pathway for women who request a primary caesarean section where there is no obstetric or medical indication?

Bibliographic details	Participant characteristics	Intervention characteristics	Methods	Outcomes and results	Reviewer comment
Authors Wiklund, I., Edman, G. & Andolf, E. Year of publication 2007 Country Sweden Ref ID 61132 Design Prospective cohort study Aim: To investigate first time mothers undergoing CS in the absence of medical indication. The outcomes recorded included their reason for the request, self-estimated health, expectations of birth and experience of delivery as well as duration of breastfeeding, re-establishment of sexual life and postnatal depression.	Inclusion Criteria Healthy women with their first full term pregnancy were included in the study during gestational weeks 37 – 39. Women were recruited from a hospital which serves a middle and high income area of Stockholm This is a report of N=357/545 women included in the entire study Case group N=91 Women planning and giving birth with elective CS Control Group N=266 Women planning a vaginal birth Exclusion Criteria Women with BMI > 30, psychiatric illness, complications during pregnancy	Data collection Cases and controls were given a baseline questionnaire (see baseline characteristics). 2 days after delivery, the women received a second questionnaire regarding delivery, trust in midwives / obstetricians, perceived pain and birth experience (VAS). 3 months after delivery, the women received a third questionnaire regarding breastfeeding, sexual life, family planning, birth experience, signs of depression (EPDS) Medical details were taken from patient notes.	Sample size calculation Not reported Recruitment Cases were identified from the hospital's theatre surgical schedule. 105 cases fulfilled inclusion criteria, and out of these, 91 cases (87%) consented to participate. 2 -3 controls per case were consecutively recruited from the same antenatal clinic. 29 (11%) women who planned a vaginal birth subsequently had an emergency CS and 36 (13%) had an instrumental delivery. Analysis An intention to treat analysis was performed. T-tests were performed for continuous data. Chi^2 tests were performed for nominal and categorical variables	Maternal outcomes <u>Maternal hospital stay (mean days)</u> Cases = 3.6 Controls = 2.8 p value = 0.001 <u>Confidence in obstetrician (at 2 days postpartum)</u> Cases = 64/70 (91%) Controls = 99/125 (79%) p value = 0.031 <u>Confidence in midwife (at 2 days postpartum)</u> Cases = 80/92 (87%) Controls = 213/242 (88%) p value = 0.068 <u>Birth experience (at 2 days postpartum)</u> (Mean Likert scale for "thinkable experience" where 1 = worst, 10 = best) Cases = 8.3 Controls = 6.7 p value = 0.001	Ethics Approval Research Ethics Committee of the Karolinska Institute Informed consent was obtained from all participants. Funding Support received from "County Council of Stockholm" and "BB Stockholm AB"

	Baseline Characteristics Cases vs. controls, p value Age (mean years) 33.0 vs. 30.4, 0.001 Native Swede 78% vs. 89%, 0.003 University education 68% vs. 71%, 0.097 Smoking 9% vs. 7%, 0.097 IVF 13% vs. 3.3%, 0.003 Planned pregnancy 79% vs. 90%, 0.012 Parenthood education 67% vs. 85%, 0.001 Perceived good health 85% vs. 98%, 0.001			Birth experience (at 3 months postpartum) (Mean Likert scale for "thinkable experience" where 1 = worst, 10 = best) Cases = 8.1 Controls = 6.6 p value = 0.002 Uncomplicated breastfeeding (at 2 days postpartum) Cases = 50/92 (54%) Controls = 162/237 (68%) p value = 0.052 Breastfeeding (at 3 months postpartum) Cases = 79% Controls = 248/266 (93%) p value = 0.001 Coitus (at 3 months postpartum) Cases = 57% Controls = 67% p value = 0.106 Family planning (plans for a sibling at 3 months postpartum) Cases = 52% Controls = 81% p value = 0.001 Depression (Edinburgh Postnatal Depression Score) In total, 243 women completed the questionnaire. 29/243 had scores lower that	

				the threshold (score of 12). No significant differences between the groups were found (p=0.877). Neonatal outcomes <u>NICU care</u> Cases = 5/99 (5%) Controls = 12/237 (5%) p value = 0.996	

Caesarean Section (update)

What is the appropriate decision to delivery interval for unplanned caesarean section?

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Full citation Hillemanns,P., Hasbargen,U., Strauss,A., Schulze,A., Genzel-Boroviczeny,O., Hepp,H., Maternal and neonatal morbidity of emergency caesarean sections with a decision-to-delivery interval under 30 minutes: Evidence from 10 years, Archives of Gynecology and Obstetrics, 268, 136-141, 2003 **Ref ID** 57811 **Country/ies where the study was carried out** Germany **Study type** Retrospective cohort study **Aim of the study** To investigate the decision to delivery interval for emergency caesarean section and to compare the preoperative maternal and neonatal morbidity to that of intrapartum non-emergency caesarean section **Study dates** 1997 to 1998 **Source of funding** Not reported	**Sample size** Total n = 218 Cases n= 109 Control n = 109 Additional Control (Bavarian registry) n = 1,095,722 **Characteristics** No statistically significant differences were observed between the cases and control groups in maternal age, parity, gestational age, smoking during pregnancy and previous CS. The gravidity was higher in control than in cases ($p \leq .001$) <u>Obstetric characteristic:</u> No statistically significant differences were observed between the case and control groups in preterm labour, PROM, preeclampsia, IUGR, twin gestation, gestational diabetes and fetal malformation. Oligo hydraminous were more common in cases ($p \leq .05$) and gestational diabetes was more	Subjects eligible for the study were identified from the central delivery book between 1997 and 1998. All emergency caesarean sections were identified as cases. Controls were matched for gestational age from women who underwent intrapartum non emergency caesarean section due to failure to progress, preeclampsia, malpresentation and other reasons. A second control group of women who had delivered in the state of Bavaria during the study period was selected from the Bavarian perinatal registry. Data was collected by reviewing the labour, delivery and anaesthesia and neonatal records. Caesarean section was defined as an emergency if severe fetal distress or clinical maternal condition were presented and required immediate caesarean section in the delivery room, referred to as 'crash'	The study was conducted at the University Hospital Munich-Grosshadern (a level 3 hospital with total of 14,706 deliveries during the study interval)	<u>Maternal outcomes</u> <u>Change in haemoglobin (mean ± SD)</u> Emergency CS = 3.6 ± 1.8 Control group = 3.1 ± 1.6 p = 0.05 <u>Blood transfusion</u> Emergency CS n = 11/109 (10.1%) Control group n= 1/109 (0.9%) $p \leq 0.05$ <u>Perioperative morbidity</u> Emergency CS n = 18/109 (16.5%) Control group n= 12/109 (11.0%) p = ns <u>Uterine / bladder laceration</u>	**Limitations** The control group consisted of women who underwent intrapartum non-emergency caesarean section due to failure to progress, preeclampsia, malpresentation and other reasons **Other information** The leading indications for emergency CS were: - Abnormal fetal heart (91%) - Prolapsed cord (21%) - Placental abruption (20%) - No reason could be identified from the records (26.6%) Failure to progress, malpresentation and amnionitis/chrionitis were the main indications for CS in the control group

	common in controls ($p \leq .05$) **Inclusion criteria** Cases = All women with emergency caesarean sections Controls = Women who underwent intrapartum non emergency caesarean section due to failure to progress, preeclampsia, malpresentation and other reasons. **Exclusion criteria** Not reported	caesarean sections (cord prolapse, placenta abruption, severe bradycardia etc) If the decision for caesarean section was made during labour as a result of fetal distress, failing labour or maternal reasons it was classified as intrapartum non-emergent caesarean section. For the emergency caesarean sections, the decision to delivery time was defined as the time interval from the decision to perform caesarean section until delivery. All emergency CS were performed in delivery rooms		Emergency CS n = 7/109 (6.4%) Control group n= 8/109 (7.4%) p = ns <u>Postpartum haemorrhage</u> Emergency CS n = 2/109 (1.8%) Control group n= 1/109 (0.9%) p = ns <u>Postpartum morbidity</u> Emergency CS n = 17/109 (15.6%) Control group n= 16/109 (14.7%) p = ns <u>Intensive care unit</u> Emergency CS n = 11/109 (10.1%) Control group n= 5/109 (4.6%) p = ns <u>Standard ferbrile morbidity</u>	

				Emergency CS n = 8/109 (7.3%) Control group n= 6/109 (5.5%) p = ns <u>Endometritis</u> Emergency CS n = 3/109 (2.8%) Control group n= 2/109 (1.8%) p = ns <u>Wound infection</u> Emergency CS n = 1/109 (0.9%) Control group n= 5/109 (4.6%) p =ns <u>Urinary tract infection</u> Emergency CS n = 3/109 (2.8%) Control group n= 2/109 (1.8%) p =ns	

				Neonatal outcomes <u>Birth weight (mean ± SD)</u> Emergency CS = 2,292 ± 1,025 Control group = 2,328 ± 1,013 p = ns <u>Apgar score < 7 after 5 min</u> Emergency CS n = 21/124 (16.9%) Control group n = 9/124 (7.3%) p ≤ 0.05 <u>Apgar score at 1 min (mean ± SD)</u> Emergency CS = 5.7 ± 2.8 Control group = 7.1 ± 2.3 p ≤ 0.001 <u>Apgar score at</u> 5 min (mean ± SD) Emergency CS = 8.2 ± 1.9 Control group = 8.8 ± 1.6	

				p ≤ 0.01 Apgar score at 10 min (mean ± SD) Emergency CS = 8.8 ± 1.5 Control group = 9.3 ± 1.0 p ≤ 0.01 Arterial cord pH (mean ± SD) Emergency CS = 7.18 ± 0.15 Control group = 7.29 ± 0.07 p ≤ 0.001 pH < 7.10 Emergency CS n = 34/124 (29.3%) Control group n = 2/124 (1.6%) p ≤ 0.001 pH < 7.00 Emergency CS n = 10/124 (8.6%) Control group n = 0/124 (0%)	

				p ≤ 0.001 <u>Perinatal mortality</u> Emergency CS n = 7/124 (5.6%) Control group n = 3/124 (2.4%) Bavarian registry n = (0.6%) *p ≤ 0.05 *compared with Bavarian registry (n = 1,100,995) <u>NICU admission</u> Emergency CS n = 74/124 (59.7%) Control group n = 65/124 (52.4%) Bavarian registry n = (4.2%) *p ≤ 0.001 *compared with Bavarian registry (n = 1,100,995)	

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Full citation Bloom,S.L., Leveno,K.J., Spong,C.Y., Gilbert,S., Hauth,J.C., Landon,M.B., Varner,M.W., Moawad,A.H., Caritis,S.N., Harper,M., Wapner,R.J., Sorokin,Y., Miodovnik,M., O'Sullivan,M.J., Sibai,B.M., Langer,O., Gabbe,S.G., National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network., Decision-to-incision times and maternal and infant outcomes, Obstetrics and Gynecology, 108, 6-11, 2006 **Ref ID** 59743 **Country/ies where the study was carried out** USA **Study type** Prospective cohort study **Aim of the study** To prospectively audit decision to incision intervals in a large cohort of women undergoing caesarean section for an emergency indication at the multiple hospitals throughout the United States, in order to measure maternal and infant outcomes potentially related to the caesarean section response time **Study dates**	**Sample size** n = 11,481 **Characteristics** Maternal age (mean in years): ≥ 30 minutes = 25 ± 6.7 (13-46) ≤ 31 minutes = 26.5 ± 6.7 (13-47) Race White: ≥ 30 minutes n= 558 (30.8%) ≤ 31 minutes n= 269 (27.1%) African: ≥ 30 minutes n= 788 (43.4%) ≤ 31 minutes n= 437 (44.0%) Hispanic: ≥ 30 minutes n= 372 (20.5%) ≤ 31 minutes n= 219 (22%) Asian: ≥ 30 minutes n= 29 (1.6%) ≤ 31 minutes n= 16 (1.6%) Nulliparous	The caesarean registry was a prospective observational study, conducted between 1999 and 2002 (at the network centre composed of 13 institutions and one coordinator centre). The study was designed to assess several specific contemporary issues related to caesarean delivery. During the study period (1999 - 2001) data was collected on all women undergoing a caesarean section at the participating centres. Data from 13 centres was transmitted weekly by telecommunications link to the data coordinating centre at the George Washington University Biostatistics Centre where they were edited for missing, out of range, and inconsistent values. The edited report was then transmitted to each centre for correction or clarification	Emergency procedures were defined as those performed for umbilical cord prolapse, placental abruption, placenta praevia with haemorrhage, non reassuring fetal heart rate pattern, or uterine rupture. Detailed information regarding medical and obstetrical history was extracted directly from maternal and infant charts by a specially trained and certified research nurse. The intervals between the point of decision to perform caesarean to the actual skin incision were calculated by a trained research nurses. The decision time was determined from either the physician's or nurse's progress notes and if notes were not available, the time the women was prepped was used as a substitute. The skin incision times were determined from intra operative records.	Maternal complications associated with emergency caesarean section Postoperative endometritis (fever with abnormal uterine tenderness in the absence of another source of infection) ≥ 30 minutes n= 212/1,814 (11.7) ≤ 31 minutes n= 129/994 (13.0) p = 0.32 Wound complication ≥ 30 minutes n= 23/1,814 (1.3) ≤ 31 minutes n= 9/994 (0.9) p = 0.39 Cystotomy ≥ 30 minutes n= 2/1,814 (0.1) ≤ 31 minutes n= 3/994 (0.3) p = 0.35 Bowel laceration ≥ 30 minutes n= 1/1,814 (0.1)	**Limitations** Indications for CS were very different in the two groups. 7% women in DDI < 30 minutes had cord prolapse compared with 0.2% in DDI > 30 group. **Other information** Emergency caesarean sections were defined to include those performed for umbilical cord prolapse, placental abruption, placenta praevia, haemorrhage, non reassuring fetal heart rate patterns, or uterine rupture There were no significant differences between the two groups (≥ 30) and (≤ 31 min) in maternal age, race, parity, education and proportion who received antenatal care Indication for CS < 30 min n = 1814 : Non reassuring FHR n = 1647 Cord prolapse n = 128 Placenta abruption n = 34 Placenta praevia n = 34 Uterine rupture n = 1 Indication for CS < 30 min n

