National Institute for Health and Care Excellence

Final

Caesarean birth

[G] Surgical opening technique

NICE guideline number NG192 (update)

Evidence review underpinning recommendation 1.4.28 in the NICE guideline

August 2023

Final

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ISBN: 978-1-4731-5361-5

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Review question

What is the most effective technique for the abdominal opening and subsequent extension of tissue layers in caesarean birth, including in overweight and obese women?

Introduction

A caesarean birth is the most common surgical procedure in obstetrics and a number of different techniques for abdominal wall entry have been developed. These vary in location, shapes (for example, curved versus straight) and techniques for opening layers of tissue. There may be differences in the outcomes for women depending on which technique is used, including the time taken to perform the caesarean, the risk of bleeding and the occurrence of pain and infection afterwards.

The aim of this review is to compare different techniques for opening the abdomen when performing a caesarean birth to determine which leads to the best outcomes for women, and to identify if any changes in the method used are necessary for overweight or obese women.

Summary of the protocol

See Table 1 for a summary of the Population, Intervention, Comparison and Outcome

Table 1: Summary of the protocol (PICO table)

Population	Pregnant women due for delivery by caesarean birth. Evidence will be stratified by: BMI: • Underweight range: <18.5 kg/m^2 • Healthy weight range: 18.5 to 24.9 kg/m^2 • Overweight range: 25 to 29.99 kg/m^2 • Obesity class 1: 30 to 34.99 kg/m^2 • Obesity class 2: 35 to 39.99 kg/m^2 • Obesity class 3: 40 kg/m^2 or more
Intervention	Any abdominal wall incision technique for caesarean birth, for example: • Joel-Cohen • Modified Joel-Cohen • Pfannenstiel • Pfannenstiel-Kerr • Modified Misgav-Ladach • Transverse abdominal incision • Mouchel incision • Maylard incision Any technique for opening subsequent layers, for example: • Blunt dissection • Sharp dissection • Cephalad-caudad stretching • Transverse blunt stretching
Comparison	• Any abdominal wall incision techniques compared to each other. • Any techniques for opening subsequent layers compared to each other.
Outcome	**Critical** • Postoperative febrile morbidity as defined by trial authors • Postoperative analgesia as defined by trial authors • Blood loss as defined by the trial authors **Important** For the mother: • Duration of surgery • Wound complications (haematoma, infection, breakdown; return to theatre for a wound complication) • Time to breastfeeding initiation For the baby: • Admission to special care baby unit

For further details see the review protocol in appendix A.

Methods and process

This evidence review was developed using the methods and process described in Developing NICE guidelines: the manual. The decision making process for a targeted review is described in appendix N of the NICE manual. Methods specific to this review question are described in the review protocol in appendix A and below.

The aim was to meta-analyse studies where possible. Where the I^2 value was greater than 80% this was considered to represent very significant heterogeneity among studies and was explored through sub-group analyses (where there were sufficient studies to conduct these analyses). Where these analyses could not explain the heterogeneity, we did not pool the study estimates but instead kept them separate as the studies were too different to combine.

Minimally important differences (MID) were used to assess clinically important differences. Cut-offs of confidence intervals of 0.8 and 1.25 were used for dichotomous outcomes and for continuous outcomes 0.5x the SD of the control group was used. Outcomes were considered to have an important benefit or harm, no evidence of an important difference, or no important difference using the following approach:

- Point estimate (PE) > +MID, 95% CI do not cross line of no effect = important benefit
- Point estimate (PE) > +MID, 95% CI cross the line of no effect = no evidence of an important difference.
- Point estimate (PE) between two MIDs = no important difference.
- Point estimate (PE) < -MID, 95% CI cross the line of no effect = no evidence of an important. Difference
- Point estimate (PE) < -MID, 95% CI do not cross line of no effect = important harm

Declarations of interest were recorded according to NICE's conflicts of interest policy.

Effectiveness evidence

Included studies

This review is a targeted review and a literature search was not conducted. Studies identified in the surveillance report were included in the evidence review.

Fourteen studies were included for this review: 4 systematic reviews (SRs), 2 of which were Cochrane reviews (Dodd 2014 (Cochrane), Mathai 2013 (Cochrane), McCurdy 2022, Pergialiotis 2021) and 10 randomised controlled trials (RCTs) (Abuelghar 2013, Asicioglu 2014, Ferrari 2001, Razzaq 2016, Saha 2013, Sahin 2018, Shaukat 2019, Sunullah 2013, Tahir 2018, Yilmaz 2018).

The SRs included 14 RCTs (Dodd 2014 included: Cromi 2008; Hidar 2007; Magann 2022; Poonam 2006; Rodriguez 1994; Sekhavat 2010; Mathai 2013 included: Franchi 2002; Giacalone 2002; Mathai 2002; McCurdy 2022 included*:* El-Sayed 2018; Pergialiotis 2021 included*:* Dikmen 2017; Morales 2019; Ozcan 2016; Mahawerawat 2010).

The SRs were used as a source of references and data. They were not included in full as not all the individual studies included in the SRs met the criteria specified in our protocol. For example, some studies included vertical incisions, and some compared closing techniques. Therefore a a de novo SR and meta-analysis was carried out, using the data from the relevant studies from the SRs. The Cochrane SRs were chosen over other SRs as a source of data when there was overlap with the included studies, as their methodology most closely aligns with NICE methodology. One systematic review (McCurdy 2022) was included as a source of data even though only one individual study (El-Sayed 2018) was relevant. This was because the individual study could not be obtained separately.

The included studies were from Egypt, France, India, Italy, Iran, Nepal, Pakistan, Panama, Switzerland, Thailand, Tunisia, Turkey and United States.

Studies compared different abdominal wall incision techniques to each other. Joel-Cohen incision, modified Joel-Cohen incision, Misgav-Ladach incision, Maylard incision and transverse abdominal incision were compared to Pfannenstiel incisions. Modified Misgav-Ladach incision was compared to Pfannenstiel-Kerr incision. Data was available for all outcomes across the different comparisons for incision techniques.

Studies also compared different expansion techniques of the uterine incision. Sharp dissection was compared to blunt dissection. Cephalad-caudad stretching was compared to transverse stretching. Data was not available for postoperative analgesia, time to breastfeeding, and admission to special care baby unit for these comparisons.

Blood loss outcomes were reported as either blood loss volumes, need for blood transfusion, haemoglobin levels and haematocrit levels.

The evidence was stratified by BMI. In the case of heterogeneity, subgroup group analysis was performed for number of previous caesarean births and type of caesarean births.

The included studies are summarised in Table 2.

See the literature search strategy in appendix B and study selection flow chart in appendix C.

Excluded studies

Studies not included in this review are listed, and reasons for their exclusion are provided in appendix J.

Summary of included studies

Summaries of the studies that were included in this review are presented in Table 2.

Table 2: Summary of included studies.

Study	Population	Intervention	Comparison	Outcomes	Strata
Abuelghar 2013 RCT Turkey	N=153 women n=76 Joel-Cohen n=77 Pfannenstiel BMI not specified Women having a primary caesarean birth Undefined caesarean birth type	Joel-Cohen incision	Pfannenstiel incision	• Postoperative febrile morbidity (as defined by trial authors) – 48 hours follow up • Postoperative analgesia (as defined by trial authors) – 24 hours follow up • Blood loss (as defined by trial authors) – intraoperative • Duration of surgery – intraoperative	• BMI mixed
Asicioglu 2014 RCT	N=1076 women n=535 sharp n=541 blunt	Sharp expansion of uterine incision	Blunt expansion of uterine incision	• Blood loss (as defined by trial authors) - intraoperative	• BMI overweight range 25 to 29.99 kg/m^2

Study	Population	Intervention	Comparison	Outcomes	Strata
Turkey	BMI overweight range: 25 to 29.99 kg/m^2 Women having either primary or repeat caesarean birth Elective caesarean birth			• Duration of surgery - intraoperative • Wound complications – up to 72 hours follow up • Admission to special care baby unit	• By number of caesarean births
Dodd 2014 (RCTs used for this review: Cromi 2008; Hidar 2007; Magann 2002; Poonam 2006; Rodriguez 1994; Sekhavat 2010) Cochrane Systematic review Italy, Iran, Nepal, Tunisia, United States	N=6 RCTs Mixed BMI population; overweight range: 25 to 29.99 kg/m^2; obesity 1: 30 to 34.99 kg/m^2 Women having primary or repeat caesarean births Mixed elective or emergency caesarean births	Cephalad-caudad stretching of uterine incision Sharp extension of uterine incision Misgav-Ladach incision	Transverse stretching of uterine incision Blunt extension of uterine incision Pfannenstiel incision	• Postoperative febrile morbidity (as defined by trial authors) – follow up not reported • Postoperative analgesia (as defined by trial authors) – 4 days follow up • Blood loss (as defined by trial authors) – intraoperative to 48 hours • Duration of surgery - intraoperative • Admission to special care baby unit – 4 days follow up	• Mixed BMI • BMI overweight range 25 to 29.99 kg/m^2 • BMI obesity 1: 30 to 34.99 kg/m^2 • By number of caesarean births (Sekhavat 2010)
Ferrari 2001 RCT Italy	N=158 women n=83 Joel-Cohen n=75 Pfannenstiel BMI healthy weight range: 18.5 to 24.9 kg/m^2 Women having a primary caesarean birth Mixed emergency or elective type	Joel-Cohen incision	Pfannenstiel incision	• Postoperative febrile morbidity (as defined by trial authors) – 48 hours follow up • Blood loss (as defined by trial authors) – intraoperative to 48 hours follow up • Duration of surgery - intraoperative	• BMI healthy weight range 18.5 to 24.9 kg/m^2

Study	Population	Intervention	Comparison	Outcomes	Strata
Mathai 2013 (RCTs used for this review: Franchi 2002; Giacalone 2002; Mathai 2002) Cochrane Systematic review France; India; Italy; Switzerland	N=3 RCTs BMI mixed population Women having a primary caesarean birth Mixed emergency and elective births	Joel-Cohen incision Maylard incision	Pfannenstiel incision	• Postoperative febrile morbidity (as defined by trial authors) – 48 hours follow up • Postoperative analgesia (as defined by trial authors) – 4 to 48 hours follow up • Blood loss (as defined by trial authors) – up to 72 hours • Duration of surgery - intraoperative • Wound complications – follow up not reported • Time to breastfeeding initiation – follow up time not reported • Admission to special care baby unit – follow up not reported	• Mixed BMI • BMI healthy weight range 18.5 to 24.9 kg/m^2
McCurdy 2022 (RCT used for this review: El-Sayed 2018) Systematic review Egypt	N=1 RCT BMI obesity 3: >40kg/m^2 Unspecified previous caesarean or type of caesarean	Pfannenstiel incision	Transverse abdominal incision (high transverse)	• Duration of surgery - intraoperative • Wound complications – follow up not reported	• BMI obesity 3: >40 kg/m^2
Pergialiotis 2021 (RCTs used for this review: Dikmen 2017; Morales 2019; Ozcan	N=4 RCTs BMI mixed population; overweight range: 25 to 29.99 kg/m^2; obesity 1: 30 to 34.99 kg/m^2	Cephalad-caudad stretching of uterine incision	Transverse stretching of uterine incision	• Blood loss (as defined by trial authors) – intraoperative to 24 hours follow up • Duration of surgery - intraoperative	• Mixed BMI • BMI overweight range 25 to 29.99 kg/m^2 • BMI obesity 1: 30 to

Study	Population	Intervention	Comparison	Outcomes	Strata
2016; Mahawera wat 2010) Systematic review Panama; Thailand; Turkley	Mixed primary or repeat caesarean births Mixed elective or emergency caesarean births			• Wound complications – follow up hospital discharge	34.99 kg/m^2
Razzaq 2016 RCT Pakistan	N=212 women n=106 sharp n=106 blunt BMI not specified Women having primary caesarean birth Mixed elective and emergency caesarean births	Sharp expansion of uterine incision	Blunt expansion of uterine incision	• Blood loss (as defined by trial authors) – intraoperative	• BMI mixed
Saha 2013 RCT India	N=302 n=151 Joel-Cohen n=151 Pfannenstiel BMI not specified Women having primary caesarean birth Mixed elective and emergency caesarean births	Modified Joel-Cohen incision	Pfannenstiel incision	• Postoperative analgesia (as defined by trial authors) – follow up not reported • Blood loss (as defined by trial authors) – follow up 48 hours • Duration of surgery - intraoperative • Wound complications – follow up nor reported	• BMI mixed
Sahin 2018 RCT Turkey	N=252 n=126 Modified Misgav-Ladach n=126 Pfannenstiel-Kerr BMI overweight range: 25 to 29.99 kg/m^2 Women having primary caesarean birth	Modified Misgav-Ladach incision	Pfannenstiel-Kerr incision	• Blood loss (as defined by trial authors) - intraoperative • Duration of surgery - intraoperative	• BMI overweight range 25 to 29.99 kg/m^2

Study	Population	Intervention	Comparison	Outcomes	Strata
	Mixed elective and emergency caesarean births				
Shaukat 2019 RCT Pakistan	N=100 n=50 sharp n=50 blunt BMI not specified Women having primary caesarean birth Elective caesarean births	Sharp expansion of uterine incision	Blunt expansion of uterine incision	• Blood loss (as reported by trial authors) – 24 hours postoperative follow up	• BMI mixed
Sunullah 2013 RCT Turkey	N=100 n=50 Joel-Cohen n=50 Pfannenstiel BMI not specified Women having primary caesarean birth Elective and emergency caesarean births	Joel-Cohen incision	Pfannenstiel incision	• Blood loss (as reported by trial authors) – 6 hours postoperative follow up • Duration of surgery – intraoperative follow up	• BMI mixed
Tahir 2018 RCT Pakistan	N=140 n=70 sharp n=70 blunt BMI overweight range: 25 to 29.99 kg/m^2 Women having primary caesarean birth Undefined type caesarean birth	Sharp expansion of uterine incision	Blunt expansion of uterine incision	• Blood loss (as defined by trial authors) – 48 hours postoperative follow up	• BMI overweight range 25 to 29.99 kg/m^2 • By number of caesarean births
Yilmaz 2018 RCT Turkey	N=140 n=70 sharp n=70 blunt BMI overweight range: 25 to 29.99 kg/m^2 Women having primary caesarean birth	Sharp incision of uterine incision	Blunt opening of uterine incision	• Postoperative analgesia (as defined by trial authors) – 48 hours follow up • Blood loss (as defined by trial authors) – intraoperative to 24 hours follow up	• BMI overweight range 25 to 29.99 kg/m^2 • By number of caesarean births

Study	Population	Intervention	Comparison	Outcomes	Strata
	Undefined type caesarean birth			• Duration of surgery - intraoperative	

BMI: body mass index; RCT: randomised controlled trial

See the full evidence tables in appendix D and the forest plots in appendix E.