1999 to 2001 **Source of funding** Supported by grants from the National Institute of Child Health and Human Development	≥ 30 minutes n= 1,115 (61.6%) ≤ 31 minutes n= 699 (70.5%) <u>Education (mean years of education)</u> ≥ 30 minutes = 11.7 ± 2.9 ≤ 31 minutes n= 12.2 ± 2.7 <u>Received antenatal care</u> ≥ 30 minutes n= 1,778 (98%) ≤ 31 minutes n= 968 (97.4%) **Inclusion criteria** Women who gave birth to a singleton infant weighting 2,500 g or more by primary caesarean, and women who were in active labour, defined as reaching a minimum of 4 cm cervical dilatation (to ensure that all women studied had their emergency event occur in a labour and delivery unit) **Exclusion criteria** Not reported			≤ 31 minutes n= 1/994 (0.1) p = 1.00 <u>Ureteral injury</u> ≥ 30 minutes n= 2/1,814 (0.1) ≤ 31 minutes n= 1/994 (0.1) p = 1.00 <u>Infant outcomes associated with emergency caesarean section</u> <u>Neonatal Death</u> <u>With no malformation</u> ≥ 30 minutes n= 7/1,814 (0.4) ≤ 31 minutes n= 1/994 (0.1) p = 0.27 <u>With malformation</u> ≥ 30 minutes n= 8/1,814 (0.4) ≤ 31 minutes n= 3/994 (0.3) p = 0.76 <u>Fetal death in labour</u> ≥ 30 minutes n= 3/1,814 (0.2)	<u>= 994 :</u> Non reassuring FHR n = 991 Cord prolapse n = 2 Placenta abruption n = 1 Placenta praevia n = 0 Uterine rupture n = 0

				≤ 31 minutes n= 0/994 (0) p = 0.31 <u>Hypoxic ischaemic encephalopathy</u> ≥ 30 minutes n= 12/1,814 (0.7) ≤ 31 minutes n= 5/994 (0.5) p = 0.61 <u>Umbilical cord pH < 7*</u> ≥ 30 minutes n= 52/1,814 (4.8) ≤ 31 minutes n= 9/994 (1.6) p = 0.001 * Umbilical artery pH was missing for 41% of the infants <u>Intubation in delivery room</u> ≥ 30 minutes n= 56/1,814 (3.1) ≤ 31 minutes n= 13/994 (1.3) p = 0.004 <u>CPR</u>	

				≥ 30 minutes n= 32/1,814 (1.8) ≤ 31 minutes n= 13/994 (1.2) p = 0.26 <u>5 minute Apgar score ≥ 3</u> ≥ 30 minutes n= 18/1,814 (1.0) ≤ 31 minutes n= 9/994 (0.9) p = 0.82	

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Full citation Holcroft,C.J., Graham,E.M., ina-Mumuney,A., Rai,K.K., Henderson,J.L., Penning,D.H., Cord gas analysis, decision-to-delivery interval, and the 30-minute rule for emergency cesareans, Journal of Perinatology, 25, 229-235, 2005 **Ref ID** 60225 **Country/ies where the study was carried out** USA **Study type** Retrospective cohort study **Aim of the study** To examine the relationship between umbilical arterial gas analysis and decision to delivery interval for emergency caesareans performed for non reassuring fetal status to determine if this would validate the 30 minute rule **Study dates** September 2001 to January 2003 **Source of funding** Not reported	**Sample size** Total n =117 Emergent n = 34 Urgent n = 83 **Characteristics** Of the 145 women who underwent a caesarean section for non reassuring fetal status, 117 met the inclusion criteria. Of the 117 women, 34 were classified as emergent and 83 as urgent There were no statistically significant differences between the two groups (emergent and urgent) in gestational age, neonatal birth weight, spinal and epidural. Women in the emergent group had more general anaesthesia compared with women in the urgent group (p = 0.003). **Inclusion criteria** All caesarean sections performed for non reassuring fetal status during the study period. **Exclusion criteria** Non vertex presentation Chromosomal abnormalities Congenital malformations	All delivery records at a single tertiary hospital from 2001 to 2003 were reviewed. The electronic FHR tracing from the hour prior to birth was obtained for each of births, and reviewed by three board-eligible or board-certified maternal - fetal medicine specialists blinded to neonatal outcomes. The reviewers then graded each case as either emergent or urgent. An emergent CS was defined as one where the reviewer wished to deliver the infant as quickly as possible. An urgent delivery was defined as one where the reviewer was willing to wait up to 30 minutes. In the event of disagreement, the cases were classified in the group that two of the three reviewers favoured. The Kappa correlation for agreement for these reviewers in classifying the cases as emergent versus urgent was 0.35, which shows fair/moderate correlation.	An emergent CS was defined as one where the reviewer wished to deliver the infant as quickly as possible. An urgent delivery was defined as one where the reviewer was willing to wait up to 30 minutes. In the event of disagreement, the cases were classified in the group that two of the three reviewers favoured. The institution used a computerized FHR monitoring system integrated with a centralised clock. Once the physician made a decision to proceed with an emergency caesarean section, the women were taken off the monitor in the labour room and brought back to operating room. The decision time was designated as the time the women were taken off the monitor in the labour room. The time of incision and delivery were determined from the same centralised clock as used for EFM.	Women in emergent group had more general anaesthesia compared with women in urgent group (p = 0.003) <u>Decision to delivery interval (min)</u> Emergent = 23 ± 15.3 Urgent = 36.7 ± 14.9 p < 0.001 <u>Neonatal death</u> Emergent = n = 1/34 Urgent = n = 0/83 p = 0.64 <u>1 minute Apgar < 7</u> Emergent = n = 15/34 (44%) Urgent = n = 27/83 (33%) p = 0.24 <u>5 minute Apgar < 7</u> Emergent = n = 3/34 (9%) Urgent = n= 8/83 (33%) p = 1.0	**Limitations** The decision time was designated as the time the women were taken off the monitor in the labour room **Other information**

	Lack of an umbilical arterial gas Those who were not monitored for at least 1 hour prior to delivery			<u>Umbilical arterial pH</u> Emergent = 7.12 ± 0.16 Urgent = 7.22 ± 0.08 p < 0.001 <u>Umbilical arterial BE (mmol/l)</u> Emergent = -8.8 ± 4.3 Urgent = -3.9 ± 2.4 p < 0.001 <u>Cord pH ≤ 7.0</u> Emergent = n = 6/34 (17.7%) Urgent = n= 2/83 (2.4%) p = 0.007 <u>Cord BE < -12.0 (mmol/l)</u> Emergent = n = 8/34 (23.5%) Urgent = n= 1/83 (1.2%) p <0.001 <u>Intraventricular haemorrhage</u> Emergent = n = 2/34 (5.9%) Urgent = n= 5/83 (6.0%)	

				p = 1.0 <u>Linear regression of decision to delivery interval versus umbilical arterial pH and umbilical base excess</u> A statistically significant correlation was found between increasing decision to delivery interval and marginally improved umbilical arterial pH (r = 0.22, p = 0.02) and base excess (r = 0.33, p< 0.001) These correlations were not clinically significant in predicting when the fetus would develop metabolic acidosis severe enough to increase the risk of long term neurologic morbidity.	

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Full citation Roy,K.K., Baruah,J., Kumar,S., Deorari,A.K., Sharma,J.B., Karmakar,D., Cesarean section for suspected fetal distress, continuous fetal heart monitoring and decision to delivery time, Indian Journal of Pediatrics, 75, 1249-1252, 2008 **Ref ID** 60814 **Country/ies where the study was carried out** India **Study type** Prospective observational study **Aim of the study** To evaluate whether a 30 minute decision to delivery interval for emergency caesarean section influences perinatal outcome **Study dates** March 2002 to March 2007 **Source of funding** Not reported	**Sample size** Total = 217 women **Characteristics** Not reported **Inclusion criteria** Gestational age ≥ 36 weeks, no fetal anomalies and non reassuring fetal heart rate pattern detected by CTG. **Exclusion criteria** Abnormal presentation Multiple pregnancy Severe intrauterine Growth Restriction (IUGR) Caesarean section for other primary indications	Data was collected from the women in one unit who underwent caesarean section for suspected fetal distress during labour. The DDI was the time between the decision to perform the caesarean and exact delivery time. The data obtained was analysed to correlate the non reassuring fetal heart and DDI with adverse neonatal outcome.	The cause of the fetal distress: n = 18 (8.2%) had thick meconium stained liquor n = 17 (7.8%) had two or more tight loops of cord around neck n = 11 (5.1%) women had retroplacental clot with blood stained liquor n = 171 (78.8%) had no detectable cause or effect of fetal distress	<u>Neonatal outcomes</u> <u>Fresh stillbirth (due to placental abruption)</u> D-D interval ≤ 30 min n = 1/121 D-D interval > 30 min n = nil/96 <u>Mean birth weight</u> D-D interval ≤ 30 min (n = 121) = 2850 ± 340 D-D interval > 30 min (n = 96) = 2760 ± 413 p = ns <u>Mean birth weight < 2500 g</u> D-D interval ≤ 30 min n = 16/121 (14.8%) D-D interval > 30 min n = 11/96 (11.4%) p = ns <u>Apgar score < 7 at 5 min</u> D-D interval ≤ 30 min n = 18/121 (14.8%) D-D interval > 30 min n = 15/96 (15.6%)	**Limitations** Emergency caesarean sections were not classified. No details about the characteristics of the women are reported. **Other information**

				p = ns <u>Umbilical cord pH < 7.10</u> D-D interval ≤ 30 min n = 8/121 (6.6%) D-D interval > 30 min n = 5/96 (5.2%) p = ns <u>Neonate requiring immediate ventilation</u> D-D interval ≤ 30 min n = 4/121 (3.3%) D-D interval > 30 min n = 96 (2.08%) p = ns <u>Admission to NICU</u> D-D interval ≤ 30 min n = 26/121 (21.4%) D-D interval > 30 min n = 7/96 (7.2%) p <0.05 <u>Indication for NICU admission</u> <u>Severe birth asphyxia (Apgar score <4 at 5 min)</u>	

				D-D interval ≤ 30 min n = 10/26 D-D interval > 30 min n = 3/7 <u>Moderate birth asphyxia (Apgar score <7 at 5 min)</u> D-D interval ≤ 30 min n = 8/26 D-D interval > 30 min n = 2/7 <u>TTN (transient tachpynea of newborn) for observation</u> D-D interval ≤ 30 min n = 8/26 D-D interval > 30 min n = 2/7	

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Full citation Thomas,J., Paranjothy,S., James,D., National cross sectional survey to determine whether the decision to delivery interval is critical in emergency caesarean section, BMJ, 328, 665-, 2004 **Ref ID** 61005 **Country/ies where the study was carried out** UK **Study type** Retrospective observational study **Aim of the study** To examinethe association between decision to delivery interval and neonatal and maternal outcomes **Study dates** 1st May 2000 to 31st July 2000 **Source of funding** NICE (National Institute for Clinical Excellence)	**Sample size** Grade 1) Immediate threat to the life of the woman or fetus (n = 4622) Grade 2) Maternal or fetal compromise not immediately life threatening (n = 9122) Grade 3) No maternal or fetal compromise but early delivery needed (n = 347) Total n = 17,780: ≤ 15 min n = 1381 16 -30 min n = 2577 31 - 45 min n = 3589 46 - 60 min n = 3261 61 - 75 min n = 1865 > 75 min n = 3891 **Characteristics** Not reported **Inclusion criteria** Singletons delivered by emergency CS **Exclusion criteria** Multiple pregnancies	The data for the study was obtained from the national sentinel caesarean section audit. The audit was designed to accurately measure caesarean rates and to assess the quality of care given to women having caesarean section in England and Wales.	The decision to delivery interval is defined as the interval in minutes from the date and time of decision to carry out the caesarean section to the date and time of birth of baby Urgency of caesarean section: Grade 1) Immediate threat to the life of the woman or fetus Grade 2) Maternal or fetal compromise not immediately life threatening Grade 3) No maternal or fetal compromise but early delivery needed Grade 4) Delivery timed to suit the woman and staff	Association between decision to delivery interval and maternal and neonatal outcomes Maternal outcomes: <u>Maternal requirement for special care</u> ≤ 15 min n = 194 (14.1%) adjusted OR 1 16 - 30 min n = 301 (11.7%) adjusted OR 0.8 (95% CI 0.7 to 1.1) 31 - 45 min n = 361 (10.1%) adjusted OR 0.9 (95% CI 0.8 to 1.2) 46 - 60 min n = 277 (8.5%) adjusted OR 0.9 (95% CI 0.7 to 1.1) 61 - 75 min n = 197 (10.6%) adjusted OR 1.1 (95% CI 0.8 to 1.4) > 75 min n = 752 (19.4%) adjusted OR 1.5 (95% CI 1.2 to 1.8) Neonatal outcomes: <u>Stillbirth</u>	**Limitations** Regression analysis was not able to control bias. Other factors associated with adverse neonatal outcome, e.g. gestation and failed instrumental delivery, were not considered **Other information** Perceived urgency was classified as grade I for 26 % (n=4622), grade 2 for 51.3% (n = 9122), and grade 3 for 20.8% (n = 3689). The most common indications for emergency CS were presumed fetal compromise, intrauterine growth retardation or an abnormal cardiogram (35%), and failure to progress (32%). Presumed fetal compromise was the primary indication (66%) with more cases with grade I urgency.

				≤ 15 min n = 11 (0.8%) adjusted OR 1 16 -30 min n = 16 (0.6%) adjusted OR 0.8 (95% CI 0.3 to 1.7) 31 - 45 min n = 5 (0.1%) adjusted OR 0.4 (95% CI 0.1 to 1.3) 46 - 60 min n = 3 (0.1%) adjusted OR 0.5 (95% CI 0.1 to 1.9) 61 - 75 min n = 4 (0.2 %) adjusted OR 1.6 (95% CI 0.5 to 5.3) > 75 min n = 11 (0.3 %) adjusted OR (95% CI) <u>5 minute Apgar score < 7</u> ≤ 15 min n = 87 (6.5%) adjusted OR 1 16 -30 min n = 139 (5.5%) adjusted OR 0.9 (95% CI 0.6 to 1.2) 31 - 45 min n = 106 (3%) adjusted OR 1 (95% CI 0.7 to 1.4) 46 - 60 min n = 71 (2.2%) adjusted OR 1.1 (95% CI 0.8 to 0.4)	

				61 - 75 min n = 35 (1.9%) adjusted OR 1.1 (95% CI 0.7 to 1.7) > 75 min n = 116 (3.1%) adjusted OR 1.7 (95% CI 1.2 to 2.4) <u>5 minute Apgar score < 4</u> ≤ 15 min n = 32 (2.4%) adjusted OR 1 16 -30 min n = 44 (1.7%) adjusted OR 0.8 (95% CI 0.5 to 1.3) 31 - 45 min n = 25 (0.7%) adjusted OR (0.795% CI 0.4 to 1.3) 46 - 60 min n = 23 (0.7%) adjusted OR 1.3 (95% CI 0.7 to 2.3) 61 - 75 min n = 10 (0.5%) adjusted OR 1.0 (95% CI 0.4 to 2.3) > 75 min n = 31 (0.8%) adjusted OR 1.4 (95% CI 0.7 to 2.5) Grade of urgency <u>Maternal requirement for special care</u> Need early delivery	

				n = 233 (6.3%) adjusted OR 1.0 Urgent, not life threatening n = 1154 (12.7%) adjusted OR 1.6 (95% CI 1.3 to 1.9) Urgent, life threatening n = 857 (18.6%) adjusted OR 2.2 (95% CI 1.7 to 2.7) <u>Stillbirth</u> Need early delivery n = 3 (0.1%) adjusted OR 1 Urgent, not life threatening n = 6 (0.1%) adjusted OR 0.9 (95% CI 0.2 to 3.1) Urgent, life threatening n = 43 (0.9%) adjusted OR 8.3 (95% CI 1.5 to 44.7) <u>5 minute Apgar score < 4</u> Need early delivery n = 3 (0.1%) adjusted OR 1 Urgent, not life threatening	

				n = 46 (0.5%) adjusted OR 0.8 (95% CI 0.4 to 1.9) Urgent, life threatening n = 115 (2.6%) adjusted OR 1.6 (95% CI 0.6 to 4.0) <u>5 minute Apgar score < 7</u> Need early delivery n = 31 (0.9%) adjusted OR 1 Urgent, not life threatening n = 189 (2.6%) adjusted OR 1.7 (95% CI 1.1 to 2.6) Urgent, life threatening n = 352 (7.9%) adjusted OR 2.9 (95% CI 1.8 to 4.8) *Data was adjusted for the primary indication for CS, cardiotocography findings, grade of urgency, and type of anaesthesia	

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Full citation Chauleur,C., Collet,F., Furtos,C., Nourrissat,A., Seffert,P., Chauvin,F., Identification of factors influencing the decision-to-delivery interval in emergency caesarean sections, Gynecologic and Obstetric Investigation, 68, 248-254, 2009 **Ref ID** 92326 **Country/ies where the study was carried out** France **Study type** Retrospective cohort study **Aim of the study** To investigate decision to delivery intervals with regard to the compliance with the recommended intervals and their influencing factors **Study dates** 1st September to 1st November 2007 **Source of funding** The study was supported by the University Hospital of Saint Etienne, Saint-Etienne (France)	**Sample size** Total n = 68 women with emergency caesarean section (EmCS) Class 1 (Extremely urgent CS) + Class 2 (Urgent CS) n = 34 Class 3 (Non urgent CS) n =34 Neonatal outcomes were reviewed for 71 babies (3 twins) **Characteristics** Univariate analysis of DDI of 68 CS: There were no statistically significant differences observed in decision to delivery interval (min) with regards to maternal gravidity (1 and >1), parity (1 and >1), gestational age at delivery (≤36 weeks and >36) and outside standard working hours (yes and no). Women who were hospitalised in the pathological pregnancy unit had longer DDI compared with women who were in the labour ward on the same hospital floor (p = 0.03) **Inclusion criteria** All emergency caesarean sections performed during the study period	Data for the study was collected from a clinical audit which was carried out in Saint-Etienne University Hospital. All emergency caesarean sections performed during the study period were included.	All files concerning an emergency CS performed during the study period were reviewed, and 68 women were identified for study inclusion. Class 1 and class 2 CS were combined in one group (n = 34) and the remaining 34 women were classified as class 3 CS.	<u>Apgar score total n =70</u> DDI > 30 min: <7 = n = 2 (0.04%) ≥7 = n = 43 (0.96%) DDI < 30 min: < = n = 0(0%) ≥7 = n = 25 (100%) p = 0.53 <u>Lactates n =54</u> DDI > 30 min: <6 = n = 31 (0.89%) ≥6 = n = 4 (0.11%) DDI < 30 min: <6 = n = 15 (0.79%) ≥6 = n = 4 (0.21%) p = 0.43 <u>pH</u> DDI > 30 min: ≤7.10 = n = 1 (0.03%)	**Limitations** No definition for DDI given Indication for CS not specified **Other information** The classification of the CS was retrospectively done by 3 obstetricians who were among the authors of this article. Three classes of CS were defined as: Extremely urgent = class 1 - imminent threat to life (extraction of infant within 15 min) Urgent = class 2 - short term threat to life (extraction of infant within 30 min) Non-urgent = class 3 - no threat to life (extraction of infant with >30 min)

	Exclusion criteria Not reported			>7.10 = n = 36 (0.97%) DDI < 30 min: ≤7.10 = n = 2 (0.11%) >7.10 = n = 17 (0.89%) p = 0.26 <u>Paediatric reanimation</u> DDI > 30 min: No = n = 27(0.59%) Yes = n = 19 (0.41%) DDI < 30 min: No = n = 17(0.68%) Yes = n = 8 (0.32%) p = 0.44 <u>Paediatric reanimation unit</u> DDI > 30 min: No = n = 35(0.76%) Yes = n = 11(0.24%) DDI < 30 min: No = n = 24 (0.96%)	
				Yes = n = 1 (0.04%) p = 0.46	

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Full citation Hillemanns,P., Strauss,A., Hasbargen,U., Schulze,A., Genzel-Boroviczeny,O., Weninger,E., Hepp,H., Crash emergency cesarean section: decision-to-delivery interval under 30 min and its effect on Apgar and umbilical artery pH, Archives of Gynecology and Obstetrics, 273, 161-165, 2005 **Ref ID** 92387 **Country/ies where the study was carried out** Germany **Study type** Retrospective cohort study **Aim of the study** To examine the effect of decision to delivery interval of crash emergency caesarean section on Apgar and umbilical artery pH **Study dates** 1988 to 1997 **Source of funding** Not reported	**Sample size** All crash CS n =109 < 32 weeks gestation n = 33 ≥ 32 weeks gestation n = 49 **Characteristics** Not reported **Inclusion criteria** Women with crash emergency CS **Exclusion criteria** Not reported	One hundred and nine (n =109) crash emergency CS were performed during the 10 year study period in a level 3 hospital (17,706 delivery per year). The crash emergency operations were performed in the delivery rooms (all delivery rooms were fully equipped with the necessary anaesthetic equipment and emergency pack). All emergency CS were performed within the 30 minute interval. The median time was 10 minutes (mean ± SD = 11.4 ± 5.2).	The decision for emergency CS was usually made by a resident. The time point was documented by the midwife, marked on the electrocardiogram paper, and defined the beginning of decision to delivery time. The consultant had to confirm the indication and perform the emergency CS under general anaesthesia unless loco-regional anaesthesia was already in place. Surgery was conducted in sub-optimal sterile condition (no shaving, no scrubbing of obstetrician, quick disinfection of the abdomen, bladder drainage, and broad spectrum antibioprophylaxis).	<u>Relation between the umbilical cord arterial blood pH and decision to delivery time:</u> Correlation coefficient r = 0.36 p> 0.05 (ns) <u>Relation between the Apgar score and decision to delivery time :</u> Emergency caesarean sections performed within 19 min presented with lower Apgar values after 1, 5, and 10 min than those required 20 min or more (p = 0.003, 0.003 and 0.01, respectively)	**Limitations** n = 33 (30.3%) of the emergency CS had a gestational age < 32 weeks and n= 60 (55%) below 37 weeks. **Other information** The CS were classified as emergency if severe fetal distress or critical maternal condition were anticipated and required immediate delivery by operation in the delivery room, referred to "crash" caesarean sections. The indication for all emergency CS n = 109: - Abnormal fetal heart n = 99 (20.28%) - Placenta abruption n = 22 (90.8%) - Cord prolapse n = 23 (21.1%) - Failure to progress n = 17 (90.8%) - Malpresentation n = 12 (11%) - Other (preeclampsia, placenta praevia, amnionitis, fetopelvic disproportion, epidural complication, failed operative vaginal delivery) n = 21 (19.2%) n= 33 (30.3%) of the emergency CS had a gestational age < 32 weeks and
					n= 60 (55%) below 37 weeks.

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Full citation Kolas,T., Hofoss,D., Oian,P., Predictions for the decision-to-delivery interval for emergency cesarean sections in Norway, Acta Obstetricia et Gynecologica Scandinavica, 85, 561-566, 2006 **Ref ID** 92419 **Country/ies where the study was carried out** Norway **Study type** Prospective cohort study **Aim of the study** To identify factors that influence the decision to delivery intervals in emergency caesarean sections. **Study dates** 1st December 1998 to 1st July 1999 **Source of funding** Not reported	**Sample size** n = 1,511 emergency caesarean sections (n = 1,297 acute, n = 214 urgent) **Characteristics** Women in the two groups (acute and urgent) were comparable in age, BMI, parity and also in neonatal birth weight and gestational age. **Inclusion criteria** All women with emergency CS **Exclusion criteria** Not reported	Prospective registration of all emergency caesareans was provided by 24 maternity units (18 level 2 with 400 - 1500 delivery per year and 6 level 3 units with > 1500 delivery per year) during the study period. 1,767 emergency singleton caesarean section were registered. However, in 256 cases information about DDI was not provided; therefore n = 1,511 emergency caesarean section included. Data for the study was obtained from the Medical Birth Registry of Norway (MBRN) that routinely collects information about all deliveries.	A registration form was designed for the study. The form gave detailed information about medical and obstetric history, complications during the pregnancy, the operation, and perinatal events. The clinicians filled in the form for every emergency caesarean section done and the MBRN entered the information into the database. The clinician that reported the data was directly involved in the decision making process for the emergency operation. Women in the two groups (acute and urgent) were comparable in age, BMI, parity and also in neonatal birth weight and gestational age. For each caesarean section, the clinicians specified the indication by ticking a list of 31 pre-specified indications. Fetal distress, abruptio placentae and umbilical cord prolapse were statistically significantly higher than any other indication listed in the form.	<u>Decision to delivery intervals (DDI) related to NICU admission</u> Total number of cases n = 1,480 (Preterm n = 284 Term n = 1,200) <u>Transfers to NICU (preterm) :</u> ALL = 85.8 % DDI < 15 min (total cases n = 39/41) = 97.4 % DDI 16 - 30 min (total cases n = 38/54) = 84.3% DDI 31 - 60 min (total cases n = 70/86) = 82.9% DDI > 60 min (total cases n = 86/103) = 84.3% p = ns <u>Transfers to NICU (term ≥ 37 weeks) total n = 1200 :</u> ALL: 21.9 % DDI < 15 min (total cases n = 70/242) = 29.0 % DDI 16-30 min (total cases n = 87/382) = 23.4%	**Limitations** **Other information** All CS performed < 8 hours after the decision for operation were classified as emergency. Emergency sections were divided into acute (those that were performed as quickly as possible after decision was made), and urgent (the decision triggered a set of particularly speedy preparation procedures)

				DDI 31 - 60 min (total cases n = 75/394) = 19.3% DDI > 60 min (total cases n = 27/182) = 15.5% p < 0.01 <u>Apgar score at 5 min < 7 (preterm) n = 284</u> ALL = 11.2 % DDI < 15 min (total cases n = 10/41) = 25.6% DDI 16-30 min (total cases n = 7/54) = 13.0% DDI 31 - 60 min (total cases n = 7/86) = 8.4% DDI > 60 min (total cases n = 7/103) = 7.0% p < 0.01 <u>Apgar score at 5 min < 7 (term)</u> <u>ALL</u>: 5.8% DDI < 15 min (total cases n = 26/242) = 11.0 % DDI 16-30 min (total cases n = 22/382) = 5.9 % DDI 31 - 60 min (total cases n	

				= 39/394) = 1.0 % DDI > 60 min (total cases n = 4/182) = 2.2% p < 0.01 <u>Apgar score at 5 min < 4 (preterm)</u> ALL = 1.5 % DDI < 15 min (total cases n = 1/41) = 2.6 % DDI 16-30 min (total cases n = 54) = 0 DDI 31 - 60 min (total cases n = 86) = 0 DDI > 60 min (total cases n = 3/103) = 3.0% p = ns <u>Apgar score at 5 min < 4 (term)</u> ALL: 1.3% DDI < 15 min (total cases n = 6/242) = 2.5% DDI 16-30 min (total cases n = 5/382) = 1.3% DDI 31 - 60 min (total cases n = 2/394) = 0.5%	

				DDI > 60 min (total cases n = 2/182) = 1.1% p = ns	

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Full citation Leung,T.Y., Chung,P.W., Rogers,M.S., Sahota,D.S., Lao,T.T., Hung Chung,T.K., Urgent cesarean delivery for fetal bradycardia, Obstetrics and Gynecology, 114, 1023-1028, 2009 **Ref ID** 92430 **Country/ies where the study was carried out** China **Study type** Retrospective cohort **Aim of the study** To estimate whether bradycardia to delivery interval was related to adverse perinatal outcome after extremely urgent caesarean section for different cause of fetal distress **Study dates** 2005 to 2008 **Source of funding** Not reported	**Sample size** Total n = 235 Irreversible n =39 Potentially reversible n = 22 Unknown n= 174 **Characteristics** There were no statistically significant differences between the three groups (irreversible, potentially reversible and unknown) in maternal age and neonatal birth weight. The median gestation at delivery and percentage of nulliparity in the irreversible group were less than in the potentially reversible and unknown groups (p<0.05). **Inclusion criteria** Pregnant women who underwent an extremely urgent CS. **Exclusion criteria** Multiple pregnancies Pregnancies with fetal abnormalities Acute maternal ketoacidosis	Women who gave birth during the study period by extremely urgent CS because of the fetal distress were identified from the hospital Obstetric Specialty Clinical Information System. The medical notes of the eligible cases were reviewed for the bradycardia to delivery interval, decision to delivery interval and umbilical cord arterial blood gas. The causes of the bradycardia were reviewed according to fetal distress and categorized into: 1) Irreversible 2) Potentially reversible 3) Unknown		Bradycardia to decision to delivery interval (BDI) [median (interquartile range)] Irreversible n= 39 11 min (9 -16) Potentially reversible n= 22 16.5 min (14 -18.3) Unknown n = 174 16 min (14 -19) p < 0.001 Decision to delivery interval (DDI) [median (interquartile range)] Irreversible n= 39 10 min (9 -12) Potentially reversible n= 22 11.5 min (10.8 -13.3) Unknown n = 174 11 min (10 -13) p = 0.001 Cord arterial pH [median	**Limitations** **Other information** The study unit had a standard intrapartum management protocol: 1) The routine use of the continuous cardiotocograph (CTG) monitoring 2) The interpretation of the CTG based on the RCOG and NICE Guideline 3) Extremely urgent caesarean section should be prepared for when there was persistent fetal bradycardia (> 110 bpm) for 3 minutes, and should be decided when it lasted for 5 minutes without sign of recovery or when the bradycardia is associated with irreversible conditions like placental abruption or cord prolapse. The definition of the extremely urgent caesarean section used in the study unit was equivalent to the grade 1 of the RCOG classification of urgency for emergency CS.