Summary of the evidence

Incision techniques:

There was evidence comparing different techniques for abdominal wall incision, in women of different BMI ranges. Most of the evidence was in a population having a primary caesarean birth, with the exception of 1 study in the Pfannenstiel versus transverse abdominal incision comparison where the number of previous births was unspecified.

Joel-Cohen incision versus Pfannenstiel incision – mixed BMI

For mixed BMI strata, there was an important benefit for the Joel-Cohen technique over the Pfannenstiel technique in terms of postoperative febrile morbidity, postoperative analgesia on demand, the total number of analgesic doses and duration of surgery. There were no important differences between incision techniques on the blood loss outcomes (fall in haemoglobin, fall in haematocrit, blood transfusion or blood loss volume), and no important difference between incision techniques for wound infection, time to breastfeeding after surgery and admission to special care baby unit.

The evidence was mostly moderate quality, with some very low to low quality evidence.

Joel-Cohen incision versus Pfannenstiel incision – BMI healthy weight range 18.5 to 24.99 kg/m^2

For BMI healthy weight range, there was an important benefit for Joel-Cohen over Pfannenstiel in terms of the fall in haemoglobin, but not fall in haematocrit or estimated blood loss volume. There was also an important benefit for Joel-Cohen in terms of total operative time. There was no important difference between incision techniques for postoperative febrile morbidity.

The evidence was mostly moderate quality, with some very low quality evidence.

Modified Joel-Cohen incision versus Pfannenstiel incision – mixed BMI

For mixed BMI strata there was an important benefit for the modified Joel-Cohen technique over the Pfannenstiel technique in terms of fall in haemoglobin, postoperative analgesia requirement and duration of surgery. There were no differences for wound complications.

The evidence ranged from high to moderate quality.

Pfannenstiel incision versus Transverse abdominal incision – BMI obesity class 3: >40kg/m^2

Evidence for Pfannenstiel versus transverse abdominal incisions in a population of BMI obesity class 3 (>40kg/m^2) showed no important differences between groups for duration of surgery, but an important harm for Pfannenstiel in terms of wound complications.

The evidence ranged from very low to low quality.

Modified Misgav-Ladach incision versus Pfannenstiel-Kerr incision - BMI overweight range 25 to 29.99 kg/m^2

Modified Misgav-Ladach technique was compared to Pfannenstiel-Kerr technique in women with an overweight BMI range 25 to 29.99 kg/m^2. The evidence showed an important benefit for modified Misgav-Ladach in terms of blood loss volumes and duration of surgery.

The evidence ranged from moderate to low quality.

Misgav-Ladach incision versus Pfannenstiel incision – mixed BMI

Misgav-Ladach technique was compared to Pfannenstiel technique in women with mixed BMI. The evidence showed an important benefit for Misgav-Ladach in terms of analgesia requirement and NICU admissions but no important differences in terms of postoperative febrile morbidity and blood transfusion.

The evidence ranged from very low to moderate quality.

Maylard incision versus Pfannenstiel incision - BMI healthy weight range 18.5 to 24.99 kg/m^2

Maylard was compared to Pfannenstiel, in a population of BMI healthy weight range 18.5 to 24.99 kg/m^2. The evidence showed no differences between techniques in terms of postoperative febrile morbidity, blood transfusion or wound complications.

The evidence was all very low quality.

Expansion of uterine incision

There was evidence comparing the different opening techniques of the uterine incision, in a population of women of different BMI ranges. The evidence was in a population of primary and repeat caesarean births.

Sharp versus blunt – BMI overweight range 25 to 29.99 kg/m^2

Sharp versus blunt dissection of the uterine incision was compared in a population of BMI overweight range 25 to 29.99 kg/m^2. The evidence showed some variation across the blood loss outcome measures: there was an important harm for sharp dissection over blunt dissection in terms of blood loss volumes in primary caesarean births, and the population of mixed primary and repeat caesarean births. There was also an important harm for sharp over blunt dissection in terms of blood loss volume over 1000ml. For postoperative haemoglobin levels, one study showed an important harm for sharp over blunt dissection. For the change from pre to postoperative haemoglobin levels, 1 study showed an important harm for sharp dissection over blunt dissection but 1 other study showed no important difference. The evidence was analysed separately due to very significant heterogeneity (I^2>80%). The evidence showed an important harm for sharp dissection over blunt dissection in those undergoing an elective caesarean birth, for the outcome change in haematocrit pre to postoperative. However for those with an undefined type of caesarean there was severe heterogeneity with 1 study showing an important harm for sharp dissection over blunt dissection, but 1 other study showing no important difference. The evidence was analysed separately due to the very significant heterogeneity, which was explained by the subgroup analysis for type of caesarean birth. There was also no important difference in blood transfusion, duration of surgery or wound complications.

The quality of the evidence ranged from very low to high.

Sharp versus blunt – BMI obesity class 1: 30 to 34.99 kg/m^2

Sharp versus blunt dissection techniques were also compared in a population of BMI obesity class 1 (30 to 34.99 kg/m^2). There were no important differences between the techniques in terms of postoperative febrile morbidity, blood loss volumes, postoperative haematocrit or blood transfusion.

The quality of the evidence ranged from low to moderate.

Sharp versus blunt – mixed BMI

Sharp versus blunt dissection techniques were also compared in a mixed BMI population. There was an important harm for sharp over blunt dissection in terms of blood loss outcome measures: blood loss volumes, and postoperative haemoglobin levels but there were no important differences for postoperative febrile morbidity or duration of surgery.

The quality of the evidence ranged from very low to low.

Cephalad-caudad versus transverse - BMI overweight range 25 to 29.99 kg/m^2

Cephalad-caudad stretching was compared to transverse stretching in a population with a BMI in the overweight range 25 to 29.99 kg/m^2. There were no differences between the techniques in terms of some blood loss outcome measures: haematocrit levels and blood transfusion. There were also no differences for duration of surgery. There was very significant heterogeneity for the blood loss outcome measures: blood loss volumes, and haemoglobin levels. For the outcome blood loss volumes, 1 study showed an important benefit for cephalad-caudad over transverse opening, however 2 other studies reporting the same outcome showed no important differences between the techniques. Due to this heterogeneity, the data were analysed separately. The same pattern was observed with the outcome change in haemoglobin levels pre to postoperative, where 2 studies showed no important differences between groups, but 1 study showed an important benefit for cephalad-caudad stretching over transverse stretching. The data were analysed separately due to concerns regarding heterogeneity.

The quality of the evidence ranged from very low to moderate.

Cephalad-caudad versus transverse - BMI obesity class 1: 30 to 34.99 kg/m^2

In the population of BMI obesity class 1 (30 to 34.99 kg/m^2), there were no important differences between cephalad-caudad and transverse stretching for the blood loss outcome measures: postoperative haemoglobin and haematocrit, and blood transfusion, or duration of surgery.

The quality of the evidence ranged from very low to moderate.

Cephalad-caudad versus transverse – mixed BMI

In a population of mixed BMI, there were no important differences between cephalad-caudad and transverse stretching for the blood loss outcomes measures: blood loss volume, postoperative haemoglobin and blood transfusion. There were also no differences for wound complications defined as haematomas.

The quality of the evidence ranged from low to high.

The majority of the evidence across all comparisons was moderate and moderate for critical outcomes.

The studies did not report long term mortality and morbidity.

See appendix F for full GRADE tables.

Economic evidence

Included studies

No economic search was conducted, therefore there is no literature search strategy in appendix B and no economic study selection flow chart in appendix G.

Excluded studies

No economic search was conducted, therefore there are no studies in appendix J.

Summary of included economic evidence

There are no included studies applicable to this review.

Economic model

No economic modelling was undertaken for this review.

The committee's discussion and interpretation of the evidence

The outcomes that matter most

The committee agreed that postoperative febrile morbidity was a critical outcome as it was indicative of an infection, and that postoperative analgesia was a critical outcome as it would inform which method of incision or expansion was the least painful. The committee also agreed that it was important to look at blood loss outcomes as some techniques may cause more bleeding than others, and the consequences of losing large amounts of blood may be severe in terms of increased need for postnatal care and the woman's experience of labour and birth. They therefore also selected blood loss as a critical outcome.

The committee also discussed important outcomes, and agreed that duration of surgery would be important to consider as some techniques might mean longer surgery times, which are often associated with other complications. This is particularly important in category 1 caesarean birth where quick delivery of the baby is crucial. They agreed that it was important to also look at whether any of the techniques were associated with an increase in wound complications, which would then require further intervention and again impact the woman's experience of labour and birth. The committee also discussed that the time to breastfeeding initiation was an important outcome for this review. The time to recovery may differ with different techniques and impact the start of breastfeeding, which for many people is an important factor to consider for bonding with the baby. Admission to special care baby unit was also chosen as an important outcome as the committee agreed on the importance of ascertaining whether different techniques impact the baby, in particular by separating the baby from the mother postnatally.

The quality of the evidence

The quality of the evidence ranged from very low to high, with the majority of the evidence of moderate quality. There were concerns over risk of bias for most of the evidence. The reasons for bias included studies not reporting enough information on randomisation methods, deviations from intended interventions, and missing outcome data. There were also concerns over imprecision for some of the evidence. Moreover, some of the evidence was downgraded for concerns about heterogeneity that could not be resolved by subgroup analysis by either number of previous caesarean births, or type of caesarean birth (either emergency or elective). Studies were not meta-analysed when there were concerns about very significant unexplained heterogeneity ($I^2 > 80\%$) and this heterogeneity could not be explained by subgroup analyses. The committee took into account the quality of the evidence in their interpretation of the evidence. They had confidence in the evidence rated moderate to high and were therefore able to make recommendations.

Benefits and harms

The committee discussed the different types of incision that can be made when carrying out a caesarean birth and the differences between them, and also the fact that named techniques were then often modified, leading to a diverse number of named incision techniques. The committee agreed that the most well-known techniques were the Joel-Cohen and the Pfannenstiel. The key features of the Joel-Cohen technique were a straight, low transverse incision in the skin with blunt expansion of the subsequent layers. In contrast the Pfannenstiel incision was a curved very low transverse incision in the skin, followed by sharp dissection of all the subsequent layers. The committee noted that the Misgav-Ladach technique was a modification of the Joel-Cohen, with blunt expansion of some, but not all, of the subsequent layers, and the Maylard was a high (but sub-umbilical) curved transverse incision. There were other differences between techniques, with some describing the method of placental removal (manual or using cord traction), and modified versions using other minor changes, such as the modified Migav-Ladach using cranial-caudal stretching.

The committee discussed that the evidence showed the Joel-Cohen incision was beneficial over the Pfannenstiel incision in terms of postoperative febrile morbidity, postoperative analgesia and duration of surgery for women with mixed BMI. They also noted that there were some benefits for haemoglobin levels and duration of surgery for women with a healthy BMI. The committee discussed that the modified Joel-Cohen technique also had the same benefits over the Pfannenstiel technique (in mixed BMI group) with evidence for benefits in haemoglobin fall, postoperative analgesia and duration of surgery.

The committee also discussed that the Misgav-Ladach technique and the modified Misgav-Ladach technique both showed benefits over the Pfannenstiel and Pfannenstiel-Kerr techniques respectively, in terms of analgesia requirement, blood loss, duration of surgery and admission to neonatal unit in women with a mixed or overweight BMI. They discussed that although there were only 2 studies, 1 for each comparison, the evidence still supported the Misgav-Ladach techniques (low transverse incision, with blunt dissection of subsequent layers) compared to the Pfannenstiel technique.

Finally, the committee noted that the Maylard technique with its higher curved incision showed no difference for any outcomes compared to the Pfannenstiel technique.

The committee discussed that the time taken to incise the skin contributed to the duration of the caesarean birth, and that the time taken to successfully deliver the baby was important as it can impact on other outcomes such as women and pregnant peoples' experience and the health of the baby.

The committee agreed that the evidence supported a recommendation for a straight transverse incision of the skin, followed by blunt expansion of the subsequent layers, as described by the Joel-Cohen and Misgav-Ladach techniques (and their modified versions), as all these techniques had benefits compared to the Pfannenstiel technique. The committee agreed not to use the names of the surgical techniques in the recommendations as the number of techniques, including the modified techniques, and the slight variations between them may lead to confusion. They therefore agreed that it was preferable to refer to the details of the incision and subsequent opening. The committee agreed they could make a strong recommendation as most of the evidence supporting the recommendation was of moderate quality.

The committee discussed that in practice, depending on the clinical picture at the time of surgery, sharp expansion of some of the layers may be required. They discussed scenarios where this would be necessary, such as scarring of the tissue due to previous surgery. The committee discussed that the evidence was all women having a primary caesarean birth, except for 1 comparison with a single study where this was unspecified. They discussed that previous caesarean births may require a different approach depending on the tissue scarring,

but agreed that a very specific recommendation could not be made due to limited evidence in that subgroup. However, they agreed that the surgeon would be best placed to make decisions based on each individual case and that limiting the recommendation to blunt expansion would not be helpful for surgeons, and agreed to add that sharp expansion can be used if necessary. The committee noted that previously the guideline had recommended sharp extension with scissors and not a knife, and agreed that again this would be too restrictive and unhelpful to surgeons. The use of tools would depend on the situation and individual woman at the time of surgery and therefore they agreed to remove this detail from the recommendation.

The committee then discussed whether the evidence supported making separate recommendations for women or pregnant people of different BMI ranges. They discussed that the evidence showed benefits for the Joel-Cohen technique across the outcomes for women with mixed BMI strata, healthy BMI, overweight and class 1 obesity. However, the committee discussed the evidence for the transverse abdominal incision compared to the Pfannenstiel, in a group of women with class 3 obesity (a BMI over 40kg/m^2). They discussed that in practice it could be helpful to have some guidance on how to manage women and pregnant people in this group, as there is a higher risk of complications such as infection when lower incisions are performed in very obese people, particularly those with a panniculus (an apron of excess skin and fat). They discussed that the evidence supported that a transverse abdominal incision which was higher than the Pfannenstiel incision was beneficial in terms of wound complications over a Pfannenstiel. They discussed the limitations of this evidence as the details of the single study contributing to this evidence came from a systematic review as the original study paper could not be obtained. The details on the study were limited, and as such bias could not be sufficiently assessed. There was also limited information on the specific details of the intervention although the study describes the transverse incision as an incision at supra-umbilical level. The committee agreed that this was at a much higher level than a Joel-Cohen or a modified Joel-Cohen incision. The committee discussed that BMI was not always a useful indicator of central adiposity, and that during a caesarean birth the woman would be in a supine position, and the position of the central adiposity would change. However, they agreed that the evidence supported a recommendation that adjustments could be made to incisions for women and pregnant people with a BMI greater than 40kg/m^2, and agreed that a recommendation to make a higher transverse incision may reduce wound infections due to occlusion of the operative site. As there was limited evidence from one study only, and of very low to low quality, the committee agreed they could not make a strong recommendation for adjustments to the incision based on BMI, and made this a weaker recommendation suggesting that the incision may need to be modified.

The committee then looked at the evidence for sharp versus blunt expansion of the uterine incision. They discussed that although the evidence showed no differences between groups in terms of postoperative febrile morbidity, duration of surgery and wound complications, there was a harm for the sharp expansion group in terms of blood loss outcomes such as volume of blood loss, postoperative haematocrit and postoperative haemoglobin. They discussed that this was seen for those with a mixed BMI and BMI in the overweight range, but not for those with class 1 obesity. However, the committee agreed there was enough evidence to support the current recommendation in the guideline to use blunt expansion of the uterine incision.

Finally, the committee discussed the evidence for cephalad-caudad compared to transverse expansion of the uterine incision. This showed no difference between groups for the outcomes of blood loss, duration of surgery or wound complications for mixed BMI, overweight BMI and class 1 obesity. There was the exception of evidence from 1 study that showed a benefit for the blood loss outcomes. However, as the quality of this evidence was very low, the committee went with the majority of the evidence that showed no difference in these outcomes. The committee discussed whether it would be useful to make a

recommendation that either technique could be used, but agreed that this was not necessary, as the direction of expansion would depend on clinical judgement at the time of surgery and as the evidence did not favour one particular technique over another the committee agreed not to highlight them in the recommendations.

The committee also looked at some of the subgroup analysis for number of previous caesarean births, which was performed due to heterogeneity. Some, but not all, of the heterogeneity was explained by the subgroup analysis, however the committee agreed that overall the evidence did not support separate recommendations by number of previous caesarean births and agreed not to make any changes.

The committee discussed that in clinical practice vertical midline incisions were no longer routinely carried out and agreed to delete the recommendation related to vertical incisions. However, they noted that there are some clinical indications when a vertical incision would be more appropriate than a transverse incision, and agreed to highlight this point in the recommendation. The committee also discussed that in clinical practice separate knives were no longer routinely used for skin incision and deeper layers but they agreed that this recommendation should remain in the guideline to ensure that current practice continues

Cost effectiveness and resource use

The committee agreed that the choice of incision would have very little impact on resource use, but that by recommending an incision which led to a shorter operating time, reduced blood loss, reduced pain and reduced infections there may be savings in resource use to treat these complications.

Recommendations supported by this evidence review

This evidence review supports the updated recommendation 1.4.28.

References – included studies

Effectiveness

Abuelghar 2013

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Appendices

Appendix A Review protocols

Review protocol for review question: What is the most effective technique for the abdominal opening and subsequent extension of tissue layers in caesarean birth, including in overweight and obese women?

Table 3: Review protocol

ID	Field	Content
0.	PROSPERO registration number	Not registered in PROSPERO as this is a targeted review where we are not conducting any new search. We are only including studies identified in the surveillance report.
1.	Review title	Abdominal wall incision
2.	Review question	What is the most effective technique for the abdominal opening and subsequent extension of tissue layers in caesarean birth, including in overweight and obese women?
3.	Objective	To update recommendation 1.4.29 in NG192 (2021) for surgical techniques in caesarean birth. The new recommendation will become number 1.4.28 in the update.
4.	Searches	No search will be conducted for this review. This review was planned as a 'C – targeted review' and we were advised to include the 2013 Cochrane and subsequent papers supplied by surveillance only. Studies identified by surveillance: Incision type: Abuelghar, Wessam Magdy; El-Bishry, Gasser; Emam, Lamiaa H. (2013) Caesarean deliveries by Pfannenstiel versus Joel-Cohen incision: A randomised controlled trial. Journal of the Turkish German Gynecology Association 14(4): 194-200 Cardona-Osuna, M E, Avila-Vergara, M A, Peraza-Garay, F et al. (2016) [Comparison of pregnancy outcomes Caesarean techniques: modified Misgav-Ladach, Pfannenstiel-Kerr and Kerr-half infraumbilical]. Ginecologia y obstetricia de Mexico 84(8): 514-22

ID	Field	Content
		Gizzo, Salvatore, Andrisani, Alessandra, Noventa, Marco et al. (2015) Caesarean section: could different transverse abdominal incision techniques influence postpartum pain and subsequent quality of life? A systematic review. PloS one 10(2): e0114190 Mathai, Matthews; Hofmeyr, G Justus; Mathai, Namratha E (2013) Abdominal surgical incisions for caesarean section. The Cochrane database of systematic reviews: cd004453 Puttanavijarn, Lunthaporn and Phupong, Vorapong (2013) Comparisons of the morbidity outcomes in repeated cesarean sections using midline and Pfannenstiel incisions. The journal of obstetrics and gynaecology research 39(12): 1555-9 Saha, Shyama Prasad, Bhattacharyya, Sanjoy Kumar, Bhattarcharjee, Nabendu et al. (2013) A randomized comparative study on modified Joel-Cohen incision versus Pfannenstiel incision for cesarean section. Journal of the Turkish German Gynecology Association 14(1): 28-34 Sahin, Nur, Genc, Mine, Turan, Guluzar Arzu et al. (2018) A comparison of 2 cesarean section methods, modified Misgav-Ladach and Pfannenstiel-Kerr: A randomized controlled study. Advances in clinical and experimental medicine : official organ Wroclaw Medical University 27(3): 357-361 Sunullah, Soysal; Mustafa, Ugur; Var, Turgut (2013) Comparison of visual analog pain scores of two different abdominal incisions for cesarean section: A prospective randomized trial. Marmara Medical Journal 26(3): 142-145 Dissection/opening of subsequent layers Asicioglu, Osman, Gungorduk, Kemal, Asicioglu, Berhan Besimoglu et al. (2014) Unintended extension of the lower segment uterine incision at cesarean delivery: a randomized comparison of sharp versus blunt techniques. American journal of perinatology 31(10): 837-44 Chicaud, B, Roux, C, Rudigoz, R-C et al. (2013) [Blunt or sharp expansion of cesarean section: a comparative study]. Journal de gynecologie, obstetrique et biologie de la reproduction 42(4): 366-71 Dodd, Jodie M, Anderson, Elizabeth R, Gates, Simon et al. (2014) Surgical techniques for uterine incision and uterine closure at the time of caesarean section. The Cochrane database of systematic reviews: cd004732 Morales, Alberto; Reyes, Osvaldo; Cardenas, Gerardo (2019) Type of Blunt Expansion of the Low Transverse Uterine Incision During Caesarean Section and the Risk of Postoperative Complications: A Prospective Randomized Controlled Trial. Journal of obstetrics and gynaecology Canada : JOGC = Journal d'obstetrique et gynecologie du Canada : JOGC 41(3): 306-311 Ozcan, Pinar, Ates, Seda, Guner Can, Meltem et al. (2016) Is cephalad-caudad blunt expansion of the low transverse uterine incision really associated with less uncontrolled extensions to decrease intra-operative blood loss? A prospective randomised-controlled trial. The journal of maternal-fetal & neonatal medicine : the official journal of the European Association of Perinatal Medicine, the Federation of Asia and Oceania Perinatal Societies, the International Society of Perinatal Obstetricians 29(12): 1952-6

ID	Field	Content
		Pergialiotis, Vasilios, Biliou, Eirini, Mitsopoulou, Dimitra et al. (2021) Cephalad-caudad versus transverse blunt expansion of the low transverse hysterotomy during cesarean delivery decreases maternal morbidity: a meta-analysis. American journal of obstetrics and gynecology Razzaq, Moona; Razaq, Fahad; Irshad, Adil (2016) Comparison of intra-operative blood loss by blunt versus sharp expansion of the uterine incision at lower segment cesarean delivery. Pakistan Journal of Medical and Health Sciences 10(4): 1437-1440 Saad, Antonio F, Rahman, Mahbubur, Costantine, Maged M et al. (2014) Blunt versus sharp uterine incision expansion during low transverse cesarean delivery: a metaanalysis. American journal of obstetrics and gynecology 211(6): 684e1-11 Shaukat, Shysta, Janjua, Mahham, Iqbal, Tayyaba et al. (2019) Comparison of intra-operative hemorrhage by blunt and sharp expansion of uterine incision at the cesarean section. Medical Forum Monthly 30(2): 96-98 Tahir, Noreen, Khan, Shazia Amir, Aslam, Rakhshanda et al. (2018) Comparison of intraoperative hemorrhage by blunt versus sharp expansion of uterine incision at caesarean delivery. Rawal Medical Journal 43(4): 654-657 Xodo, Serena, Saccone, Gabriele, Cromi, Antonella et al. (2016) Cephalad-caudad versus transverse blunt expansion of the low transverse uterine incision during cesarean delivery. European journal of obstetrics, gynecology, and reproductive biology 202: 75-80 Xu, Lileane Liang; Chau, Anthony Minh Tien; Zuschmann, Andrew (2013) Blunt vs. sharp uterine expansion at lower segment cesarean section delivery: a systematic review with metaanalysis. American journal of obstetrics and gynecology 208(1): 62e1-8 Yilmaz, FY Mathyk, BA Yildiz, S Yenigul, NN Saglam, C (2018) Postoperative pain and neuropathy after caesarean operation featuring blunt or sharp opening of the fascia: a randomised, parallel group, double-blind study. JOURNAL OF OBSTETRICS AND GYNAECOLOGY 38(7): 933 – 939 Women with a BMI in obesity range 1/2/3 Marrs, Caroline, Blackwell, Sean, Hester, Ashley et al. (2019) Pfannenstiel versus Vertical Skin Incision for Cesarean Delivery in Women with Class III Obesity: A Randomized Trial. American journal of perinatology 36(1): 97-104 Mccurdy, Rebekah J., Felder, Laura A., Berghella, Vincenzo et al. (2020) The association of skin incision placement during cesarean delivery with wound complications in obese women: a systematic review and meta-analysis. Journal of Maternal-Fetal and Neonatal Medicine: 1-13
5.	Condition or domain being studied	Labour and birth

ID	Field	Content

6.	Population	Pregnant women due for delivery by caesarean birth.
		
		Evidence will be stratified by:
		• BMI:
		  ○ Underweight range: <18.5 kg/m2
		  ○ Healthy weight range: 18.5 to 24.9 kg/m2
		  ○ Overweight range: 25 to 29.99 kg/m2
		  ○ Obesity 1: 30 to 34.99 kg/m2
		  ○ Obesity 2: 35 to 39.99 kg/m2
		  ○ Obesity 3: 40 kg/m2

7.	Intervention	Any abdominal wall incision technique for caesarean birth for example: • Joel-Cohen • Modified Joel-Cohen • Pfannenstiel • Pfannenstiel-Kerr • Modified Misgav-Ladach • Transverse abdominal incision • Mouchel incision • Maylard incision Any technique for opening subsequent layers for example: • Blunt dissection • Sharp dissection