				(interquartile range)] Irreversible n= 39 7.094 (6.991 - 7.216) Potentially reversible n= 22 7.162 (7.064 - 7.251) Unknown n = 174 7.210 (7.161 - 7.255) p < 0.001 Cases with arterial pH < 7 [n (%)] Irreversible n= 39 10 (25.6) Potentially reversible n= 22 1 (4.5) Unknown n = 174 8 (4.6) Cord base excess [median (interquartile range)] Irreversible n= 39 -10.0 (-5.6 to -13.1) Potentially reversible n= 22	

				-9.5 (-5.3 to -11.9) Unknown n = 174 -6.3 (-4.5 to -8.3) Cases with cord base excess < 12 [n (%)] Irreversible n= 39 12 (30.8) Potentially reversible n= 22 5 (22.7) Unknown n = 174 12 (6.9) Correlation between pH and base excess with BDI and DDI using Spearman's P test (P = Correlation Coefficient) pH vs BDI Irreversible n= 39 -0.354 (0.027) Potentially reversible n= 22 -0.204 (0.364) Unknown n = 174	

				0.043 (0.572) pH vs DDI Irreversible n= 39 -0.069 (0.676) Potentially reversible n= 22 -0.255 (0.252) Unknown n = 174 0.019 (0.803) BE (base excess) vs BDI Irreversible n= 39 -0.406 (0.11) Potentially reversible n= 22 -0.323 (0.153) Unknown n = 174 -0.037 (0.631) BE (base excess) vs DDI Irreversible n= 39 -0.138 (0.410) Potentially reversible n= 22 -0.162 (0.483)	

				Unknown n = 174 -0.020 (0.801)	

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Full citation Nasrallah,F.K., Harirah,H.M., Vadhera,R., Jain,V., Franklin,L.T., Hankins,G.D., The 30-minute decision-to-incision interval for emergency cesarean delivery: fact or fiction?, American Journal of Perinatology, 21, 63-68, 2004 **Ref ID** 92469 **Country/ies where the study was carried out** USA **Study type** Retrospective cohort study **Aim of the study** To identify whether a 30 minute interval has an impact on neonatal and maternal outcome in cases of emergent caesarean delivery (ECD) **Study dates** January 1999 to December 2001 **Source of funding**	**Sample size** Total: n = 111 Group I (had skin incision undertaken ≤ 30 minutes [median = 16 mins, range = 5 to 30 minutes]): n = 83 Group II (had skin incision undertaken > 30 minutes [median = 38 mins, range = 5 to 57 minutes]): n = 28 **Characteristics** There were no statistically significant differences between the two groups in maternal age, parity, weight or gestational age at delivery. **Inclusion criteria** All women with singleton gestations between 32 and 42 weeks who underwent emergency CS during the study period **Exclusion criteria** Not reported	The study was conducted at a tertiary hospital and data was retrospectively collected from women's medical notes. Subjects were identified and categorized into two groups: Group I = decision to incision (D-I) ≤ 30 min Group II = decision to incision (D-I) > 30 min No statistically significant differences were observed between the two groups in maternal age, parity, weight or gestational age at delivery. In group I there were 10 women with the history of a prior CS compared with 0 in group II. 108/111 were performed through transverse incisions of the lower uterine segment. General anaesthesia was performed more in group I (50/83 [60%]) than group II (2/28 [7%]), p < 0.001	The indication for ECD included: no reassuring fetal heart rate patterns, placental abruption, cord prolapse, bleeding placenta praevia, and suspected uterine rupture. The timing of the decision to perform caesarean section, presence of the patient in the operating room, skin incision and type of anaesthesia were obtained from the nursing and operating room records.	<u>Time intervals (min) between the two groups = median (range)</u> Group I = decision to incision (D-I) = 16 (5 - 30) Group II = decision to incision (D-I) = 38 (31 - 57) Group I = decision to operating room interval = 6 (2 - 22) Group II = decision to operating room interval = 16 (5 - 30) Group I = operating room to incision interval (D-I) = 8 (2 - 26) Group I = operating room to incision interval (D-I) = 16 (7 - 44) <u>Maternal outcomes</u> <u>Estimated blood loss (ml)</u> Group I (n = 83) = 1000 (500 - 3500) Group II (n = 28) = 950 (800 -1700) p = ns	**Limitations** n = 50/83 (60%) in group I had general anaesthesia compared to n = 2/28 (7%) in group II **Other information**

				Blood transfusion n (%) Group I (n = 83) = 6 (7%) Group II (n = 28) = 0 (0%) p = ns Surgical injuries n (%) Group I (n = 83) = 10 (12%) Group II (n = 28) = 1 (4%) p = ns Uterine rupture n (%) Group I (n = 83) = 5 (6%) Group II (n = 28) = 0 (0%) p = ns Caesarean hysterectomy n (%) Group I (n = 83) = 2 (2.5%) Group II (n = 28) = 0 (0%) p = ns Neonatal outcomes Apgar score at 1 min ≤ 3 n (%) Group I (n = 83) = 11 (13%)	

				Group II (n = 28) = 1 (3.6%) p = ns <u>Apgar score at 1 min 4-6 n (%)</u> Group I (n = 83)= 22 (27%) Group II (n = 28) = 2 (7%) p = ns <u>Apgar score at 1 min ≥ 7 n (%)</u> Group I (n = 83)= 50 (60%) Group II (n = 28) = 25 (89.4%) p = 0.009 <u>Apgar score at 5 min < 7 n (%)</u> Group I (n = 83) = 8 (9.5%) Group II (n = 28) = 1 (3.6%) p = ns <u>Apgar score at 5 min ≥ 7 n (%)</u> Group I (n = 83)= 75 (90.5%) Group II (n = 28) = 27	

				(96.4%) p = ns <u>Apgar score at 10 min < 7 n (%)</u> Group I (n = 83) n = 2 Group II (n = 28) n = not reported <u>Apgar score at 10 min ≥ 7 n (%)</u> Group I (n = 83) n = 3 Group II (n = 28) n = not reported <u>Umbilical cord venous pH ≥ 7.20 n (%)</u> Group I (n = 83) = 69 (83%) Group II (n = 28) = 25 (89%) p = ns <u>Umbilical cord venous pH 7.17 - 7.00 n (%)</u> Group I (n = 83)= 10 (12%) Group II (n = 28) = 3 (11%) p = ns <u>Umbilical cord venous pH <</u>	

				7.00 n (%) Group I (n = 83) = 4 (5%) Group II (n = 28) = 0 (0%) p = ns Umbilical cord arterial pH ≥ 7.20 n (%) Group I (n = 83) = 60 (72%) Group II (n = 28) = 20 (71%) p = ns Umbilical cord arterial pH 7.17 - 7.00 n (%) Group I (n = 83) = 18 (22%) Group II (n = 28) = 8 (29%) p = ns Umbilical cord arterial pH < 7.00 n (%) Group I (n = 83) = 5 (6%) Group II (n = 28) = 0 (0%) p = ns Seizures n (%)	

				Group I (n = 83) = 4 (5%) Group II (n = 28) = 0 (0%) p = ns <u>Encephalopathy n (%)</u> Group I (n = 83) = 5 (6%) Group II (n = 28) = 0 (0%) p = ns <u>Admission to NICU n (%)</u> Group I (n = 83) = 21 (25%) Group II (n = 28) = 6 (21%) p = ns <u>NICU stay [days median (range)]</u> Group I (n = 83) = 13 (1 - 40) Group II (n = 28) = 9 (3 - 35) p = ns	

Caesarean Section (update)

What is the effectiveness of antibiotics given prior to clamping of the cord compared to antibiotics given after clamping of the cord during a planned or emergency caesarean section?

Bibliographic details	Number of Participant Participant Characteristics	Intervention characteristics	Outcome measures	Quality Assessment	Reviewer comment
Authors Nokiani,F.A., Akbari,H., Rezaei,M. **Year of publication** 2009 **Study location** Iran **Ref ID** 57298 **Aim of study** To determine whether cefazolin administration prior to skin incision was superior to cefazolin administration at the time of cord clamping for prevention of post-caesarean maternal and neonatal infectious morbidity **Study type** Randomised controlled study	**Inclusion Criteria** Women with singleton pregnancies delivered by caesarean sections (CS) performed between 8am and 2pm each working day, between February 2007 and March 2008. Therefore, these were mostly elective CS, although some emergency cases were included. **Exclusion Criteria** Previous CS Confirmation of any systemic diseases such as diabetes mellitus, hypertension, immune compromised disease, coagulation disorders, heart or renal failure. Febrile state Greater than 18 hours duration since amniotic rupture of membranes	**Intervention** 2g IV cefazolin in 50ccl normal saline given at 30-60 minutes prior to skin incision and 2g cephazolin given 6 hours after operation. The intervention was performed by one of two investigators; the other investigator performed follow up of women and neonates. **Comparison** 2g IV cefazolin in 50ccl normal saline given at cord clamp and 2g cephazolin given 6 hours after operation. The intervention was performed by one of two investigators; the other investigator performed follow up of women and neonates.	**Maternal outcomes** Follow up of women and neonates was performed by one of two investigators; the other investigator performed the intervention. Outcomes were assessed by a single obstetrics and gynaecology resident following caesarean section. 1) Surgical site opening Definition: wound dehiscence before incision intervention group = 0/196 (0%) after clamping comparison group = 1/91 (1.1%) p value = not estimable 2)Total maternal fever before incision intervention group = 10/196 (5.1%) after clamping comparison group = 3/91 (3.3%) p value = 0.761 3) Maternal fever at day 2 before incision intervention group = 9/196 (4.6%) after clamping comparison group = 3/91 (3.3%) p value = 0.756 4) Maternal fever at day 40	Limitations Allocation concealment: Unclear Participants blinded to intervention: No Carers blinded to intervention: No Investigators blinded to intervention: Unclear, single assessor Number of participants not completing treatment: None Number of participants with no available outcome data: None Selective outcome reporting: No Any other limitations: All subjects received 2g cefazolin 6 hours postoperatively (tend to reduce effect size), significantly more women undergoing elective surgery in the "before incision" intervention group (179/196, 91.3%) compared to the "post clamping" comparison group (74/91, 81.3%) (p = 0.015) Indirectness Population: None Intervention: None	**Funding** Not reported **Other information** Informed consent given by women: Yes Sample size calculation: Not reported Ethics board permission: Medical Ethics Committee of Kermanshah University of Medical Sciences

	Baseline Characteristics At baseline, there were no significant differences between intervention and comparison groups for mean age, distribution by age group, mean parity, distribution of number of previous births, BMI (range 19-28kg/m^2) and fetal gestational age (at least 37 weeks). There were significantly more women undergoing elective surgery in the "before incision" intervention group (179/196) compared to the "post clamping" comparison group (74/91) (p = 0.015) During surgery, all women received general anaesthesia. **Intervention Group** N = 196 **Comparison Group** N = 91		before incision intervention group = 1/196 (0.5%) after clamping comparison group = 0/91 (0%) p value = 1.0 5) Endometritis Definition: fever, open cervix on vaginal examination and vaginal bleeding before incision intervention group = 0/196 (0%) after clamping comparison group = 0/91 (0%) **Neonatal outcomes** Follow up of women and neonates was performed by one of two investigators; the other investigator performed the intervention. Outcomes were assessed by a trained nurse on days 1, 3 and 7. Sepsis work up was performed by well-orientated paediatrician. 1) Total neonatal sepsis before incision intervention group = 4/196 (2.0%) after clamping comparison group = 1/91 (1.1%) p value = 1.0 (NCC calculated p = 0.67) 2) Total need for NICU before incision intervention group = 5/196 (2.6%) after clamping comparison group = 1/91 (1.1%) p value = 0.668 3) Newborn hospitalisation (days) before incision intervention group = 2.99± 0.07, n=196 after clamping comparison group = 2.99± 0.11, n=191 p value = 0.578	Comparison: None Outcomes assessed: None Imprecision No statistically significant differences between treatment and comparison groups for any maternal or neonatal outcome	

Bibliographic details	Number of Participant Participant Characteristics	Intervention characteristics	Outcome measures	Quality Assessment	Reviewer comment
Authors Sullivan,S.A., Smith,T., Chang,E., Hulsey,T., Vandorsten,J.P., Soper,D. **Year of publication** 2007 **Study location** USA **Ref ID** 57285 **Aim of study** To determine whether the administration of cefazolin prior to skin incision was superior to administration at the time of umbilical cord clamping for the prevention of post-caesarean infectious morbidity **Study type** Randomised controlled study	**Inclusion Criteria** Women were eligible for inclusion if the estimated fetal gestational age was > 24 weeks and caesarean delivery was required at the tertiary care center **Exclusion Criteria** Cephalosporin allergy Gestational age < 18 weeks Exposure to any antibiotic within 1 week of delivery Need for an emergent caesarean delivery **Baseline Characteristics** At baseline, there were no significant differences between the intervention and comparison groups for mean maternal age, mean maternal weight, parity, race, Medicaid cover, premature delivery (less than 37 weeks, 30/175 [17%] vs. 46/182 [25%]; p=0.08), mean fetal gestational age (37.5 ± 2.8 vs. 37 ± 3.1; p=0.11) and birthweight.	**Intervention** 1g IV cefazolin in 50cc normal saline given at least 15 minutes prior to skin incision and 50cc IV normal saline given at time of cord clamping Infusion bags including cefazolin or placebo were identical in appearance Surgery performed by resident physicians, giving a longer than average surgery time (infection risk factor) **Comparison** 50cc IV normal saline given at least 15 minutes prior to skin incision and 1g IV cefazolin in 50cc normal saline given at time of cord clamping Infusion bags including cefazolin or placebo were identical in appearance Surgery performed by resident physicians giving a	**Maternal outcomes** 1) Total infectious morbidity Includes endomyometritis, wound infection, haematoma/seroma, pyelonephritis and pneumonia (definitions given) before incision intervention group = 8/175 (4.5%) after clamping comparison group = 21/182 (11.5%) RR 0.4 (95% CI 0.18 to 0.87) (NCC calculated RR 0.39) Adjusted OR 0.35 (95% CI 0.14 to 0.82) OR adjustment made during logistic regression for 6 unspecified demographic and clinical variables associated with infectious risk. 2) Wound infection Definition: purulent discharge, erythema and induration of the incision site before incision intervention group = 5/175 (3%) after clamping comparison group = 10/182 (5%) RR 0.52 (95% CI 0.18 to 1.5) Adjusted OR 0.4 (95% CI 0.14 to 1.3) OR adjustment made during logistic regression for 6 unspecified demographic and clinical variables associated with infectious risk. 3) Endomyometritis Definition: maternal fever greater than 100.4° F on two separate occasions, along with fundal tenderness, tachycardia or leukocytosis	Limitations Allocation concealment: Yes, random number table used by pharmacy staff to generate sequence Participants blinded to intervention: Yes Carers blinded to intervention: Yes Investigators blinded to intervention: Yes Number of participants not completing treatment: 8 (3 from intervention group, 5 from comparison group) Number of participants with no available outcome data: None, data found for all treatment non-completers Selective outcome reporting: No Any other limitations: No Indirectness Population: Tertiary center for high risk group (see baseline characteristics) Intervention: None Comparison: None Outcomes assessed: None - definitions given for outcomes assessed and relevant Imprecision Statistically significant benefit of	**Funding** Department of Obstetrics and Gynaecology Research Foundation, Medical University of South Carolina **Other information** Informed consent given by women: Yes Sample size calculation: Power = 0.80, α = 0.05 requires 174 subjects in each arm to detect a 50% decrease in overall infectious morbidity for subjects given pre-operative antibiotic prophylaxis Ethics board permission: Institutional