ID	Field	Content
		• Cephalad-caudad stretching • Transverse blunt stretching
8.	Comparator	• Any abdominal wall incision techniques compared to each other. • Any techniques for opening subsequent layers compared to each other.
9.	Types of study to be included	Include published full-text papers: • Systematic reviews of RCTs • Parallel RCTs (individual, cluster) Conference abstracts will not be included because these do not typically have sufficient information to allow full critical appraisal
10.	Other exclusion criteria	Midline/vertical incision
11.	Context	This review question will partly update the following: Caesarean Birth (NG192)
12.	Primary outcomes (critical outcomes)	• Postoperative febrile morbidity as defined by trial authors • Postoperative analgesia as defined by trial authors • Blood loss as defined by the trial authors
13.	Secondary outcomes (important outcomes)	For the mother • Duration of surgery • Wound complications (haematoma, infection, breakdown; return to theatre for a wound complication) • Time to breastfeeding initiation For the baby • Admission to special care baby unit

ID	Field	Content
14.	Data extraction (selection and coding)	All references identified by the searches and from other sources will be uploaded into EPPI and de-duplicated. Titles and abstracts of the retrieved citations will be screened to identify studies that potentially meet the inclusion criteria outlined in the review protocol. Full versions of the selected studies will be obtained for assessment. Studies that fail to meet the inclusion criteria once the full version has been checked will be excluded at this stage. Each study excluded after checking the full version will be listed, along with the reason for its exclusion. A standardised form will be used to extract data from studies. The following data will be extracted: study details (reference, country where study was carried out, type and dates), participant characteristics, inclusion and exclusion criteria, details of the interventions if relevant, setting and follow-up, relevant outcome data and source of funding. One reviewer will extract relevant data into a standardised form, and this will be quality assessed by a senior reviewer
15.	Risk of bias (quality) assessment	Quality assessment of individual studies will be performed using the following checklists: • ROBIS tool for systematic reviews • Cochrane RoB tool v.2 for RCTs • Cochrane RoB tool v.2 for cluster randomised trials The quality assessment will be performed by one reviewer and this will be quality assessed by a senior reviewer
16.	Strategy for data synthesis	Quantitative findings will be formally summarised in the review. Where multiple studies report on the same outcome for the same comparison, meta-analyses will be conducted using Cochrane Review Manager software. A fixed effect meta-analysis will be conducted and data will be presented as risk ratios if possible or odds ratios when required (for example, if only available in this form in included studies) for dichotomous outcomes, and mean differences or standardised mean differences for continuous outcomes. Heterogeneity in the effect estimates of the individual studies will be assessed using the I^2 statistic. Alongside visual inspection of the point estimates and confidence intervals, I^2 values of greater than 50% and 80% will be considered as significant and very significant heterogeneity, respectively. Heterogeneity will be explored as appropriate using sensitivity analyses and pre-specified subgroup analyses. If heterogeneity cannot be explained through subgroup analysis then a random effects model will be used for meta-analysis, or if the I^2 figure is greater than 80%and/or the studies are fundamentally too different, then the data will not be pooled and the studies will be reported separately.

ID	Field	Content			
		The confidence in the findings across all available evidence will be evaluated for each outcome using an adaptation of the 'Grading of Recommendations Assessment, Development and Evaluation (GRADE) toolbox' developed by the international GRADE working group: http://www.gradeworkinggroup.org/ Minimally important differences: Validated scales/continuous outcomes: published MIDs where available All other outcomes & where published MIDs are not available: 0.8 and 1.25 for all relative dichotomous outcomes; +/- 0.5x control group SD for continuous outcomes			
17.	Analysis of sub-groups	Primary, repeat and mixed or undefined caesarean birth Elective, emergency and mixed or undefined caesarean birth			
18.	Type and method of review	☒	Intervention		
		☐	Diagnostic		
		☐	Prognostic		
		☐	Qualitative		
		☐	Epidemiologic		
		☐	Service Delivery		
		☐	Other (please specify)		
19.	Language	English			
20.	Country	England			
21.	Anticipated or actual start date	March 2023			
22.	Anticipated completion date	May 2023			
23.	Stage of review at time of this submission	Review stage		Started	Completed
		Preliminary searches		☐	☐

ID	Field	Content		
		Piloting of the study selection process	☑	☐
		Formal screening of search results against eligibility criteria	☐	☐
		Data extraction	☐	☐
		Risk of bias (quality) assessment	☐	☐
		Data analysis	☐	☐
24.	Named contact	5a. Named contact National Guideline Alliance 5b Named contact e-mail [Guideline email]@nice.org.uk [Developer to check with Guideline Coordinator for email address] 5e Organisational affiliation of the review National Institute for Health and Care Excellence (NICE) and National Guideline Alliance [Note it is essential to use the template text here to enable PROSPERO to recognise this as a NICE protocol]		
25.	Review team members	[Give the title, first name, last name and the organisational affiliations of each member of the review team. Affiliation refers to groups or organisations to which review team members belong.] From the [Insert Development centre]: [Tech lead] [Tech analyst] [Health economist] [Information specialist] [Others]		

ID	Field	Content
26.	Funding sources/sponsor	This systematic review is being completed by the [Insert Development centre] which receives funding from NICE.
27.	Conflicts of interest	All guideline committee members and anyone who has direct input into NICE guidelines (including the evidence review team and expert witnesses) must declare any potential conflicts of interest in line with NICE's code of practice for declaring and dealing with conflicts of interest. Any relevant interests, or changes to interests, will also be declared publicly at the start of each guideline committee meeting. Before each meeting, any potential conflicts of interest will be considered by the guideline committee Chair and a senior member of the development team. Any decisions to exclude a person from all or part of a meeting will be documented. Any changes to a member's declaration of interests will be recorded in the minutes of the meeting. Declarations of interests will be published with the final guideline.
28.	Collaborators	Development of this systematic review will be overseen by an advisory committee who will use the review to inform the development of evidence-based recommendations in line with section 3 of Developing NICE guidelines: the manual. Members of the guideline committee are available on the NICE website: [NICE guideline webpage].
29.	Other registration details	[Give the name of any organisation where the systematic review title or protocol is registered (such as with The Campbell Collaboration, or The Joanna Briggs Institute) together with any unique identification number assigned. If extracted data will be stored and made available through a repository such as the Systematic Review Data Repository (SRDR), details and a link should be included here. If none, leave blank.]
30.	Reference/URL for published protocol	[Give the citation and link for the published protocol, if there is one.]
31.	Dissemination plans	NICE may use a range of different methods to raise awareness of the guideline. These include standard approaches such as: notifying registered stakeholders of publication publicising the guideline through NICE's newsletter and alerts issuing a press release or briefing as appropriate, posting news articles on the NICE website, using social media channels, and publicising the guideline within NICE. [Add in any additional agree dissemination plans.]
32.	Keywords	[Give words or phrases that best describe the review.]
33.	Details of existing review of same topic by same authors	[Give details of earlier versions of the systematic review if an update of an existing review is being registered, including full bibliographic reference if possible. NOTE: most NICE reviews will not constitute an update in PROSPERO language. To be an update it needs to be the same review question/search/methodology. If anything has changed it is a new review]

ID	Field	Content	
34.	Current review status	☐	Ongoing
		☐	Completed but not published
		☐	Completed and published
		☐	Completed, published and being updated
		☐	Discontinued
35..	Additional information	[Provide any other information the review team feel is relevant to the registration of the review.]	
36.	Details of final publication	www.nice.org.uk	

CDSR: Cochrane Database of Systematic Reviews; CENTRAL: Cochrane Central Register of Controlled Trials; DARE: Database of Abstracts of Reviews of Effects; GRADE: Grading of Recommendations Assessment, Development and Evaluation; HTA: Health Technology Assessment; MID: minimally important difference; NGA: National Guideline Alliance; NHS: National health service; NICE: National Institute for Health and Care Excellence; RCT: randomised controlled trial; RoB: risk of bias; SD: standard deviation

Appendix B Literature search strategies

Literature search strategies for review question: What is the most effective technique for the abdominal opening and subsequent extension of tissue layers in caesarean birth, including in overweight and obese women?

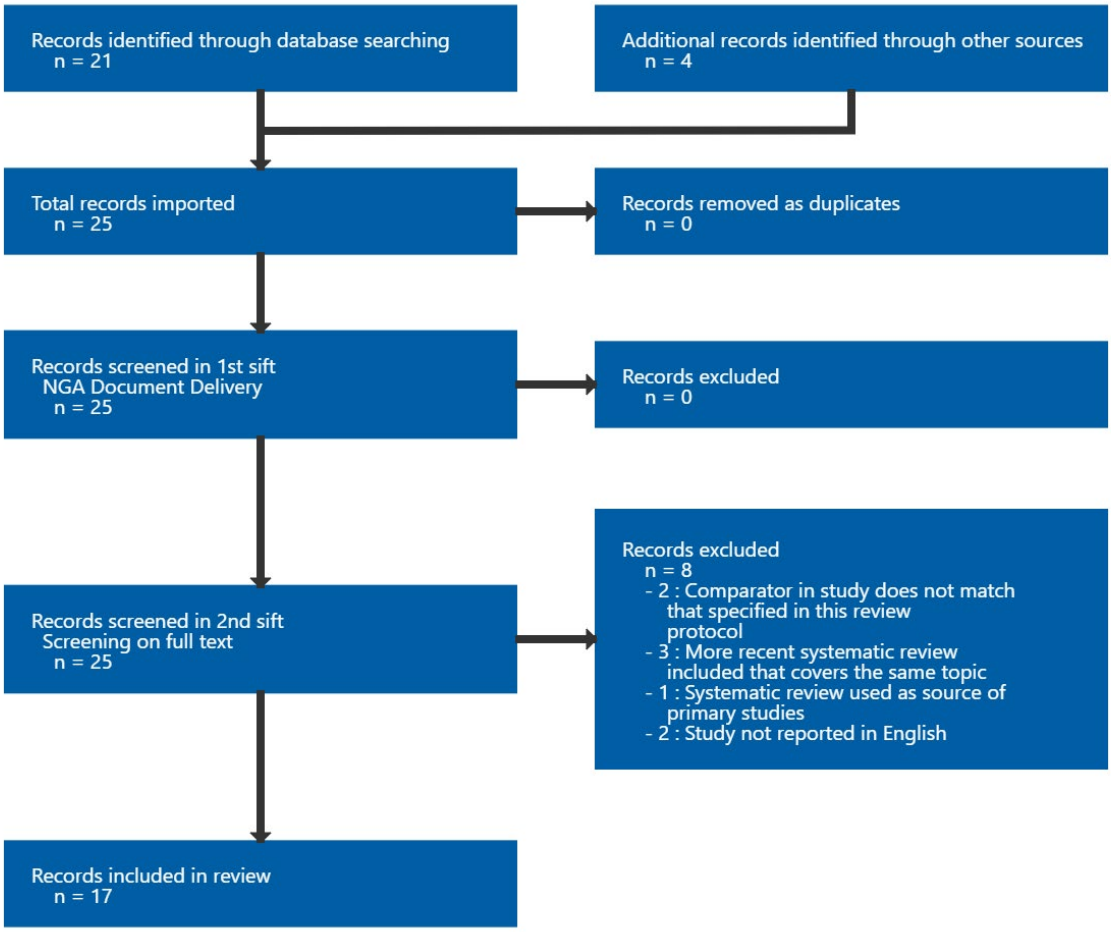
A literature search was not conducted for this review question.

Appendix C Effectiveness evidence study selection

Study selection for: What is the most effective technique for the abdominal opening and subsequent extension of tissue layers in caesarean birth, including in overweight and obese women?

No literature search was conducted for this review. Studies identified in the surveillance report were included in the review.

Figure 1: Study selection flow chart



[a]

[a] 14 studies are included in the review, however 3 primary studies identified for this review have been included under the systematic review entry but still appear in the PRISMA diagram.

Appendix D Evidence tables

Evidence tables for review question: What is the most effective technique for the abdominal opening and subsequent extension of tissue layers in caesarean birth, including in overweight and obese women?