	There were no significant differences between the intervention and comparison groups for the following obstetric variables : indications for caesarean section, diabetes, multiple gestation, pre-eclampsia, estimated blood loss, ROM time, internal monitors, subcutaneous drain insertion and operative time. The author notes that, compared to the general population, the study population (from a tertiary care centre) was at higher risk. Specifically, women were more obese, and more likely to have diabetes, pre-term delivery, multiple gestation and be of a minority ethnic group. Treatment effects might be diminished in a lower risk group. **Intervention Group** N = 175 mothers **Comparison Group** N = 182 mothers	longer than average surgery time (infection risk factor)	before incision intervention group = 2/175 (1%) after clamping comparison group = 10/182 (5%) RR 0.2 (95% CI 0.15 to 0.94) (NCC calculated RR 0.208) Adjusted OR 0.22 (95% CI 0.05 to 0.9) OR adjustment made during logistic regression for 6 unspecified demographic and clinical variables associated with infectious risk. **Neonatal outcomes** 1) Sepsis Definition: a positive blood culture before incision intervention group = 6/185 (3%) after clamping comparison group = 7/194 (3%) p value = 0.99 2) Number of NICU admissions Determined by staff neonatologists blinded to group assignment before incision intervention group = 25/185 (13.5%) after clamping comparison group = 33/194 (17%) p value = 0.40 3) Mean number of days in NICU Determined by staff neonatologists blinded to group assignment before incision intervention group = 14.2 ± 15.8, n = 185 after clamping comparison group = 19.7 ± 24.9, n = 194 p value = 0.01 4) Length of stay Unit of measurement unspecified, determined by staff neonatologists blinded to group assignment.	pre-clamp antibiotics for maternal outcomes Statistically significant benefit of pre-clamp antibiotics to reduce mean number of days in NICU No other statistically significant differences were found for other neonatal outcomes	Review Board at the Medical University of South Carolina and the research division of the Department of Obstetrics and Gynaecology (approval #11120 Jan 2003)

			before incision intervention group = 6.6 ± 9.9, n = 185 after clamping comparison group = 8.5 ± 15.8, n = 194 p value = 0.17 5) Intermediate admission No definition reported, determined by staff neonatologists blinded to group assignment. before incision intervention group = 35/185 (19%) after clamping comparison group = 32/194 (16.4%) p value = 0.65 6) Sepsis workup before incision intervention group = 35/185 (19%) after clamping comparison group = 36/194 (18.5%) p value = 0.96		

Bibliographic details	Number of Participant Participant Characteristics	Intervention characteristics	Outcome measures	Quality Assessment	Reviewer comment
Authors Thigpen,B.D., Hood,W.A., Chauhan,S., Bufkin,L., Bofill,J., Magann,E., Morrison,J.C. **Year of publication** 2005 **Study location** USA **Ref ID** 57297 **Aim of study** To determine whether the timing of prophylactic antibiotics at caesarean delivery influences maternal/neonatal infectious morbidity **Study type** Randomised controlled study	**Inclusion Criteria** Women in active labour who subsequently required a caesarean section Women with GBS were given aqueous penicillin 5 million units IV then 3 million units q 4 hours **Exclusion Criteria** Acute chorioamnionitis Allergy to penicillin or cephalosporins Caesarean section without labour Administration of antibiotics in the previous 2 week prenatal period Vaginal birth before caesarean section performed 44/346 women were excluded prior to randomisation **Baseline Characteristics** At baseline, there were no significant differences between the intervention and comparison groups in age, race, gestational age nulliparity, parity, cervical ripening, induction and cervical dilation. Perioperatively, there were	**Intervention** 2g IV cefazolin given before skin incision and IV placebo given just after cord clamping **Comparison** IV placebo given before skin incision and 2g IV cefazolin given just after cord clamping	**Maternal outcomes** 1) Wound infection Definition: tenderness with wound dehiscence, breakdown of surgical edges, and/or purulent drainage with or without an elevated maternal temperature before incision intervention group = 6/153 after clamping comparison group = 8/149 RR 0.84 (95% CI 0.45 to 1.55) (NCC calculated RR 0.73 [95% CI 0.25 to 2.05]) 2) Endometritis Definition: maternal temperature ≥ 100.4°F on 2 separate occasions 6 hours apart, exclusive of the first 12 hours following surgery accompanied by uterine tenderness and/or purulent or foul smelling lochia before incision intervention group = 12/153 after clamping comparison group = 22/149 RR 0.67 (95% CI 0.42 to 1.07) (NCC calculated RR 0.52 [95% CI 0.26 to 1.01]) **Neonatal outcomes** 1) Total infectious morbidity Includes suspected sepsis, sepsis, pneumonia, UTI, meningitis, and viral syndrome. Definitions given. before incision intervention group = 20/153 after clamping comparison group = 21/149 RR 0.96 (95% CI 0.68 to 1.34) 2) Sepsis	Limitations Allocation concealment: Yes, pharmacy controlled Participants blinded to intervention: Yes Carers blinded to intervention: Yes Investigators blinded to intervention: Yes Number of participants not completing treatment: 44 women excluded prior to randomisation Number of participants with no available outcome data: None Selective outcome reporting: No Any other limitations: Indirectness Population: Population at high risk of infection Intervention: None Comparison: None Outcomes assessed: None Imprecision There were no statistically significant differences between treatment and comparison groups for any maternal or neonatal outcome	**Funding** Not reported **Other information** Informed consent given by women: Yes Sample size calculation: Power = 0.08 to detect a 10% difference between the 2 groups with 300 women in total. This was attained due to endometritis and wound infection rates being 50% higher than expected Ethics board permission: Institutional Review Board for the University of Mississippi Medical Centre (IRB #2000-112, Nov 28 2000)

	no significant differences between the intervention and comparison groups for cervical dilation at CS, other antibiotic prophylaxis before CS, general anaesthesia, indications for CS, operative time, estimated blood loss, pre- and post-operative haematocrit. There was a significant difference between groups in the time since membranes had ruptured (7.2 hrs±5.8 " skin incision group" vs. 8.6hrs ±6.4 "post clamp" group; p=0.045). Additional IV fluids were given at the discretion of the attending anaesthetist, but no other antibiotics were given unless a postoperative infection was diagnosed. **Intervention Group** N = 153 **Comparison Group** N = 149		Determined by a positive blood culture. before incision intervention group = 7/153 after clamping comparison group = 7/149 RR 0.96 (95% CI 0.58 to 1.69) (NCC calculated RR 0.97 [95% CI 0.35 to 2.70]) 3) NICU admission before incision intervention group = 20/153 after clamping comparison group = 21/149 RR 1.28 (95% CI 0.91 to 1.79) (NCC calculated RR 0.92 [95% CI 0.52 to 1.63])		

Bibliographic details	Number of Participant Participant Characteristics	Intervention characteristics	Outcome measures	Quality Assessment	Reviewer comment
Authors Yildirim,G., Gungorduk,K., Guven,H.Z., Aslan,H., Celikkol,O., Sudolmus,S., Ceylan,Y. **Year of publication** 2009 **Study location** Turkey **Ref ID** 57299 **Aim of study** To determine whether the timing of antibiotic prophylaxis at caesarean delivery influences maternal and neonatal infectious morbidity **Study type** Randomised controlled study	**Inclusion Criteria** Women undergoing elective caesarean section during June 2007 and December 2007 in a tertiary care centre (without any exclusion criteria) **Exclusion Criteria** Use of antibiotics in the previous 24 hours Pathology needing treatment with antibiotics Pre-existing maternal disease such as diabetes, collagen vascular disease, or immune system problems Chorioamnionitis Fever on admission Need for transfusion before or during CS Preterm CS **Baseline Characteristics** At baseline, there were no significant differences between intervention and comparison groups in age, gravidity, parity, fetal gestational age, indications	**Intervention** 1g IV cefazolin in 50cc normal saline given 10 to 45 minutes prior to skin incision **Comparison** 1g IV cefazolin in 50cc normal saline post clamping	**Maternal outcomes** 1) Total infectious morbidity No definition given before incision intervention group = 17/194 (8.8%) after clamping comparison group = 23/195 (11.8%) p value = 0.32 RR 1.39 (95% CI 0.71 to 2.69) 2) Overall infectious morbidity Includes febrile morbidity, wound infection, endometritis, UTI, mastitis, septic pelvic thrombophlebitis, and RTI before incision intervention group = 23/194 (11.9%) after clamping comparison group = 27/195 (13.8%) p value = 0.65 RR 1.19 (95% CI 0.65 to 2.16) 3) Febrile morbidity Definition: persistent fever of greater than 38°C for at least 24 hours after surgery, not associated with lower abdominal or pelvic tenderness and with no signs of infection elsewhere. before incision intervention group = 9/194 (4.6%) after clamping comparison group = 7/195 (3.6%) p value = 0.60 RR 0.76 (95% CI 0.29 to 2.09) 4) Wound infection	Limitations Allocation concealment: Yes Participants blinded to intervention: No Carers blinded to intervention: Unclear Investigators blinded to intervention: Unclear Number of participants not completing treatment: 11 (6 in intervention group, 5 in comparison group) Number of participants with no available outcome data: 11 Selective outcome reporting: No Any other limitations: Indirectness Population: None Intervention: None Comparison: None Outcomes assessed: None Imprecision No statistically significant differences were found between the two treatment groups for any maternal or neonatal outcome	**Funding** Not reported **Other information** Informed consent given by women: Yes Sample size calculation: Power = 80%, α = 0.05, 197 women needed to detect a 50% difference in postoperative infections Ethics board permission: Not reported

	for CS or BMI. Perioperatively, there were no significant differences between intervention and comparison groups for pre- or post-operative haematocrit, pre- or post-operative haemoglobin, estimated blood loss, pre-operative temperature or operative time. **Intervention Group** N = 194 **Comparison Group** N = 195		Definition: erythema, swelling, discharge or tenderness before incision intervention group = 6/194 (3.1%) after clamping comparison group = 8/195 (4.1%) p value = 0.59 RR 1.34 (95% CI 0.45 to 3.93) 5) Endometritis Definition: body temperature of greater than 38.5°C with concomitant foul smelling discharge or abnormally tender uterus on bimanual examination before incision intervention group = 5/194 (2.6%) after clamping comparison group = 7/195 (3.6%) p value = 0.56 RR 1.40 (95% CI 0.43 to 4.51) 6) Septic pelvic thrombophlebitis No definition given before incision intervention group = 0/194 (0%) after clamping comparison group = 0/195 (0%) 7) UTI MSU culture before incision intervention group = 3/194 (1.5%) after clamping comparison group = 5/195 (2.6%) p value = 0.47 RR 1.67 (95% CI 0.39 to 7.11) 8) RTI No definition given before incision intervention group = 0/194 (0%)		

			after clamping comparison group = 0/195 (0%) **Neonatal outcomes** 1) Sepsis No definition given before incision intervention group = 9/201 (4.4%) after clamping comparison group = 13/198 (6.3%) p value = 0.38 RR 1.47 (95% CI 0.61 to 3.53) 2) Number of NICU admissions before incision intervention group =4/201 (2%) after clamping comparison group = 7/198 (3.4%) p value = 0.35 RR 1.77 (95% CI 0.51 to 6.16) 3) Mean number of days in NICU before incision intervention group = 8.25 ± 2.62, n=201 after clamping comparison group = 5.66 ± 2.58, n=198 p value = 0.16		

Bibliographic details	Number of Participant Participant Characteristics	Intervention characteristics	Outcome measures	Quality Assessment	Reviewer comment
Authors Wax,J.R., Hersey,K., Philput,C., Wright,M.S., Nichols,K.V., Eggleston,M.K., Smith,J.F. **Year of publication** 1997 **Study location** USA **Ref ID** 57294 **Aim of study** To test the hypothesis that a single 1g dose of cefazolin administered preoperatively is no more effective than one administered after cord clamping in preventing post caesarean infections **Study type** Randomised controlled study	**Inclusion Criteria** Women undergoing caesarean section if in labour with a single fetus of at least 37 weeks gestation, recruited over the course of 12 months. **Exclusion Criteria** Penicillin or cephalosporin allergy Antibiotic use within 2 weeks of delivery Temperature ≥37.8°C in labour Insulin dependent diabetes mellitus HIV infection Chronic glucocorticoid use Multiple gestation. **Baseline Characteristics** The women in the two groups were similar for maternal age, race and weight. The two groups were also similar for the following intrapartum and surgical	**Intervention** Pharmacy prepared 50ml intravenous infusion for each patient containing 1g of cefazolin in 0.9% saline identical in appearance **Comparison** Pharmacy prepared 50ml intravenous infusion for each patient containing 0.9% saline	**Maternal outcomes** 1) Total infectious morbidity Definition: wound infection, endometritis, intra-abdominal abcess formation, septic pelvic thrombophlebitis, pneumonia or UTI before incision intervention group = 2/49 after clamping comparison group = 3/41 2) Wound infection Definition: incisional erythema, tenderness, warmth, with or without purulent drainage before incision intervention group = 1/49 after clamping comparison group = 2/41 3) Endometritis Definition: fever reaching 100.4°F on two occasions at least 6 hours apart or a single fever ≥ 101°F outside the first 24 hours following delivery, associated with uterine or parametrial tenderness, malodorous or purulent lochia or leucocytosis. before incision intervention group = 1/49 after clamping comparison group = 1/41 4) Septic pelvic thrombophlebitis No definition given. before incision intervention group = 0/49	Limitations Allocation concealment: Yes, computer generated randomisation code used by pharmacy staff to generate sequence Participants blinded to intervention: Yes Carers blinded to intervention: Yes Investigators blinded to intervention: Yes Number of participants not completing treatment: None Number of participants with no available outcome data: None Selective outcome reporting: No Any other limitations: No Indirectness Population: Military hospital Intervention: None Comparison: None Outcomes assessed: None - definitions given for outcomes assessed and relevant Imprecision No statistically significant differences were found for maternal or neonatal outcomes	**Funding** Supported by the Bureau of Medicine and Surgery Clinical Investigation Program P93-00000-029 **Other information** Study size calculation: The study was powered for the primary outcome of endometritis. Given a 20% post-caesarean rate of endometritis, a sample size of 88 subjects would provide 80% power to detect a 25% difference in post-operative infections with $\alpha = 0.05$. Written and verbal consent given by

	characteristics: number of women with ruptured membranes, duration of rupture, number of women on whom internal monitors were used, number of vaginal examinations, pre-operative haematocrit, general anaesthetic, vertical uterine incision, manual placental delivery, duration of surgery, time from infusion to incision, and time from incision to second incision. The group receiving cefazolin preoperatively had a significantly longer mean duration of labour (13.0 ±7.2 hours, n = 49 vs. 9.9 ± 7.3 hours, n = 41; p = 0.03) and internal monitors were used for significantly longer (11.1 ± 4.2, n = 49 vs. 9.3 ± 4.7, n = 41; p = 0.04) when compared to the group receiving antibiotics after cord clamping. Their babies were similar for gestational age at delivery, birth weight, newborn 1 and 5 minutes Apgar scores < 7, umbilical arterial cord pH < 7.2 and intensive care admissions.		after clamping comparison group = 0/41 5) UTI No definition given. before incision intervention group = 0/49 after clamping comparison group = 0/41 **Neonatal outcomes** 1) Neonatal sepsis before incision intervention group = 0/49 after clamping comparison group = 0/41 2) Neonatal sepsis workup before incision intervention group = 6/49 after clamping comparison group = 2/41 p = 0.28 3) Neonatal pneumonia Definition: based on clinical and radiographic findings before incision intervention group = 2/49 after clamping comparison group = 0/41		participants Ethical approval given by hosting organisation

	Intervention Group n = 49 **Comparison Group** n = 41				

Bibliographic details	Number of Participant Participant Characteristics	Intervention characteristics	Outcome measures	Quality Assessment	Reviewer comment
Authors Gordon,H.R., Phelps,D., Blanchard,K. **Year of publication** 1979 **Study location** USA **Ref ID** 57293 **Aim of study** To resolve whether antibiotics can be started during surgery or immediately after cord clamping with the same decrease in maternal postoperative morbidity as when started pre-operatively, and whether the antibiotics have an effect on neonatal morbidity, including nursery stay **Study type** Some other intervention type	**Inclusion Criteria** Starting November 1976, all obstetric patients undergoing caesarean section at 2 Los Angeles medical centres were considered for inclusion. These were primarily indigent cases. **Exclusion Criteria** Exclusions were: penicillin allergy, temperature > 38°C prior to caesarean section, women already on prescribed antibiotics and those who declined to participate. The ethical board did not permit inclusion of emergency caesarean sections (due to anticipated difficulties with getting consent from women) and this resulted in sections for fetal distress and bleeding generally being excluded. For this review, a third treatment group who received no antibiotics is not reported. **Baseline Characteristics**	**Intervention** 1g of ampicillin given intravenously 15 - 30 minutes prior to anaesthetic induction and repeated 2 and 8 hours postoperatively for a total of 3 doses **Comparison** 1g ampicillin given intravenously immediately on clamping the umbilical cord and repeated 2 and 8 hours postoperatively for a total of 3 doses	**Maternal outcomes** 1) Total infectious morbidity Definition: includes endometritis, urinary tract infection and/or wound infection, with a positive culture. Inclusion of other infections not confirmed. before incision intervention group = 4/38 (10.6%) after clamping comparison group = 3/40 (7.3%) p = NS 2) Wound infection Definition: positive culture before incision intervention group = 0/38 after clamping comparison group = 1/40 p = NS 3) Endometritis Definition: positive culture before incision intervention group = 4/38 after clamping comparison group = 2/40 p = NS 4) Mean length of maternal hospital stay (days) before incision intervention group = 5.1, n = 38 after clamping comparison group = 4.7, n = 40 p = NS **Neonatal outcomes**	Limitations Allocation concealment: Unclear, randomisation performed, but method not stated Participants blinded to intervention: No Carers blinded to intervention: Yes Investigators blinded to intervention: Unclear, not stated Number of participants not completing treatment: None Number of participants with no available outcome data: None Selective outcome reporting: No Any other limitations: Only elective caesarean sections are included. Data not reported for neonatal outcomes because the number in each treatment group is not specified Indirectness Population: None Intervention: None Comparison: None Outcomes assessed: None - definitions given for outcomes assessed and relevant Imprecision No statistically significant differences were found for any maternal outcome	**Funding** Not stated **Other information** Ethical approval given by "The Human Subject Protection Committee" for inclusion of elective caesarean sections only No power calculation given

	64 women were cared for at the San Bernardino County Medical Centre and 50 were cared for at the University of California at Los Angeles Medical Centre. The author reports "acceptable randomisation" for baseline characteristics of indication for caesarean section (CPD, breech, repeat caesarean section, failed induction, bleeding, fetal distress), meconium, blood transfusion, duration of labour, duration of membranes rupture and duration of internal monitoring. No risk ratios or p values provided. **Intervention Group** N = 38 **Comparison Group** N = 40		None reportable, due to the numbers of participants in each group not being specified.		

Caesarean Section (update)

What are the risks and benefits of planned caesarean section compared with planned vaginal birth for both women and babies in women who have had a previous caesarean section?

Bibliographic details	Number of Participant Participant Characteristics	Intervention characteristics	Outcome measures to be used	Results	Reviewer comment
Authors Cahill,A.G., Tuuli,M., Odibo,A.O., Stamilio,D.M., Macones,G.A. **Year of publication** 2010 **Country of publication** USA **Ref ID** 65899 **Sub-type** Retrospective cohort study **Aim of study** To estimate the rate of success and risk of maternal morbidities in women with three or more caesareans who attempted vaginal birth after caesarean (VBAC)	**Inclusion Criteria** Women with at least one prior caesarean delivery **Exclusion Criteria** Women without a prior low transverse uterine incision **Demographics - Total** Total n = 25005 with a history of prior CS (860/25,005 had at least 3 CS) **Cases** n = 771/860 elected for a repeat CS **Controls** n = 89/860 had planned VBAC	**Experimental** Women who had ≥3 prior CS and elected for a repeat caesarean n=771 **Control** Women with attempted VBAC after ≥3 caesareans n = 89 Women attempted VBAC after one or two prior caesareans n =13,617 (2 prior CS = 1082, 1 prior CS = 12,535) **method** Between 1996 and 2000, the maternal risks associated with VBAC in women with at least one prior CS were studied in 17 centres in the north eastern USA. This study is a secondary analysis of women with the history of three or more caesareans who attempted VBAC. Women were identified for inclusion using	**Outcomes** Uterine rupture (defined a priori as full thickness disruption of the uterine scar, identified at laparoscopy) Bladder injury Surgical injury Transfusion (need for transfusion) Fever (determined by the caring physician, temperature of > 38.0°C) **Raw Data** **Summary Data**	**Results** Women with ≥3 prior CS n = 860/25,005 (n = 89 planned VBAC, n = 771 elected for repeat CS): n=748/860 (87%) had 3 prior CS n = 97/860 (11%) had 4 prior CS n = 13/860 (1.5%) had 5 prior CS n = 2/860 (0.2%) had 6 prior CS Successful VBAC attempt (%): Women with ≥3 prior CS = 79.8% Women with 2 prior CS = 74.6% Women with 1 prior CS = 75.5%	**Funding** Supported by a grant from NICHD **Quality Items** **Other information** There were no significant differences between the VBAC and elective repeat caesarean groups with respect to gravidity, diabetes, hypertension and twin gestation. Women in attempted VBAC group were significantly younger, delivered about one week earlier, were more likely to be of black race and were less likely to deliver at a university hospital. When compared with those who had one prior CS, women with ≥3 prior CS and attempted VBAC had a significantly higher rate of preterm birth (<34), had significantly higher rate of alcohol and tobacco use, were more likely to be of black race

		International Classification of Disease, Ninth Revision (ICD - 9) for 'previous caesarean delivery, delivered'. Charts were extracted by trained research nurses using close ended extraction tools.		Successful VBAC attempt ≥3 prior vs. 1 prior CS: Unadjusted RR 1.06 (95% CI 0.95 to 1.17) Adjusted OR* 1.40 (95% CI 0.81 to 2.41) p = 0.22 Successful VBAC attempt ≥3 prior vs. 2 prior CS: Unadjusted RR 1.07 (95% CI 0.96 to 1.19) Adjusted OR* 1.49 (95% CI 0.85 to 2.60) p = 0.16 <u>VBAC (≥3) vs. Repeat CS :</u> <u>Uterine rupture = n/total (%)</u> VBAC = 0/89 (0) Repeat CS = 0/771 (0) p = NC <u>Bladder injury = n/total (%)</u> VBAC = 0/89 (0) Repeat CS = 12/771 (1.6) p = 0.24 <u>Surgical injury= n/total (%)</u> VBAC = 0/89 (0)	and less likely to deliver at a university hospital. No significant difference was observed between the two groups with respect to maternal age, post term birth, diabetes, prior vaginal delivery, induction and oxytocin exposure.

				Repeat CS = 7/771 (0.9) p = 0.44 <u>Transfusion (need for transfusion) = n/total (%)</u> VBAC = 2/89 (2.2) Repeat CS = 17/771 (2.2) Unadjusted RR 1.02 (95% CI 0.24 to 4.34) p = 0.98 <u>Fever= n/total (%)</u> VBAC = 14/89 (15.7) Repeat CS = 121/771 (15.7) p = 0.99 Unadjusted RR 1.00 (95% CI 0.60 to 1.67) <u>VBAC ≥ 3 prior CS vs. VBAC 1 prior CS</u> <u>Transfusion ≥ 3 prior CS = 2.2%</u> <u>Transfusion 1 prior CS = 0.7%</u> Adjusted OR*: too few events to perform adjusted	

				analysis p = 0.10 <u>Fever ≥ 3 prior CS = 15.7%</u> <u>Fever 1 prior CS = 9.5%</u> Adjusted OR** 1.50 (95% CI 0.50 to 4.56) p = 0.47 <u>VBAC ≥ 3 prior CS vs. VBAC 2 prior CS</u> <u>Transfusion ≥ 3 prior CS = 2.2%</u> <u>Transfusion 2 prior CS = 0.9%</u> Adjusted OR: too few events to perform adjusted analysis p = 0.25 <u>Fever ≥ 3 prior CS = 15.7%</u> <u>Fever 2 prior CS = 8.9%</u> Adjusted RR** 1.80 (0.59 - 5.51) p = 0.30 *adjusted for prior vaginal delivery, induced labour,	

				oxytocin exposure, or diabetes (any type) ** adjusted for prior vaginal delivery or black vs. non black race **Results 2** **Results 3**	

Bibliographic details	Number of Participant Participant Characteristics	Intervention characteristics	Outcome measures to be used	Results	Reviewer comment
Authors Guise,J.M., Eden,K., Emeis,C., Jonas,D.E., Morgan,L.C., Reuland,D., Gilchrist,M., Finkelstein,J., Wiswanathan,M., Lohr,K.N., Lyda-McDonald,B. **Year of publication** 2010 **Country of publication** Developed countries **Ref ID** 66341 **Sub-type** **Aim of study** To examine the published literature on vaginal birth after caesarean (VBAC) and review the trends and incidence of VBAC, maternal benefits and harms, infants benefits and harms and relevant factors influencing each.	**Inclusion Criteria** Full text studies with data on women with a prior caesarean delivery eligible for a TOL (trial of labour) or ERCD (elective repeat caesarean delivery) and maternal and/or infant outcomes. Studies were included if: They had 10 or more participants, represented the target population, and reported data on benefits and harms to the mother or infant. Studies of women with prior caesarean delivery who delivered preterm and at term were included (for maternal outcomes). For neonatal outcomes, studies which reported outcomes for term babies (≥ 37 weeks) were included. **Exclusion Criteria** Studies of women without a prior caesarean delivery, nulliparous patients, breech delivery, exclusive focus on preterm delivery, low birth weight, studies of pregnancies including twins or abortions, studies begun or published	**Experimental** Elective Repeat Caesarean Delivery (ERCD) **Control** Trial of labour (TOL) No studies of health outcomes measured "intended" vaginal birth after caesarean (VBAC) therefore primary comparison groups are TOL and ERCD. **method**	**Outcomes** **Raw Data** Studies were included in the synthesis if they achieved a good or fair quality rating. Two reviewers independently rated the quality of the RCTs, cohorts, case control studies and case series studies using valid tools specific to different study designs. The strength of available evidence was assessed using the method described in the Methods Reference Guide for Effectiveness and Comparative Effectiveness Reviews (Similar to the GRADE system). Meta analysis was conducted for homogenous studies using MetaAnalyst (Beta 3.13) and STATA 10.1 (Stata Corp). A random effects model was used to combine the studies while incorporating variations among studies. Statistical heterogeneity assessed using the standard Q test and the chi square statistic. **Summary Data** Maternal outcomes:	**Results** Maternal outcomes: Mortality rate Any gestational ages (GAs) n = 12 studies: Overall: Total n = 24/402,883 ERCD: n = 19/229635 13.4 per 100,000 (95% CI 4.3 to 41.6 per 100,000) Heterogeneity p = 0.521 TOL n = 5/167,220 3.8 per 100,000 (95% CI 0.9 to 15.5 per 100,000) Heterogeneity Fisher exact test p = 0.443 RR 2.76 (95 % CI 1.07 to 714) Adjusted risk difference = 9	**Funding** Supported by the office of Medical Applications of Research (OMAR) at the National Institute of Health and the Agency for Healthcare Research and Quality (AHRQ) **Quality Items** **Other information** The range of ToL and VBAC rates were large (28 - 82% and 49 - 87% respectively). In 43 US based studies, 74% of women who had a ToL gave birth vaginally: Overall studies: n = 67 (14 prospective cohort studies + 53 retrospective cohort studies) Vaginal birth after caesarean rates in US studies Any GAs n = 30 studies 0.74 (95% CI 0.71 to 0.77) Term n= 13 studies 0.73 (95% CI 0.70 to 0.77) Vaginal birth after caesarean