Abuelghar, 2013

Bibliographic Reference	Abuelghar WM; El-Bishry G; Emam LH; Caesarean deliveries by Pfannenstiel versus Joel-Cohen incision: A randomised controlled trial.; Journal of the Turkish German Gynecological Association; 2013; vol. 14 (no. 4)

Study details

Country/ies where study was carried out	Turkey
Study type	Randomised controlled trial (RCT)
Study dates	January 2012 to January 2013
Inclusion criteria	Not specified
Exclusion criteria	• Women having experienced previous abdominal operations • previous caesarean section • any disease that could affect post-operative recovery (cardiac, diabetes mellitus, preeclampsia) • patients who were complicated with unilateral or bilateral extension of the uterine incision during caesarean section.
Patient characteristics	Age, years - mean (SD): Joel Cohen: 26.75 (3.7) Pfannenstiel: 26.53 (3.65) Parity - mean (SD): Joel Cohen: 1 (1.2) Pfannenstiel: 1 (1.5)

	Gestational age, weeks - mean (SD): Joel Cohen: 38.86 (1.4) Pfannenstiel: 38.78 (1.2) All primary caesarean population. Undefined type of caesarean birth.
Intervention(s)/control	Joel Cohen incision: • Straight transverse incision through the skin only, 3cm below the anterior superior iliac spines (higher than Pfannenstiel). • Subcutaneous tissues opened in the middle 3 cm. • Fascia incised transversely in the midline then extended laterally with blunt finger dissection. Pfannenstiel incision: • Skin and rectus sheath opened transversely using sharp dissection. • Rectus sheath dissected free from underlying abdominal muscles. • Peritoneum opened longitudinally using sharp dissection. • Uterus was opened with a transverse lower segment incision. All patients received the same dose of prophylactic antibiotics, transferred to the same post-operative ward and received the same medication.
Duration of follow-up	Blood loss outcomes during caesarean section. Postoperative outcomes up to 48 hours post operative (length of hospital stay).
Sources of funding	Not specified
Sample size	N= 153 randomised Joel Cohen: n=76 randomised (64 analysed, 12 lost to follow-up) Pfannenstiel: n=77 randomised (64 analysed, 13 lost to follow-up)
Other information	Subgroup information: Mixed BMI population Women having a primary caesarean birth

Outcomes

Outcome	Joel Cohen Incision, , N = 64	Pfannenstiel Incision, , N = 64
Postoperative temperature >=38 degrees C No of events	n = 7	n = 15
Analgesic doses used postoperative (lower values better) both groups received Pethidine 50mg IM Mean (SD)	2.4 (0.8)	3 (0.8)
Total operative time (Minutes) (lower values better) Mean (SD)	22.36 (2.45)	31.59 (2.88)
Postoperative haemoglobin drop (g/dL) (lower values better) Mean (SD)	0.35 (0.26)	0.34 (0.21)
Postoperative haematocrit drop (%) (lower values better) Mean (SD)	0.67 (0.29)	0.47 (0.35)

Critical appraisal

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low *(Randomisation was computer-generated; the allocation sequence was concealed in, opaque, sealed envelopes.)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Some concerns *(Participants were blinded, as were all staff apart from the obstetrician performing the intervention. However no information on intention to treat analysis.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Some concerns *(Some missing outcome data, however balanced between groups, unlikely to depend on the true value.)*
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low *(Measurement of the outcome was not inappropriate. Only single obstetrician was aware of the intervention received, so probably not the outcome assessor as other personnel were involved. Outcomes were not subjective.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Some concerns *(Protocol unavailable to assess bias)*
Overall bias and Directness	Risk of bias judgement	Some concerns *(No information on intention to treat analysis, and no protocol available to judge selection of results.)*
Overall bias and Directness	Overall Directness	Directly applicable
Overall bias and Directness	Risk of bias variation across outcomes	No variation

Asıcıoglu, 2014

Bibliographic Reference	Asıcıoglu O; Gungorduk K; Asıcıoglu BB; Yıldırım G; Gungorduk OC; Ark C; Unintended extension of the lower segment uterine incision at cesarean delivery: a randomized comparison of sharp versus blunt techniques.; American journal of perinatology; 2014; vol. 31 (no. 10)

Study details

Country/ies where study was carried out	Turkey
Study type	Randomised controlled trial (RCT)
Study dates	March 2011 to February 2012
Inclusion criteria	• Aged 18 to 40 • elective caesarean birth (caesarean performed before the onset of labour)
Exclusion criteria	• Emergency caesarean birth • planned caesarean hysterectomy • high risk of bleeding, such as HELLP (hemolysis, elevated liver enzymes, low platelets); preeclampsia, placental insertion anomalies, abnormal placentation, parity >5, multiple pregnancy) • women whom either a low segment vertical uterine or classical upper segment was utilised.
Patient characteristics	Age, years - mean (SD): Sharp: 28.90 (3.4) Blunt: 29.13 (3.1) Parity - mean (SD): Sharp: 1.27 (0.87) Blunt: 1.19 (0.59) BMI, kg/m2 - mean (SD):

	Sharp: 28.6 (3.35) Blunt: 28.2 (3.11) <u>Gestational age at delivery, weeks - mean (SD):</u> Sharp: 38.34 (0.43) Blunt: 38.61 (0.64) <u>Previous caesarean = 1, number (%):</u> Sharp: 392 (73.3) Blunt: 386 (71.3) <u>Previous caesarean >=2, number (%):</u> Sharp: 133 (24.9) Blunt: 143 (26.4) Mixed population for primary or repeat caesarean birth. Elective type of caesarean birth population.
Intervention(s)/control	Sharp expansion of the uterine incision: • cutting laterally and cephalad using bandage scissors. Blunt expansion: of the uterine incision: • placing index fingers in the incision and pulling the fingers apart laterally and cephalad. Both groups underwent Pfannenstiel incisions: • The fascia was freed from the abdominal muscles in both the cranial and caudal directions. • Rectus muscles were separated at the midline and the peritoneum opened in an identical manner using vertical midline incision. • Uterine incision initiated with a scalpel to incise the lower uterine segment transversely for 1 to 2 cm in the midline.
Duration of follow-up	Discharge at postoperative day 3 if no infection or complication

Sources of funding	Not industry funded
Sample size	N=1076 randomised Sharp: n=535 Blunt: n=541
Other information	Subgroup information: BMI overweight range: 25 to 29.99 kg/m^2 Women having either primary or repeat caesarean birth

Outcomes

Outcome	**Sharp , , N = 535**	**Blunt, , N = 541**
Blood loss >1000 ml No of events	n = 61	n = 37
Estimated blood loss mL (lower values better) Mean (SD)	853.67 (42)	664.8 (38)
Operating time (Minutes) (lower values better) Mean (SD)	38.21 (0.33)	36.15 (0.45)
Postpartum endometritis (wound complications) No of events	n = 30	n = 27
NICU admission No of events	n = 3	n = 3

Outcome	Sharp , , N = 535	Blunt, , N = 541
Preoperative haemoglobin level (g/L) (Baseline) (higher values better) Mean (SD)	11.6 (0.89)	11.45 (0.77)
Postoperative haemoglobin level (g/L) (higher values better) Mean (SD)	9.63 (0.18)	9.98 (0.24)
Preoperative haematocrit level (%) (Baseline) (higher values better) Mean (SD)	34.45 (1.68)	34.42 (2.46)
Postoperative haematocrit level (%) (higher values better) Mean (SD)	29.23 (0.41)	30.98 (0.27)
Blood transfusion No of events	n = 40	n = 34

Critical appraisal

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low *(Randomisation generated using random numbers table. Allocation was concealed in envelopes.)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low *(No information if participants were blinded, however there were no deviations from intended interventions and intention to treat analysis performed.)*

Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low *(Data available for all participants)*
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low *(Unclear if outcome assessors were blind however outcomes were not subjective.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Some concerns *(Protocol unavailable to judge bias in this domain.)*
Overall bias and Directness	Risk of bias judgement	Low
Overall bias and Directness	Overall Directness	Directly applicable
Overall bias and Directness	Risk of bias variation across outcomes	No variation

Dodd, 2014

Bibliographic Reference	Dodd JM; Anderson ER; Gates S; Grivell RM; Surgical techniques for uterine incision and uterine closure at the time of caesarean section.; The Cochrane database of systematic reviews; 2014; (no. 7)

Study details

Country/ies where study was carried out	Cromi 2008: Italy Hidar 2007: Tunisia Magann 2002: United States Poonam 2006: Nepal Rodriguez 1994: United States Sekhavat 2010: Iran
Study type	Cochrane Systematic Review
Study dates	Extracted from individual RCT

	Cromi 2008: November 2005 and July 2007 Hidar 2007: Not reported Magann 2002: June 1998 to June 2000 Poonam 2006: September 2001 to September 2004 Rodriguez 1994: September 1992 to June 1993 Sekhavat 2010: April 2007 to December 2008
Inclusion criteria	Cromi 2008: • Birth after 30 weeks gestation. Hidar 2007: • Caesarean birth after 36 weeks' gestation (either elective or emergency) • singleton fetus. Magann 2002: • Women undergoing caesarean birth with low transverse uterine incision Poonam 2006: • Women undergoing primary lower segment caesarean birth • greater than 37 weeks' gestation. Rodriguez 1994: • Women undergoing caesarean birth Sekhavat 2010: • Primiparous women undergoing caesarean birth

Exclusion criteria	Cromi 2008: • Not specified Hidar 2007: • Less than 20 years • coagulopathy • placenta praevia Magann 2002 (extracted from individual RCT): • declined to participate • emergency caesarean with insufficient time to counsel women • women in whom low segment vertical uterine or classical upper segment were utilised Poonam 2006 (extracted from individual RCT): • Multiple pregnancy • previous caesarean Rodriguez 1994: • If there was insufficient time to provide consent, or due to time restraints due to an emergency procedure Sekhavat 2010: • Multiple pregnancy • major medical or surgical conditions • anaemia • thromboembolic disease • polyhydramnios

	• requiring emergency caesarean
Patient characteristics	Extracted from individual RCT **Cromi 2008:** Maternal age, years - mean (SD): Transverse: 32.7 (4.8) Cephalad-caudad: 32.6 (4.9) Nulliparous - number (%): Transverse: 351 (86.4) Cephalad-caudad: 344 (84.9) BMI (kg/m2): Transverse: 27.3 (4.2) Cephalad-caudad: 26.7 (4.0) Gestational age, weeks - mean (SD): Transverse: 38.5 (2.6) Cephalad-caudad: 38.3 (2.4) Previous caesarean delivery - number (%): Transverse: 90 (22.2) Cephalad-caudad: 104 (25.7) Mixed primary or repeat caesarean birth. Mixed type (elective and emergency birth). **Hidar 2007:** Mixed type (elective and emergency). No further details reported in Cochrane. Individual RCT in French therefore unable to extract further information. **Magann 2002:** Maternal age, years - mean (SD):

	Blunt: 24.7 (6.3) Sharp: 24.4 6.2) Nulliparous - n/N: Blunt: 157/475 Sharp: 153/470 BMI, kg/m2 - mean (SD): Blunt: 33.7 (8.5) Sharp: 34.2 (8.7) Previous caesarean birth - n/N: Blunt: 278/475 Sharp: 263/470 Mixed primary or repeat caesarean birth. Mixed type (elective and emergency birth). **Poonam 2006:** Maternal age, years - mean (range): Blunt: 24.5 (18-40) Sharp: 23.6 (18-40) Gestational age, weeks - mean (range): Blunt: 38.6 (37-42) Sharp: 38.4 (37-42) Primary caesarean birth. Mixed emergency or elective birth. **Rodriguez 1994:** Maternal age, years - mean (SD): Blunt: 25.8 (0.5) Sharp: 25.7 (0.5)

	Gestational age, weeks - mean (SD): Blunt: 38.5 (0.4) Sharp: 39 (0.3) Mixed primary or repeat caesarean birth. Elective caesarean birth **Sekhavat 2010:** Maternal age, years - mean (SD): Blunt: 24.3 (4.5) Sharp: 25.1 (4.9) BMI, kg/m2 - mean (SD): Blunt: 26.6 (3.9) Sharp: 27.4 (3.1) Gestational age, weeks - mean (SD): Blunt: 38.7 (1.5) Sharp: 38.1 (2.2) Elective caesarean - number: Blunt: 33 Sharp: 37 Primary caesarean birth. Elective type caesarean birth.
Intervention(s)/control	Details of incision type extracted from individual RCT: Cromi 2008: Pfannenstiel incision - uterine incision was initiated with a scalpel to incise the lower uterine segment transversely and cavity entered bluntly. At this point direction of expansion was as assigned. • Transverse direction of blunt extension of uterine incision.

	• Cephalad-caudad direction of blunt extension of uterine incision. Hidar 2007: • Sharp extension of uterine incision. • Blunt extension of uterine incision. Magann 2002: A transverse uterine incision in the lower uterine segment of approximately 2cm in length was made. Incision expanded by designated method (sharp or blunt). Expansions were laterally and cephalad. • Blunt extension of uterine incision. • Sharp extension of uterine incision. Poonam 2006: • Blunt extension of uterine incision. (Misgav Ladach technique = Joel-Cohen incision, straight transverse 3 cm below anterior superior iliac spines) • Sharp extension of uterine incision. (Pfannenstiel incision made) Rodriguez 1994: Uterine incision was initiated with a transverse scalpel incision approximately 1 cm in length. Direction was lateral and upward for both groups. • Blunt extension of uterine incision. • Sharp extension of uterine incision. Sekhavat 2010: Pfannenstiel incision performed - transverse uterine incision in the lower segment of approximately 1-2cm in length made with a scalpel and then extended as per assigned method. Expansion was lateral and cephalad. • Blunt extension of uterine incision.

	• Sharp extension of uterine incision.
Duration of follow-up	Cromi 2008: Blood loss outcomes during caesarean birth. Haemoglobin outcomes 1 day postoperative. Hidar 2007: Unable to access full text to extract further information. Magann 2020: Blood loss volumes measured during caesarean birth. Haematocrit measured 48 hours postoperative. Poonam 2006: Blood loss outcomes during caesarean birth. Postoperative outcomes follow up not reported, but hospital stay duration up to 4 days. Rodriguez 1994: Haemoglobin measured 24 hours postoperative. Sekhavat 2010: Blood loss and transfusion outcomes during caesarean birth. Haemoglobin and haematocrit levels 24 hours postoperative.
Sources of funding	Extracted from individual RCT Cromi 2008: Not reported Hidar 2007: Not reported Magann 2002: Not industry funded Poonam 2006: Not reported Rodriguez 1994: Not reported Sekhavat 2010: Not reported
Sample size	Cromi 2008: N=811 Transverse: n=406 Cephalad-caudad: n=405

	Hidar 2007: N=300 Blunt: n=147 Sharp: n=153 Magann 2002: N=945 Blunt: n=475 Sharp: n=470 Poonam 2006: N=400 Blunt: n=200 Sharp: n=200 Rodriguez 1994: N=296 Blunt: n=145 Sharp: n=151 Sekhavat 2010: N=200 Blunt: n=100 Sharp: n=100
Other information	Risk of bias assessed by review authors using Risk of Bias tool 1: **Cromi 2008:** Random sequence generation: Low Allocation concealment: Unclear Incomplete outcome data: Low Selective reporting: Low Other bias: Low Blinding of participants and personnel: Unclear Blinding of outcome assessment: Unclear

	Hidar 2007: Random sequence generation: Low Allocation concealment: Low Incomplete outcome data: Low Selective reporting: Low Other bias: Low Blinding of participants and personnel: Unclear Blinding of outcome assessment: Unclear **Magann 2002:** Random sequence generation: Low Allocation concealment: Low Incomplete outcome data: Low Selective reporting: Low Other bias: Low Blinding of participants and personnel: High Blinding of outcome assessment: High **Poonam 2006:** Random sequence generation: Unclear Allocation concealment: Unclear Incomplete outcome data: Low Selective reporting: Low Other bias: Low Blinding of participants and personnel: Unclear Blinding of outcome assessment: Unclear **Rodriguez 1994:** Random sequence generation: Unclear Allocation concealment: Unclear Incomplete outcome data: Low Selective reporting: Low Other bias: Low

	Blinding of participants and personnel: Unclear Blinding of outcome assessment: Unclear **Sekhavat 2010:** Random sequence generation: Low Allocation concealment: Low Incomplete outcome data: Low Selective reporting: Low Other bias: Low Blinding of participants and personnel: Low Blinding of outcome assessment: Unclear Subgroup information: Mixed BMI population; overweight range: 25 to 29.99 kg/m^2; obesity 1: 30 to 34.99 kg/m^2 Women having primary or repeat caesarean births Mixed elective or emergency caesarean births

Cromi 2008

Outcome	**Transverse, , N = 406**	**Cephalad-caudad, , N = 405**
Estimated blood loss mL (lower values better) Mean (SD)	440 (341)	398 (242)
Blood loss >1500ml extracted from individual RCT No of events	n = 8	n = 1

Outcome	Transverse, , N = 406	Cephalad-caudad, , N = 405
Haemoglobin decrease (g/dL) (lower values better) extracted from individual RCT Mean (SD)	1.2 (1)	1 (0.8)
Duration of surgery (lower values better) Mean (SD)	38.9 (11.9)	40.4 (11.8)
Blood transfusion No of events	n = 3	n = 3

Hidar 2007

Outcome	Sharp, , N = 153	Blunt, , N = 147
Postoperative febrile morbidity (including endometritis) No of events	n = 2	n = 3

Magann 2002

Outcome	Sharp, , N = 470	Blunt, , N = 475
Postoperative febrile morbidity (including endometritis) No of events	n = 66	n = 51

Outcome	Sharp, , N = 470	Blunt, , N = 475
Blood loss (lower values better) Mean (SD)	886 (197)	843 (164)
Haematocrit change (%)(higher values better) extracted from individual RCT Mean (SD)	6.1 (3.2)	5.5 (3)
Blood transfusion No of events	n = 9	n = 2

Poonam 2006

Outcome	Misgav-Ladach, , N = 200	Pfannenstiel, , N = 200
Postoperative febrile morbidity (including endometritis) No of events	n = 7	n = 14
Added analgesic requirement Extracted from individual RCT No of events	n = 8	n = 38
NICU admission Extracted from individual RCT No of events	n = 3	n = 16

Outcome	Misgav-Ladach, , N = 200	Pfannenstiel, , N = 200
Blood transfusion No of events	n = 1	n = 2

Rodriguez 1994

Outcome	Sharp, , N = 151	Blunt, , N = 145
Postoperative febrile morbidity (including endometritis) No of events	n = 65	n = 63
Birth time from start of surgery to infant birth (Minutes) (lower values better) extracted from individual RCT Mean (SD)	11.7 (0.4)	11.5 (0.4)
Decrease in haemoglobin (gm/dL) (lower values better) extracted from individual RCT Mean (SD)	2.2 (0.2)	1.8 (0.1)

Sekhavat 2010

Outcome	Sharp, , N = 100	Blunt, , N = 100
Blood loss cm^3 (lower values better)	443 (86)	375 (95)

Outcome	Sharp, , N = 100	Blunt, , N = 100
Mean (SD)		
Decrease in haemoglobin level (g/dl) pre to post operative (lower values better) extracted from individual RCT Mean (SD)	3 (1.2)	1.1 (0.9)
Decrease in haematocrit (%) pre to post operative (lower values better) extracted from individual RCT Mean (SD)	4.6 (2.6)	2.4 (2.6)
Duration of surgery (Minutes) (lower values better) Mean (SD)	30.7 (11.4)	27.9 (10.5)
Blood transfusion No of events	n = 1	n = 1

Critical appraisal - NGA Critical appraisal - ROBIS checklist

Section	Question	Answer
Study eligibility criteria	Concerns regarding specification of study eligibility criteria	Low

Section	Question	Answer
Identification and selection of studies	Concerns regarding methods used to identify and/or select studies	Low
Data collection and study appraisal	Concerns regarding methods used to collect data and appraise studies	Low
Synthesis and findings	Concerns regarding the synthesis and findings	Low
Overall study ratings	Overall risk of bias	Low
Overall study ratings	Applicability as a source of data	Fully applicable *(Further study characteristic details had to be extracted from the individual studies to meet the information required as specified by our review protocol. Not all studies included in this systematic review were relevant for our review and therefore not extracted. However, aside from this the relevant studies and this review was fully applicable to our review question.)*

Ferrari, 2001

Bibliographic Reference	Ferrari AG; Frigerio LG; Candotti G; Buscaglia M; Petrone M; Taglioretti A; Calori G; Can Joel-Cohen incision and single layer reconstruction reduce cesarean section morbidity?; International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics; 2001; vol. 72 (no. 2)

Study details

Country/ies where study was carried out	Italy

Study type	Randomised controlled trial (RCT)
Study dates	January 1997 to June 1998
Inclusion criteria	• Gestational age >30 weeks • no previous caesarean birth • eligible for caesarean by Pfannenstiel technique.
Exclusion criteria	Not specified
Patient characteristics	Age, mean (SE) Joel Cohen: 31.7 (0.53) Pfannenstiel: 30.7 (0.56) Parity >0, number (%): Joel Cohen: 27 (32.5) Pfannenstiel: 14 (18.7) p=0.049 Pre-gestation BMI (kg/m2) - mean (SE): Joel Cohen: 22.81 (0.43) Pfannenstiel: 21.85 (0.45) Gestational week, mean (SE): Joel Cohen: 38.3 (0.17) Pfannenstiel: 38.2 (0.24) Emergency caesarean birth (defined as urgency), number (%): Joel Cohen: 45 (54.2) Pfannenstiel: 32 (42.7) Primary caesarean birth population. Mixed caesarean type; emergency and elective.

Intervention(s)/control	Joel Cohen incision (referred to as modified technique in the study): • superficial transverse cut of the skin, 3cm above pubis symphysis • in the midline, the cut is deepened to the fascia with scalpel • blunt expansion of incision using index fingers Pfannenstiel incision (referred to as traditional technique in the study) • Pfannenstiel initial incision (no further details provided on expansion)
Duration of follow-up	Blood loss intraoperative. Haemoglobin 48 hours postoperative. Febrile morbidity 48 hours postoperative.
Sources of funding	Not reported
Sample size	N=158 randomised Joel Cohen: n=83 Pfannenstiel: n=75
Other information	Subgroup information: BMI healthy weight range: 18.5 to 24.9 kg/m^2 Women having a primary caesarean birth Mixed emergency or elective type

Outcomes

Outcome	**Joel Cohen, , N = 83**	**Pfannenstiel, , N = 75**
Post-operative febrile morbidity Severe defined as >38 degrees C, 48 hours after operation No of events	n = 5	n = 4

Outcome	Joel Cohen, , N = 83	Pfannenstiel, , N = 75
Blood loss cm^3 (lower values better) Standardised Mean (SE)	348.3 (21.25)	370.9 (22.06)
Total operating time (Minutes) (lower values better) Standardised Mean (SE)	31.6 (1.38)	44.4 (1.44)
Fall in haemoglobin levels postoperative (g/dL) (lower values better) Mean (SE)	-1.03 (0.12)	-1.2 (0.12)
Fall in haematocrit levels postoperative (%) (lower values better) Mean (SE)	-3.03 (0.38)	-3.04 (0.4)

Critical appraisal

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(Method of randomisation generation not reported)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	High *(Study was unblinded with no information on deviations for intended intervention. There was no information regarding intention to treat analysis.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low *(No indication that there was loss of outcome data.)*

Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low *(Outcome assessors were unblinded but outcomes were not subjective so unlikely to have been affected by knowledge of intervention)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Some concerns *(Protocol not available to assess bias appropriately)*
Overall bias and Directness	Risk of bias judgement	Some concerns *(Randomisation was concealed but not enough information regarding deviations from intended intervention, and as the study was unblinded there may have been deviations.)*
Overall bias and Directness	Overall Directness	Directly applicable
Overall bias and Directness	Risk of bias variation across outcomes	No variation

Mathai, 2013

Bibliographic Reference	Mathai M; Hofmeyr GJ; Mathai NE; Abdominal surgical incisions for caesarean section.; The Cochrane database of systematic reviews; 2013; (no. 5)

Study details

Country/ies where study was carried out	Franchi 2002: Italy and Switzerland Giacalone 2002: France Mathai 2002: India
Study type	Cochrane Systematic Review
Study dates	Franchi 2002: January 1998 to May 2000 Giacalone 2002:

	Mathai 2002:
Inclusion criteria	Franchi 2002: • Over 18 years old • singleton pregnancy Giacalone 2002: • Over 18 years old • gestation over 37 weeks • emergency or elective caesarean. Mathai 2002: • Women with singleton pregnancy at longitudinal lie at term • requiring caesarean birth under spinal anesthesia
Exclusion criteria	Franchi 2002: • Gestation less than 32 weeks • previous myomectomy • previous longitudinal abdominal incision • previous caesarean birth prior to 32 weeks • 2 or more caesarean births • maternal diseases requiring long-term medical treatment. Giacalone 2002: • Scarred abdominal wall • previous caesarean • hernia • multifetal gestation

	• grand multiparity • diabetes mellitus • myopathy • corticosteroid therapy during pregnancy • on anticoagulants • haemostatic disorder • having general anaesthesia. Mathai 2002: • Multiple pregnancy • previous abdominal surgery • conditions where midline or paramedian incisions were planned • spinal anaesthesia contraindicated
Patient characteristics	**Franchi 2002:** <u>Maternal age, years - mean (SD):</u> Joel-Cohen: 30 (5.1) Pfannenstiel: 30.6 (4.6) <u>Obesity, number (%):</u> Joel-Cohen: 12 (7.9) Pfannenstiel: 10 (6.3) <u>Gestational age at delivery, weeks - median (range):</u> Joel-Cohen: 38 (32-42) Pfannenstiel: 38 (32-42) <u>Previous caesarean - number (%):</u> Joel-Cohen: 11 (7.2) Pfannenstiel: 22 (13.9)

	Elective caesarean - number (%): Joel-Cohen: 13 (8.6) Pfannenstiel 23 (14.6) Primary caesarean births. Mixed type of caesarean births. **Giacalone 2002**: Age, years - mean (SD): Pfannenstiel: 28.5 (4.7) Maylard: 29.9 (4.6) BMI, kg/m2 (pre-pregnancy) - mean (SD): Pfannenstiel: 20.9 (2.5) Maylard: 21.3 (3.7) Gestational age at delivery, weeks - mean (SD): Pfannenstiel: 40 (1.7) Maylard: 39.5 (1.6) Primary caesarean births. Mixed type of caesarean births. **Mathai 2002:** Primary caesarean births. Further participants characteristics not reported in the study.
Intervention(s)/control	Franchi 2002: • Joel-Cohen incision • Pfannenstiel incision Giacalone 2002: • Maylard incision • Pfannenstiel incision

	Mathai 2002: • Joel-Cohen incision • Pfannenstiel incision
Duration of follow-up	**Franchi 2002:** Intraoperative outcomes during caesarean birth. Postoperative febrile morbidity, up to 8 hours after first 24 hours. **Giacalone 2002:** Intraoperative outcomes during caesarean birth. Postoperative febrile morbidity, 2 occasions 4 hours apart. **Mathai 2002:** Postoperative analgesia 4 hours post surgery. Total doses of analgesia in the first 24 hours. Postoperative haematocrit 3 days postoperative.
Sources of funding	Franchi 2002: Not reported. Giacalone 2002: Not reported. Mathai 2002: Not reported.
Sample size	**Franchi 2002:** N=312 Joel-Cohen: n=154 Pfannenstiel: n=158 **Giacalone 2002:** N=97 Maylard: n=43 Pfannenstiel: n=54 **Mathai 2002:** N=105 randomised (4 lost to follow-up: 1 underwent caesarean hysterectomy; 1 had vaginal delivery; 2 spinal anaesthesia ineffective - 1 per group)

	Joel-Cohen: n=51 Pfannenstiel: n=50
Other information	Risk of bias assessed by review authors using Risk of Bias tool 1: **Franchi 2002:** Random sequence generation: Low Allocation concealment: Unclear Blinding of participants and personnel: High Blinding of outcome assessment: Unclear Incomplete outcome data: Low Selective reporting: Unclear Other bias: Unclear **Giacalone 2002:** Random sequence generation: Low Allocation concealment: Low Blinding of participants and personnel: High Blinding of outcome assessment: Low Incomplete outcome data: High Selective reporting: Unclear Other bias: Unclear **Mathai 2002:** Random sequence generation: Low Allocation concealment: Low Blinding of participants and personnel: High Blinding of outcome assessment: Low Incomplete outcome data: Low Selective reporting: Unclear Other bias: Unclear Subgroup information: BMI mixed population