	before the 1980 NIH Consensus Conference on VBAC, and studies focusing on patients with particular conditions such as gestational diabetes, HIV, preeclampsia, etc. Non-English language papers, editorials, letters, studies available exclusively in abstract form, and studies of animals or cadavers were also excluded. Studies conducted in undeveloped or developing countries were excluded. For the neonatal outcomes, any studies that did not exclude cases with congenital or fetal anomalies (before or after analysis) were excluded **Demographics - Total** Relevant studies were identified from multiple searches of MEDLINE; DARE; Cochrane data base (1966 to September 2009); and from recent systematic reviews, reference lists, reviews, editorials, websites and experts. Of the 3,134 citations reviewed, 2171 met the exclusion criteria at the abstract level, 936 full text papers were retrieved and reviewed for inclusion. A total		<u>Mortality</u> All GAs n = (12 good or fair quality studies observational studies) Term studies (n = 4 good or fair quality studies observational studies) Only one of the studies stratified maternal death rates by the institution size/number of births. <u>Uterine rupture</u> Defined as a complete uterine rupture (separation through the entire thickness of the wall including visceral serosa) or incomplete uterine rupture (separation that was not completely through the entire thickness of the wall including visceral serosa) All GAs (n = 4 good or fair quality observational studies) <u>Transfusion/PPH</u> Term studies (n = 4 good or fair quality observational studies) <u>Hysterectomy</u>	less death per 100,000 (95% CI 1.6 to 11.7) from ToL group when compared to the ERCD group. <u>Term studies n= 4 studies:</u> <u>Overall:</u> n = 20/381929 <u>ERCD:</u> n = 17/225239 9.6 per 100,000 (95% CI 2.1 to 43.2 per 100,000) Heterogeneity = Fisher's exact test p = 0.013 <u>TOL:</u> n = 3/156690 1.9 per 100,000 (95% CI 0.4 to 9.5 per 100,000) Heterogeneity Fisher's exact test p = 0.443 RR 3.94 (95% CI 1.2 to 12.5; p = 0.025) Adjusted risk difference = 7 less death per 100,000 (95% CI 1.4 to 8.7) from ToL group when compared to the ERCD group.	<u>rates in non-US studies</u> <u>Any GAs n = 19 studies</u> 0.73 (95% CI 0.70 to 0.77) <u>Term n = 5 studies</u> 0.73 (95% CI 0.71 to 0.74) Studies were stratified by the year of data collection, study design, country and gestational age. No factors except "study design" were found to result in statistically significant differences. The rate of VBAC for 14 prospective studies was 73% (95% CI 71% to 77%) compared with 77% (95% CI 75% to 79%) for the 53 retrospective studies.

	of 203 full text papers met inclusion after applying paper inclusion/exclusion criteria. **Cases** **Controls**		Term studies (n = 3 good or fair quality observational studies) Infection All GAs (n = 10 good or fair quality observational studies) The confidence in the magnitude and direction of the body of evidence is low due to inconsistencies in definition, indirect evidence, and high risk of bias. Five studies reported on endometritis and chorioamnionitis and five other studies reported on wound and other postpartum infections. Surgical injury All GAs (n = 7 observational studies, 4 from same cohort of patients that reported differently on surgical injury rates) Surgical injury was defined differently between studies. Length of hospital stay All GAs (n = 8 good or fair quality studies observational	One Canadian study stratified maternal death rate by institution size: Less than 500 deliveries per year: Odds ratio TOL compared with RCD = 2.68 (95% CI 0.16 to 45.5) Higher than 500 deliveries per year: Odds ratio TOL compared with RCD = 0.16 (95% CI 0.02 to 1.29) Uterine rupture rate All GAs n = 4 studies: Overall: n = 154/47,202 ERCD: n = 6/26535 Uterine rupture rate: 0.026% (95% CI 0.009 to 0.082)	

			studies) All studies were affiliated with teaching institutions. There was significant heterogeneity among studies I^2 = 98.2%, p < 0.001 Neonatal outcomes <u>Mortality</u> Perinatal mortality: Defined as death at less than 28 days age and fetal deaths of 20 weeks or more gestation Term studies (n = 5 good or fair quality observational studies), 3 conducted in tertiary or university settings, 2 studies used population databases. Neonatal mortality: Defined as death in the first 28 days of life Term studies (n = 6 good or fair quality observational studies), 2 studies representative of academic medical centres, 2 studies representative of population database and 2 studies representative of a diversity of hospital types)	Heterogeneity Fisher exact test p = 0.421 <u>TOL:</u> n = 148/20717 Uterine rupture rate: 0.47% (95% CI 0.28% to 0.77%) Heterogeneity Fisher exact test = I^2 = 77.6% p = 0.004 RR 0.031 (95% CI 0.014 to 0.070) Adjusted risk difference = 5.1 additional ruptures per 1000 women undergoing TOL (95% CI 2.3 to 11.2) The increased risk of uterine rupture among the TOL group is largely affected by one study that included women with incisional types other than low transfer caesarean section. However the authors concluded that the contribution of incisional types to the overall data set was small, thus leaving this finding largely unexplained. None of the four studies provided details on	

			TOL = Test for heterogeneity performed based on fisher exact test: p = 0.037 <u>NICU admission</u> All GAs (n = 8 good or fair quality observational studies), inconsistency and imprecise measures, no studies defined the criteria for NICU admission <u>Sepsis</u> All GAs (n = 3 good or fair quality observational studies) <u>Neonatal respiratory morbidity</u> Term studies (n = 6 fair quality observational studies) <u>Bag and mask ventilation</u> All GAs (n = 3 good or fair quality observational) <u>Rates of transient tachypnea (TTN)</u> Term studies (n = 3 good or fair quality observational studies)	the proportion of women who underwent induction of labour. <u>Term n = 2 studies:</u> <u>Overall:</u> n = 222/34445 <u>ERCD:</u> n = 4/18195 Uterine rupture rate = 0.02% (95% CI 0.003 to 0.189) <u>ToL:</u> n = 118/16250 Uterine rupture rate = 0.70% (95% CI 0.51 to 0.96) RR 0.03 (95% CI 0.011 to 0.082) Adjusted risk difference = 6 more rupture per 1000 from ToL group when compared to the ERCD group. <u>Transfusion rate</u> <u>All GAs n = 9 studies:</u>	

			Hypoxic-ischemic encephalopathy/asphyxia (HIE) Term studies (n = 3 good or fair quality observational studies) lack of consistency in measurement presented in studies	Overall: n = 1353/401307 ERCD: n = 712/233884 Heterogeneity I^2 = 98.9%, p<0.001 TOL: n = 641/167423 Heterogeneity I^2 = 98.6%, p<0.001 RR 0.795 (95% CI 0.714 to 0.884) limited to term studies: 4 studies ERCD: n = 607/227960 Transfusion rate = 0.5% (95% CI 0.2 to 1.3 per 100) Heterogeneity I^2 = 99.3%, p < 0.001 TOL: n = 547/156690	

				Transfusion rate = 0.7% (95% CI 0.2% to 2.2%) Heterogeneity I^2 = 99.4%, p < 0.001 RR 0.76 (95% CI 0.67 to 0.85) Adjusted risk difference = 0.14% (95% CI 0.07 to 0.22) <u>PPH (rate %)</u> <u>All GAs n = 6 studies:</u> Studies were inconsistent regarding the definition of haemorrhage and outcomes measured n = not reported <u>ERCD:</u> n = not rported PPH rate = 6.82% <u>TOL:</u> n = not reported PPH rate = 2.36% All studies found a trend toward increased	

				blood loss with ERCD. However none found a statistically significant difference in PPH rates between TOL and RECD. <u>Term studies n = 1 study:</u> Low risk women were separated from high risk women based on antenatal conditions. Women in low risk group with ToL had a lower rate of PPH compared with RECD (2.36% vs. 6.82% p = ns) <u>Multiple CS (RCD) n= 3</u> Definitions of hemorrhage varied among studies. In one study among women with a prior caesarean delivery, the percentage of women with blood transfusions increased with increasing number of prior caesarean deliveries from 1.8, 2.6, 4.3, 4.6, and 14.6 percent for women with one to five or more prior caesarean deliveries,	

				respectively. The odds ratio for women with five or more caesarean deliveries was 7.6 (95% CI: 4.0 to 14.3). One study compared outcomes for women at a single institution in Israel undergoing a second versus three or more caesarean deliveries. Women were identified who experienced "excessive blood loss" of greater than 1000 mL or were transfused two or more units. Among women having their second caesarean delivery, 3.3 % (16/491) met this definition compared with 7.9 % (22/277) of those with two or more prior caesarean delivery (odds ratio 2.3; 95 percent CI: 1.1 to 4.5). One study performed a secondary analysis of a multicentre, retrospective cohort study and examined incidence of blood transfusion. In women with two	

				prior caesarean deliveries who did not attempt a TOL, 1.18 percent of 2,888 women received a transfusion (odds ratio 0.54; 95 % CI: 0.23 to 1.27). Rates of haemorrhage/transfusion were < 5 %, the risk appears to increase with increasing numbers of CS. **Results 2** Hysterectomy Rates <u>All GAs n = 8 studies:</u> <u>Overall:</u> n= 477/402,059 <u>ERCD:</u> n = 280/234349 Rate of hysterectomy = 0.28% (95% CI 0.12% to 0.67%) Hetrogeneity = Fisher exact test p < 0.001 <u>TOL:</u> n = 197/167710 Rate of hysterectomy = 0.17%	

				(95% CI 0.13 to 0.38) Heterogeneity $I^{2 =}$ 75.4%; p <0.001 RR 1.01 (95% CI 0.84 to 1.22) <u>Term only n=3 studies:</u> Total n = 422/383242 <u>ERCD:</u> n = 248/227479 Hysterectomy rate = 0.16% (95% CI 0.07% to 0.36%) Heterogeneity I^2 = 97.3%, p =0.672 <u>TOL:</u> n = 174/155763 Hysterectomy rate = 0.14% (95% CI 0.08% to 0.22%) Heterogeneity I^2 = 85.2%, p = 0.001 RR 0.97 (95% CI 0.804 to 1.184) <u>Rate of hysterectomy in women with multiple CS (n = 7 studies)</u> One study reported women	

				with ≥1 prior caesarean were significantly more likely to require hysterectomy (odds ratio 7.9; 95 percent CI: 5.8 to 10.7). Similarly, another study noted an increased risk for hysterectomy with primary caesarean (odds ratio 7.13; 95 percent CI: 3.71 to 13.7). The risk of peripartum hysterectomy for women with ≥2 prior caesareans was significantly higher (odds ratio 18.6; 95 percent CI: 7.67 to 45.4) than for women with one prior caesarean delivery (odds ratio 2.14; 95 percent CI: 1.37 to 3.33). Hysterectomy rates in one study for women undergoing a primary caesarean were 0.062%, and increased with one prior caesarean delivery to 0.735%. Women with ≥1 prior caesarean had a hysterectomy rate of 1.08%, these rates were statistically significant. One study compared women undergoing a second caesarean versus women with two or more prior caesareans. The rate of hysterectomy increased from 0.2% (1/491) to 1.1% (3/277) in the multiple caesarean group, but the	

				result was not statistically significant. One study found a similar rate of hysterectomy in women with four or more prior caesareans of 1.1% (2/170). One study noted increasing incidence of hysterectomy with increasing number of caesareans from 0.65, 0.42, 0.90, 2.41, 3.49, and 8.99% with zero to five or more prior caesareans, respectively. Women with five or more prior caesareans were 15 times more likely to require hysterectomy (odds ratio 15.2; 95 percent CI: 6.9 to 33.5), these results were statistically significant. Repeat caesarean section (RCD): One previous CS = OR 0.7 to 2.14 One and more CS = OR 1.4 to 7.9 Two or more CS = OR 3.8 to 18.6 <u>Infection</u> <u>All GAs n = 10 studies:</u>	

				Studies reported endometritis or chorioamniotitis and wound infection <u>ERCD:</u> Infection rate = 32 per 1000 (95% CI 13 - 73) Heterogeneity I^2 = 99.4%, p < 0.001 <u>TOL:</u> Infection rate = 46 per 1000 (95% CI 15 - 135) Heterogeneity I^2 = 99.7%, p < 0.001 <u>Term studies = not reported</u> <u>Multiple CS (RCD)</u> All GAs n = 4 studies: There was no uniform definition of infection. One US study reported an incidence of "febrile morbidity" of 19.2% (163/847) for women undergoing RCD, but the authors did not define febrile morbidity. Similarly, another study noted 14.1% of women with three or more prior cesareans had postoperative infections (odds ratio 0.9; 95%	

				CI: 0.5 to 1.8), but the criteria for infection were not defined. Urinary tract infection (UTI) and upper respiratory tract infection (URI) were used by one study to describe postoperative infectious complications. One study defined postpartum endometritis clinically on the absence of findings consistent with an extrauterine source. There was a statistically significant increase in endometritis with multiple caesareans (p<0.001). Based on these studies the risk of postoperative infection with multiple CSs remains unclear. Multiple CS (RCD) Wound infection All GAs n = 4 studies: One study reviewed wound infection and wound dehiscence and found no statistically significant change with multiple caesareans (p=0.09 and 0.18, respectively). Similarly, another study found no correlation between number of caesareans and wound problems. Surgical injury:	

				<u>All GAs n = 7 studies:</u> Four studies (4) from same cohort of patients (reported differently on surgical injury rates). None found a significant difference between ERCD and TOL for the rate of surgical injury. <u>Multiple CS n= 2 studies</u> Both studies evaluated bladder injuries. One found 1.6% of women with two or more prior caesareans had a bladder injury (4/250). Another study noted less than 0.3% of women with less than three prior caesareans experienced a bladder injury compared with 4.5% of women with five or more prior caesareans. This trend was statistically significant at p<0.001. The risk of bowel and ureteral injury with increasing number of caesareans was also statistically significant, although overall incidence was less than 1.2%. <u>Mean length of hospital stay (days)</u> <u>All GAs n = 8 studies:</u>	

				ERCD: Mean = 3.92 days (95% CI 3.56 - 4.29 days) TOL: Mean = 2.55 days (95% CI 2.34 - 2.76 days) **Results 3** Neonatal outcomes Perinatal Mortality: Term n = 5 studies: Overall: n = 118/76899 ERCD: n = 46/35,686 Mortality rate = 0.05% (95% CI 0.007% - 0.38%) ToL: n = 72/41,213 Mortality rate = 0.13% (95% CI 0.06% - 0.3%) RR 0.73 (95% CI 0.51 to 1.06)	

				Adjusted risk difference : 0.41% (95% CI 0.012% to 0.08%) Intrapartum death rate: TOL = 0.1 to 0.4 per 1000 ERCD = 0 to 0.04 per 1000 <u>Neonatal Mortality</u> <u>Term n = 6 studies</u> <u>Overall:</u> n = 91/108328 <u>ERCD:</u> n = 40/63,843 Mortality rate = 0.5% (95% CI 0.02% to 0.15%) <u>TOL:</u> n = 51/44,485 Mortality rate = 0.11% (95% CI 0.06% to 0.2%) Heterogeneity based on Fisher's exact test: p = 0.0218 RR 0.546 (95% CI 0.362 to 0.824)	