	Women having a primary caesarean birth Mixed emergency and elective births

Outcomes

Franchi 2002

Outcome	Joel-Cohen, , N = 152	Pfannenstiel, , N = 158
Postoperative febrile morbidity Define as >38 deg C on 2 occasions 4 h apart, excluding first 24 h, and in the absence of known operative or non-operative site infection. No of events	n = 3	n = 5
Wound infection No of events	n = 6	n = 4
Admission to special care baby unit - all types No of events	n = 8	n = 7
Admission to special care baby unit - emergency caesarean No of events	n = 8	n = 6
Blood transfusion No of events	n = 0	n = 0

Giacalone 2002

Outcome	Pfannenstiel, , N = 54	Maylard, , N = 43
Postoperative febrile morbidity No of events	n = 1	n = 1
Wound infection No of events	n = 3	n = 3
Blood transfusion No of events	n = 1	n = 1

Mathai 2002

Outcome	Joel-Cohen, , N = 51	Pfannenstiel, , N = 50
Postoperative febrile morbidity No of events	n = 3	n = 12
Postoperative analgesia on demand No of events	n = 23	n = 41
Total dose of analgesics in 24 hours (lower values better) Mean (SD)	2.1 (0.6)	2.9 (0.9)
Estimated blood loss mL (lower values better) Mean (SD)	410 (103)	468 (151)
Total operative time (minutes) (lower values better) Mean (SD)	33.1 (7.8)	44.5 (16.9)

Outcome	Joel-Cohen, , N = 51	Pfannenstiel, , N = 50
Time from surgery to start of breastfeeding (hours) (lower values better) Mean (SD)	6.9 (9.9)	12.4 (27.6)
Postoperative haematocrit (%) (higher values better) Mean (SD)	33.62 (4.1)	32.72 (4.6)

Critical appraisal - NGA Critical appraisal - ROBIS checklist

Section	Question	Answer
Study eligibility criteria	Concerns regarding specification of study eligibility criteria	Low
Identification and selection of studies	Concerns regarding methods used to identify and/or select studies	Low
Data collection and study appraisal	Concerns regarding methods used to collect data and appraise studies	Low
Synthesis and findings	Concerns regarding the synthesis and findings	Low
Overall study ratings	Overall risk of bias	Low

Section	Question	Answer
Overall study ratings	Applicability as a source of data	Fully applicable *(Further study characteristic details had to be extracted from the individual studies to meet the information required as specified by our review protocol. One study included in this review was not included in our review as there was no outcome data available. However, aside from this the relevant studies and this review was fully applicable to our review question.)*

Mccurdy, 2022

Bibliographic Reference	Mccurdy RJ; Felder LA; Saccone G; Edwards RK; Thornburg LL; Marrs C; Conner SN; Strauss R; Berghella V; The association of skin incision placement during cesarean delivery with wound complications in obese women: a systematic review and meta-analysis.; The journal of maternal-fetal & neonatal medicine : the official journal of the European Association of Perinatal Medicine, the Federation of Asia and Oceania Perinatal Societies, the International Society of Perinatal Obstetricians; 2022; vol. 35 (no. 12)

Study details

Country/ies where study was carried out	El-Sayed 2018: Egypt
Study type	Systematic review of RCTs
Study dates	El-Sayed 2018: Not reported in systematic review. Full text unavailable.
Inclusion criteria	El-Sayed 2018: Not reported in systematic review. Full text unavailable.
Exclusion criteria	El-Sayed 2018: • Not scheduled for caesarean • Gestational age <36 weeks • Haemoglobin <10 g/dL • Medication usage (including cortisone and anti-coagulants)

Patient characteristics	**El-Sayed 2018:** BMI at delivery, kg/m2 - mean (SD): Pfannenstiel: 45.9 (3.1) Transverse: 47.2 (3.3) El-Sayed 2018 unable to access full publication, therefore information only available from McCurdy - unable to extract further information from the RCT.
Intervention(s)/control	El-Sayed 2018: Intervention: Pfannenstiel (infrapannus - low transverse) Comparison: Transverse incision (supraumbilical and suprapannus- high transverse)
Duration of follow-up	El-Sayed 2018: Not reported in systematic review, full text unavailable.
Sources of funding	El-Sayed 2018: Not reported in systematic review, full text unavailable.
Sample size	El-Sayed 2018: Randomised N= 72 Pfannenstiel: n= 36 Transverse: n= 36
Other information	Subgroup information: BMI obesity 3: >40kg/m^2 Unspecified previous caesarean or type of caesarean

Outcomes

El-Sayed 2018

Outcome	**Transverse incision, , N = 36**	**Pfannenstiel, , N = 36**
Duration of surgery (lower values better) Reported as 'operative time (mins)' Mean (SD)	88.5 (7.7)	91 (9.2)

Outcome	Transverse incision, , N = 36	Pfannenstiel, , N = 36
Wound complications Lower values are better No of events	n = 4	n = 21

Critical appraisal - NGA Critical appraisal - ROBIS checklist

Section	Question	Answer
Study eligibility criteria	Concerns regarding specification of study eligibility criteria	Low
Identification and selection of studies	Concerns regarding methods used to identify and/or select studies	Low
Data collection and study appraisal	Concerns regarding methods used to collect data and appraise studies	High *(Reports of risk of bias assessment in supplementary material, however bias assessment not available in supplemental material.)*
Synthesis and findings	Concerns regarding the synthesis and findings	Unclear *(Not information regarding heterogeneity sensitivity analysis.)*
Overall study ratings	Overall risk of bias	High *(Unable to locate risk of bias assessments.)*
Overall study ratings	Applicability as a source of data	Fully applicable

Pergialiotis, 2021

Bibliographic Reference	Pergialiotis V; Mitsopoulou D; Biliou E; Bellos I; Karagiannis V; Papapanagiotou A; Rodolakis A; Daskalakis G; Cephalad-caudad versus transverse blunt expansion of the low transverse hysterotomy during cesarean delivery decreases maternal morbidity: a meta-analysis.; American journal of obstetrics and gynecology; 2021; vol. 225 (no. 2)

Study details

Country/ies where study was carried out	Extracted from individual RCT: Dikmen 2017: Turkey Mahawerawat and Jeerasap 2010: Thailand Morales 2019: Panama Ozcan 2015: Turkey
Study type	Systematic review of RCTs
Study dates	Extracted from individual RCT: Dikmen 2017: July 2014 to June 2015 Mahawerawat and Jeerasap 2010: November 2009 to August 2010 Morales 2019: October 2012 to May 2013 Ozcan 2015: February 2015 to April 2015
Inclusion criteria	Dikmen 2017: Repeated caesarean birth Mahawerawat and Jeerasap 2010: Low-segment transverse caesarean birth at >=30 weeks of gestation Morales 2019: Maternal or fetal indication for elective or emergency caesarean birth Ozcan 2015: Low-segment transverse primary or repeat caesarean birth, term pregnancy, women aged 18-40, spinal anaesthesia

Exclusion criteria	Dikmen 2017: Refusal to participate, placenta previa, placental abruption, coagulation disorders, <34 weeks of gestation, anomalies, multiple pregnancies, primary caesarean birth. Mahawerawat and Jeerasap 2010: Refusal to participate, emergency caesarean birth without consent to participation, placenta previa Morales 2019: Refusal to participate, placenta previa, placental abruption, previous uterine scar, <=33 6/7 weeks of gestation, multiple pregnancies, bleeding disorders, HELLP syndrome, stillbirth, preoperative HB<10.5 g/dL, uterine atony, required use of scissors, uterine atony Ozcan 2015: Placental abruption, placenta previa, severe medical conditions (diabetes mellitus, hypertension, blood and thrombophilia disorders), uterine overdistention (multiple pregnancies, suspected macrosomia, polyhydramnios), anticoagulation therapy, major abdominal surgery, hysterectomy, bladder injury
Patient characteristics	**Dikmen 2017:** Age, years - mean±SD: Cephalad-Caudad: 29.46±5.69 Transverse: 30.01±5.76 BMI- kg/m2 - mean±SD: Cephalad-Caudad: 30.17±4.62 Transverse: 30.70±5.30 Gestational age, weeks - mean±SD: Cephalad-Caudad: 38.59±1.45 Transverse: 38.48±1.87 Previous caesarean birth, n/N (%): Cephalad-Caudad: 40/93 (43.01) Transverse: 33/90 (36.66) Pre-op Hb (g/ dL) - mean±SD: Cephalad-Caudad: 11.85±1.44 Transverse: 12.16±1.33

	Pre-op Hct - mean±SD: Cephalad-Caudad: 36.10±3.55 Transverse: 37.03±3.52 Repeat caesarean population. Type undefined. **Mahawerawat and Jeerasap 2010:** Age, years - mean±SD: Cephalad-Caudad: 26.30±6.20 Transverse: 26.40±6.00 BMI- kg/m2 - mean±SD: Cephalad-Caudad: 28.00±3.70 Transverse: 27.60±3.50 Gestational age, weeks - mean±SD: Cephalad-Caudad: 38.50±1.50 Transverse: 38.20±1.70 Previous caesarean birth, n/N (%): Cephalad-Caudad: 87/250 (34.80) Transverse: 95/250 (38.00) Mixed primary and repeat population. Type undefined. **Morales 2019:** Age, years – mean ± SD: Cephalad-Caudad: 25.94±6.02 Transverse: 26.22±7.84 Gestational age, weeks – mean ± SD: Cephalad-Caudad: 38.52±3.48 Transverse: 38.67±3.77

	Pre-op Hb (g/ dL) – mean ± SD: Cephalad-Caudad: 12.00±0.90 Transverse: 12.10±1.00 Primary caeasean birth population. Mixed caesarean type: emergency and elective. **Ozcan 2015:** Age, years – mean ± SD: Cephalad-Caudad: 30.40±4.60 Transverse: 29.70±5.60 BMI- kg/m2 – mean ± SD: Cephalad-Caudad: 28.13±2.31 Transverse: 28.70±1.83 Gestational age, weeks – mean ± SD: Cephalad-Caudad: 38.50±1.10 Transverse: 38.70±1.10 Pre-op Hct – mean ± SD: Cephalad-Caudad: 36.40±3.03 Transverse: 35.30±6.44 Mixed primary and repeat caesarean population. Undefined type of caesarean population.
Intervention(s)/control	Intervention: Cephalad-caudad direction of expansion of incision Control: Transverse direction of expansion of incision Details of incision extracted from individual RCT: Dikmen 2017: Pfannenstiel incision in both groups, with blunt extension.

	Mahawerawat and Jeerasap 2010: Either Pfannenstiel or low midline skin incision was used depending on the clinical situation and preference of surgeons. Morales 2019: Pfannenstiel transverse incision, entered bluntly. Ozcan 2015: Pfannenstiel incision. Blunt expansion of incisions.
Duration of follow-up	Dikmen 2017: Haemoglobin and hematocrit postoperative day 1, blood transfusion determined after this. Mahawerat and Jeerasap 2010: Blood loss and other outcomes recorded immediately after operative. Haemoglobin levels recorded 24 hours postoperative. Morales 2019: Postoperative outcome recorded up to the time of hospital discharge, time frame not given. Ozcan 2015: Haemoglobin and hematocrit levels recorded 24 hours post surgery.
Sources of funding	Dikmen 2017: Not reported Mahawerat and Jeerasap 2010: Not reported Morales 2019: Not reported Ozcan 2015: Not reported
Sample size	Dikmen 2017: N=183 Cephalad-caudad: n=93 Transverse: n=90 Mahawerawat and Jeerasap 2010: N=500 Cephalad-caudad: n=250 Transverse: n=250 Morales 2019: N=839 Cephalad-caudad: n=425 Transverse: n=414 Ozcan 2015: N=110 Cephalad-caudad: n=54

	Transverse: n=56 (*112 randomised, 2 discontinued intervention; 1 in each group)
Other information	Risk of bias: as assessed by review authors using Risk of Bias 2 tool: <u>Dikmen 2017:</u> Bias arising from the randomisation process: High Bias due to deviations from intended intervention: Low Bias due to missing outcome data: Low Bias in measurement of the outcome: Low Bias in selection of the reported result: Low **Overall: Some concerns** <u>Mahawerawat 2010:</u> Bias arising from the randomisation process: High Bias due to deviations from intended intervention: Low Bias due to missing outcome data: Low Bias in measurement of the outcome: Low Bias in selection of the reported result: Low **Overall: Some concerns** <u>Morales 2019:</u> Bias arising from the randomisation process: Low Bias due to deviations from intended intervention: Low Bias due to missing outcome data: Low Bias in measurement of the outcome: Low Bias in selection of the reported result: Low **Overall: Low** <u>Ozcan 2015:</u> Bias arising from the randomisation process: High Bias due to deviations from intended intervention: Low Bias due to missing outcome data: Low Bias in measurement of the outcome: Low

	Bias in selection of the reported result: Low **Overall: Some concerns** Subgroup information: BMI mixed population; overweight range: 25 to 29.99 kg/m^2; obesity 1: 30 to 34.99 kg/m^2 Mixed primary or repeat caesarean births Mixed elective or emergency caesarean births