				<u>NICU admission</u> n = 8 studies (pooled data not reported) 6 of the 8 studies found no significant differences in frequency of NICU admission between TOL and ERCD One study reported the greater risk of NICU admission in infants undergoing an ERCD without labour (OR = 2.93) when compared to a successful VBAC (OR = 1.0g) <u>Sepsis</u> (pooled data not reported) n = 3 studies measured sepsis; only one study defined and measured proven sepsis. In this study, there were no differences in proven sepsis in infants born born by TOL versus ERCD. <u>Neonatal respiratory morbidity</u> n = 6 fair quality observational studies (term)	

				Bag and mask ventilation Term n = 3 studies: Overall: n = 245/2110 ERCD: n = 62/976 Rates for infants needing bag = 2.5% (95% CI 1.6% to 3.6 %) TOL: n = 183 /1134 Rates for infants needing bag= 5.5% (95% CI 3.5% to 7.6 %) Between study heterogeneity I^2 = 42.9%, Q statistic = 3.5, p = 0.1736 RR 0.39 (95 % CI 0.30 to 0.52) Adjusted risk difference (TOL vs. ERCD): 2.5% (95% CI 0.72% to 5.0%) Rates of transient tachypnea (TTN) Term n= 3 studies:	

				<u>Overall:</u> n = 617/4927 <u>ERCD:</u> n = 190/1476 Rate Of TTN = 4.2% (95% CI 1.9% to 7.3%) <u>ToL:</u> n = 427/3451 Rate of TTN = 3.6% (95% CI 0.9% to 8.0%) Between study heterogeneity I^2 = 67%, Q statistic = 6.05, p = 0.0485 RR 1.04 (0.88 to 1.21) Adjusted risk difference (ToL vs. ERCD) = -0.83% (95% CI -3.35% to 1.7%) <u>Hypoxic-ischemic encephalopathy/asphyxia (HIE)</u> <u>Term n = 3 studies:</u> Lack of consistency in the measurements presented in studies	

				Studies reported higher risk of HIE for ToL compared with ERCD but the true relationship is not clear due to the low strength evidence. Pooled result not reported <u>Apgar score</u> n = 4 studies found no differences in apgar score of > 7 at 5 minutes in infants undergoing a TOL versus ERCD. n = 3 studies found no differences in apgar score of > 7 at 5 minutes in infants born by VBAC versus RCD after a TOL.	

Bibliographic details	Number of Participant Participant Characteristics	Intervention characteristics	Outcome measures to be used	Results	Reviewer comment
Authors Tahseen,S., Griffiths,M. **Year of publication** 2010 **Country of publication** UK **Ref ID** 76986 **Sub-type** Systematic review **Aim of study** To assess the success rate and associated major complications of trial of vaginal birth after two caesarean sections (VBAC-2) compared with VBAC -1 and repeat third caesarean section (RCD)	**Inclusion Criteria** Searches were performed on the following databases: Medline (from 1966), CINAHL (from 1982), the Cochrane library (2008, Issue 3), Current Controlled Trials, HIMC database, National research register, Research Findings Electronic Register (ReFER), SIGLE (from 1980) and Biomed Central **Exclusion Criteria** Individual reports, duplicated publications and comment papers were excluded. When the studies reported details of the same cohort, only the study with the most updated, complete and relevant data were used. **Demographics - Total** n = 20 studies were appraised for quality, n=3 excluded based on the poor quality, n = 17 studies included **Cases** Women with attempted VBAC after 2 prior CS **Controls** Women with attempted VBAC after 1 prior CS and repeat third CS	**Experimental** **Control** **method** Data was extracted independently by the two authors and discrepancies were resolved by discussion. Appraisal tools STROBE were used to assess methodological quality of evidence. Meta-analyses were performed with RevMan (Review Manager, The Cochrane Collaboration). Inter-study heterogenity was tested with chi square test for heterogenity at the significant level of p = 0.10 and a random effects model was generated whenever the I^2 was > 25% using Mantel-Haenszel analysis method.	**Outcomes** VBAC 2 versus VBAC 1 Success rates Uterine rupture rates Hysterectomy rates Blood transfusion VBAC 2 versus RCS Hysterectomy rates Blood transfusion Febrile morbidity Adverse neonatal outcomes Perinatal death Asphyxial injury NICU admission rate **Raw Data** **Summary Data**	**Results** VBAC 2 versus VBAC 1 Success rate of VBAC 2 versus VBAC 1 n = 6 studies, events/numbers (%) VBAC 2 = 3274/4565 (72%) VBAC 1 = 38814/50685 (76.5%) p < 0.0001 OR 1.48 (95 % CI = 1.23 to 1.78) Heterogeneity = I^2 = 83% Uterine rupture rates in VBAC 2 versus VBAC 1 n = 5 studies VBAC 2 = 69/4320 (1.5%) VBAC 1 = 327/45197 (0.7%) OR 0.42 (95 % CI = 0.29 to 0.60) Heterogeneity I^2 = 35 % Hysterectomy rates in VBAC 2 versus VBAC 1 n = 3 studies Total number VBAC 2 = 8/4565	**Funding** Not reported **Quality Items** **Other information**

				(0.1%) Total number VBAC 1 = 42/50686 (0.08%) OR 0.29 (95 % CI 0.13 to 0.61) Heterogeneity I^2 = 0% <u>Blood transfusion rates in VBAC 2 versus VBAC 1 n = 2 studies</u> Total number VBAC 2 = 41/2057 (1.9%) Total number VBAC 1 = 358/29450 (1.2%) OR 0.56 (95 % CI 0.40 to 0.77) Heterogeneity I^2 = 0% VBAC 2 versus RCS <u>Hysterectomy rates in VBAC 2 versus RCS n= 7 studies</u> Total number VBAC 2 = 9/1747 (0.5%) Total number RCS = 51/8009 (0.6%) OR 0.75 (95 % CI = 0.23 to 2.43)	

				Heterogeneity I^2 = 42% <u>Blood transfusion rates in VBAC 2 versus RCS n= 6 studies</u> VBAC 2 = 47/2292 (2%) RSC = 172/10277 (1.7%) OR 0.94 (95 % CI = 0.45 to 1.96) Heterogeneity I^2 = 64% <u>Febrile morbidity rates in VBAC 2 versus RCS n= 6 studies</u> VBAC 2 = 192/2678 (7%) RSC = 630/9858 (6%) OR 0.81 (95 % CI = 0.55 to 1.18) Heterogeneity I^2 = 65% **Results 2** <u>Adverse neonatal outcomes: all studies</u> <u>Perinatal death or asphyxial injury rates n= 6 studies</u> (Note: prelabour still births and deaths unrelated to the mode of delivery were not included) Rates = 0.09% (ranges	

				0-0.33%) <u>NICU admission rate n= 6 studies</u> Rates = 7.7% (ranges 0-0.34.9%) <u>Adverse neonatal outcomes: all studies VBAC 1 vs. VBAC 2</u> <u>Perinatal death or Asphyxial injury rates</u> VBAC 1 = 0.09% VBAC 2 = 0.05% p = 0.35 <u>Adverse neonatal outcomes: all studies VBAC 2 vs. RCS</u> VBAC 1 = 0.09% RCS = 0.01% p = 0.14 <u>NICU admission rate</u> VBAC 2 = 8.85% RCS = 8.49% **Results 3**	

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Authors Law,L.W., Pang,M.W., Chung,T.K., Lao,T.T., Lee,D.T., Leung,T.Y., Sahota,D.S., Lau,T.K. **Year of publication** 2010 **Country of publication** Hong Kong **Ref ID** 109248 **Sub-type** **Aim of study** To examine and compare the psychological status and morbidity during and after delivery among women with a previous caesarean section (CS) who were randomised to planned vaginal birth (VBAC) or planned CS	**Inclusion Criteria** Women with one previous lower segment CS and singleton pregnancy, eligible for VBAC **Exclusion Criteria** Women who had one or more previous vaginal deliveries or a contraindication for vaginal delivery **Demographics - Total** Total planned CS n = 146, planned VBAC = 145, refused randomisation n = 103 **Cases** Planned CS **Controls** Planned VBAC	**Experimental** Planned CS: Women in this group were scheduled to have an elective CS at 38 weeks of gestation **Control** Planned VBAC: Women in this group were allowed to go into spontanous labour. Regardless of the original randomaisation, CS was arranged in presence of medical indications. **method** Eligible women were invited to participate in the study at their first antenatal visit before 28 weeks gestation. Women who agreed to participate were randomised to either planned VBAC or planned CS by drawing sequentially numbered, opaque, sealed envelopes, each containing a computer generated allocation code. Women who declined randomisation were also asked to complete baseline psychometric scales for comparison with those who agreed to randomisation. Psychometric tests were performed at the time of recruitment, at 34 weeks	**Outcomes** The difference in the psychometric scores in women randomised to planned VBAC or planned CS. **Raw Data** **Summary Data**	**Results** Comparison of psychometric scores of study women : S-AI median (IQR) Baseline : Planned CS = 33 (25 - 43.3) Planned VBAC = 31 (24 - 40) p = 0.226 3rd trimester (34 weeks) : Planned CS = 35.5 (25.8 - 44) Planned VBAC = 33 (24.8 - 45) p = 0.423 Within subject changes (p) Planned CS = (0.078) Planned VBAC = (<0.001) EPDS median (IQR) Baseline	**Funding** Not reported **Quality Items** **Other information**

		gestation, 2-3 days after delivery, and at 3 months and 6 months after delivery. <u>Psychometric scales used:</u> State-Trait Anxiety Inventory: used to measure the present existing state and the enduring anxiety trait of an individual. The scale has a 40 item self report scale divided into two 20 item sections (S-AI [evaluates the anxiety state], T-AI [assesses the anxiety trait]) EPDS (Edinburgh Postnatal Scale): 10 item scale for identifying antenatal and postnatal depression BDI (Beck Depression Inventory): 21 item scale to measure the severity of depression GHQ-12: used to measure general psychological well-being and quality of life All four scales were validated in Hong Kong Chinese populations. The client's overall satisfaction with their childbirth experience was assessed using		Planned CS = 5.0 (1 - 10) Planned VBAC = 5 (1 - 9) p = 0.398 3rd trimester (34 weeks) Planned CS = 5 (0 - 9) Planned VBAC = 3.5 (0 - 9.3) p = 0.423 Post delivery Planned CS = 2 (0 - 7) Planned VBAC = 1 (0 - 7) p = 0.404 Postnatal 3 months Planned CS = 2 (0 - 7) Planned VBAC = 1 (0 - 6) p = 0.452 Postnatal 6 months Planned CS = 0 (0 - 4) Planned VBAC =0.5 (0 - 4) p = 0.766 Within subject changes (p)	

		a Chinese version of CSQ (Client Satisfaction Questionnaire) Sample size: The required sample size for detection of a standardised effect size (on psychological well being) of 0.4 at power of 90% and two tailed alpha of 0.05 was 131 in each arm. Therefore the study required 144 in each arm (total 288), assuming 10% drop out rate. <u>Statistical Analysis:</u> Performed with Statistical Package for Social Science version 16.0 (SPSS, IL). Univariate analysis was used to compare baseline characteristics, baseline psychometric scores and subgroup analyses. Fridman test or Wilcoxon signed ranks test and Mann-Whitney test were also used. The analysis was based on the intention to treat analysis. <u>Characteristics:</u> There were no statistically significant differences between the three groups		Planned CS = (p<0.001) Planned VBAC = (p<0.001) <u>BDI median (IQR)</u> Baseline Planned CS = 5 (3 - 9.3) Planned VBAC = 5 (2 - 9) p = 0.514 3rd trimester (34 weeks) : Planned CS = 4.5 (2 - 9) Planned VBAC = 4.5 (1 - 8) p = 0.314 Post delivery : Planned CS = 2 (0 - 6) Planned VBAC = 2 (0 - 6) p = 0.933 Postnatal 3 months Planned CS = 2 (0 - 5.3) Planned VBAC = 2 (0 - 6)	

		(planned CS, planned VBAC, refused randomisation) in maternal age, gestation at recruitment, marital status, educational level, residential status (Hong Kong citizen), background psychiatric disorders and future fertility wishes. Women who refused randomisation had higher family income (mean 3.37 thousand US $ [SD 2.54]) when compared with randomised CS (mean 2.76 thousand US $ [SD 2.09]) and planned VBAC group (mean 2.70 thousand US $ [SD 2.34]) p = 0.01)		p = 0.780 Postnatal 6 months Planned CS = 1.5 (0 - 4.8) Planned VBAC = 1 (0- 4.3) p = 0.929 Within subject changes (p) Planned CS = (p<0.001) Planned VBAC = (p<0.001) <u>GHQ-12 median (IQR)</u> Baseline Planned CS = 1 (0 - 3) Planned VBAC = 1 (0 -3) p = 0.514 3rd trimester (34 weeks) Planned CS = 1 (0 - 3) Planned VBAC = 1 (0 - 3) p = 0.783 Post delivery Planned CS = 0 (0 - 2)	

				Planned VBAC = 0 (0 - 3) p = 0.721 Postnatal 3 months Planned CS = 0 (0 - 2) Planned VBAC = 0 (0 - 2) p = 0.467 Postnatal 6 months Planned CS = 0 (0 - 1) Planned VBAC = 0 (0 - 2) p = 0.728 Within subject changes (p) Planned CS = (p<0.001) Planned VBAC = (p<0.001) <u>CSQ median (IQR)</u> Post delivery Planned CS = 24 (23 - 25) Planned VBAC = 24 (23 - 26)	

				p = 0.353 Postnatal 6 months Planned CS = 24 (22 - 25) Planned VBAC =23 (22 - 25) p = 0.433 Within subject changes (p) Planned CS = (0.186) Planned VBAC = (<0.001) IQR = inter-quartile range, S-AI = State Anxiety Inventory, EPDS = Edinburgh Postnatal Depression Scale, BDI = Beck Depression Inventory, GHQ-12 + General Health Questionnaire Significantly more women in planned VBAC (27/123) requested to change to elective CS, compared to those who were randomised to planned CS (15/135) and requested to change to planned VBAC (OR: 2.25; 95% CI: 1.13-4.47). Subgroup analyses	

				showed that women who changed from planned CS to VBAC had lower satisfaction at delivery [Client Satisfaction Score: 24.0 (23.0-24.3), 23.0 (22.0-24.0); p=0.009] compared to women who did not change their plan for elective CS. **Results 2** **Results 3**	