Outcomes

Dikmen 2017

Outcome	**Cephalad-caudad, , N = 93**	**Transverse, , N = 90**
Transfusion No of events	n = 0	n = 2
Fall in haemoglobin (mg/dL) (lower values better) extracted from individual RCT Mean (SD)	1.26 (0.76)	1.44 (0.86)
Fall in haematocrit (%) (lower values better) extracted from individual RCT Mean (SD)	3.4 (2.26)	4.5 (2.47)
Operation duration (Minutes) (lower values better) extracted from individual RCT Mean (SD)	30.26 (6.97)	32.22 (10)

Morales 2019

Outcome	Cephalad-caudad, , N = 425	Transverse, , N = 414
Transfusion No of events	n = 4	n = 7
Blood loss (ml) (lower values better) extracted from RCT Mean (SD)	560 (105)	565 (120)
Broad ligament haematoma No of events	n = 17	n = 26
Decrease in haemoglobin levels (mg/dL) (lower values better) Mean (SD)	1.1 (0.9)	1.2 (1.1)

Ozcan 2016

Outcome	Cephalad-caudad, , N = 54	Transverse, , N = 56
Blood loss (lower values better) weight of compresses (units not specified assumed g) Mean (SD)	407.7 (195.9)	551.4 (178.6)
Operating time (Minutes) (lower values better) Mean (SD)	42.3 (11.6)	42 (12.1)
Fall in haemoglobin concentration (g/dL) (lower values better) pre to post operative Mean (SD)	0.99 (0.68)	1.41 (0.66)

Outcome	Cephalad-caudad, , N = 54	Transverse, , N = 56
Fall in haematocrit concentration (g/dL) (lower values better) pre to post operative Mean (SD)	2.98 (1.77)	4.11 (1.82)

extracted from individual RCT

Mahawerawat 2010

Outcome	Cephalad-caudad, , N = 250	Transverse, , N = 250
Blood loss (ml) Mean (SD)	374 (272)	348.8 (132.69)
Decrease in haemoglobin level (g/dL) (lower values better) Mean (SD)	0.6 (0.75)	0.5 (0.68)
Total operative time (Minutes) (lower values better) Mean (SD)	37.3 (13.96)	38 (14.28)

Extracted from individual RCT

Critical appraisal - NGA Critical appraisal - ROBIS checklist

Section	Question	Answer
Study eligibility criteria	Concerns regarding specification of study eligibility criteria	Low

Section	Question	Answer
Identification and selection of studies	Concerns regarding methods used to identify and/or select studies	Low
Data collection and study appraisal	Concerns regarding methods used to collect data and appraise studies	Unclear *(Data extraction forms and Risk of Bias 2 tool was used however no mention of a second person assessing bias or extraction.)*
Synthesis and findings	Concerns regarding the synthesis and findings	Unclear *(Not enough information on any sensitivity analyses.)*
Overall study ratings	Overall risk of bias	Unclear
Overall study ratings	Applicability as a source of data	Fully applicable *(Most of the outcomes were extracted from the individual RCTs as the ones listed in our protocol were not listed in this review. However other aspects of the review are directly applicable.)*

Razzaq, 2016

Bibliographic Reference	Razzaq M; Razaq F; Irshad A; Comparison of intra-operative blood loss by blunt versus sharp expansion of the uterine incision at lower segment cesarean delivery. ; Pakistan Journal of Medical and Health Sciences ; 2016; vol. 10 (no. 4); 1437-1440

Study details

Country/ies where study was carried out	Pakistan
Study type	Randomised controlled trial (RCT)
Study dates	January 2016 to June 2016

Inclusion criteria	• Single pregnancy confirmed on ultrasonography • Term pregnancy >37 weeks of gestation confirmed by dating scan • Patients required elective/emergency lower segment caesarean • 18-35 years
Exclusion criteria	• Patients with multiple pregnancy • Abnormal presentation • Grand multiparty Parity> 5 • High risk of bleeding e.g. placenta previa, placental abruption, pre eclampsia, bleeding disorders • Patients with previous history of classical uterine incision
Patient characteristics	Maternal age – mean ± SD Blunt: 26.51±4.69 Sharp: 25.51±5.17 Gestational age in weeks – mean ± SD Blunt: 39.38±1.32 Sharp: 39.17±1.30
Intervention(s)/control	Both groups underwent lower segment incision Blunt: Blunt expansion of uterine incision by pulling cut margins of uterus with fingers Sharp: Sharp expansion of uterine incision with scissors in a crescentric and cephalic direction
Duration of follow-up	Not reported
Sources of funding	Not reported
Sample size	Randomised N= 212 Blunt: n= 106 Sharp: n=106
Other information	Subgroup information: BMI mixed population

	Primary caesarean birth population (assumed as previous uterine incision excluded). Mixed type of caesarean (elective and emergency).

Outcomes

Outcome	Blunt, , N = 106	Sharp, , N = 106
Blood loss – (elective and emergency) (lower values better) Reported as 'intraoperative blood loss'. (ml). Lower values are better Mean (SD)	365.51 (64.77)	407.41 (62.67)
Blood loss - **Elective caesarean** (lower values better) number of women undergoing elective caesarean not reported Mean (SD)	368.47 (60.95)	406.31 (58.32)
Blood loss - **Emergency caesarean** (lower values better) number of women undergoing emergency caesarean not reported Mean (SD)	361.79 (69.75)	408.89 (68.31)

Critical appraisal

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(Randomisation was by lottery method but no information on concealment.)*
Domain 2a: Risk of bias due to deviations from the intended	Risk of bias for deviations from the intended interventions	Some concerns *(No information on blinding of participants or personnel delivering the*

interventions (effect of assignment to intervention)	(effect of assignment to intervention)	*intervention. No information on any deviations from intended interventions and no information on intention to treat analysis.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low *(Data probably available for most participants.)*
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	High *(High risk of bias for blood loss measurement. Some of the blood loss was measure objectively by weight, and some of the blood loss was measured using a fist size measurement which is subjective. Outcome assessors probably knew intervention assignment as no mention of blinding in the study.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Some concerns *(Protocol not available to appropriately judge bias in this domain)*
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable
Overall bias and Directness	Risk of bias variation across outcomes	No variation

Saha, 2013

Bibliographic Reference	Saha SP; Bhattarcharjee N; Das Mahanta S; Naskar A; Bhattacharyya SK; A randomized comparative study on modified Joel-Cohen incision versus Pfannenstiel incision for cesarean section.; Journal of the Turkish German Gynecological Association; 2013; vol. 14 (no. 1)

Study details

Country/ies where study was carried out	India

Study type	Randomised controlled trial (RCT)
Study dates	July, 2010 to December, 2011
Inclusion criteria	• Gestation >34 weeks • requiring caesarean birth for different indications
Exclusion criteria	• Post caesarean section pregnancy • History of any other previous abdominal surgery which may have produced adhesion internally • Very obese patient • Multifetal gestation • Patients with a history of antepartum haemorrhage
Patient characteristics	Maternal age – mean (SD) Modified Joel Cohen: 23.08 (3.48) Pfannenstiel 23.24 (4.69) Gestational age in weeks – mean (SD) Modified Joel Cohen: 38.7 (1.63) Pfannenstiel: 38.4 (1.6) Parity – N (%) Primi: Modified Joel Cohen: 118 (78.15%) Pfannenstiel: 121 (80.13%) Multi: Modified Joel Cohen: 33 (21.85%) Pfannenstiel: 30 (19.87%) Type of caesarean – N (%): Emergency: Joel-Cohen: 107 (70.86) Pfannenstiel: 112 (74.17) Elective:

	Joel-Cohen: 44 (29.14) Pfannenstiel: 39 (25.83)
Intervention(s)/control	Modified Joel Cohen • A straight transverse incision of about 12 cm length was made 3 cm below the arbitrary line joining two anterior superior iliac spines. • The midline incision was deepened in a short transverse cut of about 2-3 cm through the fat, down to the rectus sheath. A small transverse incision was made in the midline over the rectus sheath and the incision was enlarged bilaterally about 2 cm on either side underneath the fat and subcutaneous tissue. • The fascial borders were gently separated caudally and cranially using the fingers. • The rectus muscles were pulled on their corresponding side • The parietal peritoneum was opened transversely and enlarged by stretching in a caudal and cranial direction simultaneously Pfannenstiel • Incision of about15 cm length at the lowermost transverse crease (2 cm above symphysis pubis) with a gentle curve upwards. • Once the fascia was exposed the rectus sheath • Separation of rectus muscles and opening of peritoneum were carried out in the traditional way.
Duration of follow-up	Haemoglobin levels 48 hour postoperative.
Sources of funding	Not reported
Sample size	Randomised N= 302 Modified Joel Cohen: n=151 Pfannenstiel: n= 151 <u>Lost to follow up:</u> Modified Joel Cohen: n= 7 Pfannenstiel: n= 10

	Completed the study: Modified Joel Cohen: n=144 Pfannenstiel: n= 141 Analysed: Modified Joel Cohen: n=151 Pfannenstiel: n= 151
Other information	Subgroup information: Mixed BMI population All primary caesarean population. Mixed type of caesarean population (emergency and elective).

Outcomes

Outcome	**Modified Joel-Cohen, , N = 151**	**Pfannenstiel (control), , N = 151**
Postoperative analgesia requirement other than paracetamol Reported as 'Post operative analgesia requirement other than paracetamol'. Lower values are better No of events	n = 33 ; % = 21.85	n = 81 ; % = 53.64
Duration of surgery (lower values better) Reported as 'time taken for operation in minutes'. Lower values are better Mean (SD)	29.81 (2.58)	32.67 (2.78)
Wound complications Lower values are better No of events	n = 5 ; % = 3.31	n = 12 ; % = 7.95
Postoperative fall in haemoglobin after 48 hours (gm/dL) (lower values better) Mean (SD)	0.57 (0.1)	0.82 (0.13)

Critical appraisal

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low *(Randomisation sequence was computer generated and allocation was concealed.)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low *(Participants were blinded, but personnel delivering the intervention were not blinded. However no deviations from the intended intervention as all received their allocated intervention. Intention to treat analysis used.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low *(Data was available for nearly all participants)*
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low *(Measurement of the outcomes was not inappropriate. The personnel delivering the intervention were unblinded but outcomes were not subjective therefore not at risk of bias.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Some concerns *(Prespecified protocol not available therefore unable to appropriately assess bias in this domain.)*
Overall bias and Directness	Risk of bias judgement	Low
Overall bias and Directness	Overall Directness	Directly applicable
Overall bias and Directness	Risk of bias variation across outcomes	No variation

Şahin, 2018

Bibliographic Reference	Şahin N; Genc M; Turan GA; Kasap E; Güçlü S; A comparison of 2 cesarean section methods, modified Misgav-Ladach and Pfannenstiel-Kerr: A randomized controlled study.; Advances in clinical and experimental medicine : official organ Wroclaw Medical University; 2018; vol. 27 (no. 3)

Study details

Country/ies where study was carried out	Turkey
Study type	Randomised controlled trial (RCT)
Study dates	October 2014 - July 2015
Inclusion criteria	• Gestational age >36 weeks • First caesarean birth (the women could have delivered vaginally before) • An obstetric indication for caesarean birth
Exclusion criteria	• Presence of any additional surgical procedure, such as myomectomy, cystectomy or tubal ligation • Placenta previa • Placental abruption • Preeclampsia • Eclampsia • HELLP syndrome.
Patient characteristics	Maternal age in years – mean (SD) Pfannenstiel Kerr: 30.2 (5.4) Modified Misgav-Ladach: 31.4 (4.7) BMI, kg/m2 – mean (SD) Pfannenstiel Kerr: 30.23 (5.09) Modified Misgav-Ladach: 29.22 (3.97)

	Gestational age, weeks - mean (SD) Pfannenstiel Kerr: 38.42 (1.6) Modified Misgav-Ladach: 38.82 (0.6)
Intervention(s)/control	Modified Misgav-Ladach • A Joel-Cohen skin incision was performed with a straight superficial transverse cut in the skin about 3 cm below the line of the spinae iliacae anteriores superiores, and the subcutaneous tissue was opened upwards in the midline to reach the rectus sheath above the insertion of the pyramidalis muscles • The parietal peritoneum was opened digitally at the upper level of the intermuscular space. Pfannenstiel-Kerr • Pfannenstiel incision which was extended through the subcutaneous tissue until the rectus sheath was exposed • The rectus sheath was then opened in the midline. Scissors were used to extend the rectus sheath incision laterally, and to separate it from the pyramidalis and rectus muscles
Duration of follow-up	Intraoperative
Sources of funding	Not reported
Sample size	Randomised N= 252 Pfannenstiel Kerr: n = 126 Modified Misgav-Ladach: n = 126 Lost to follow up Pfannenstiel Kerr: n = 0 Modified Misgav-Ladach: n = 0 Analysed Pfannenstiel Kerr: n = 126 Modified Misgav-Ladach: n = 126
Other information	Subgroup information: BMI overweight range: 25 to 29.99 kg/m^2 Primary caesarean birth population. Mixed type of caesarean (emergency or elective).

Outcomes

Outcome	Modified Misgav-Ladach, , N = 126	Pfannenstiel-Kerr, , N = 126
Blood loss (lower values better) (mL) Mean (SD)	205 (146)	370 (251)
Duration of surgery (lower values better) Reported as 'operating time (min)'. (between skin incision and skin closure) Mean (SD)	16.89 (2.45)	35.24 (4.81)

Critical appraisal

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low *(Allocation sequence was random and computer generated. Sequence was concealed until assignment to the intervention.)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Some concerns *(No deviations from the intended intervention. Participants were blinded, as were midwives but not surgeons. No information on intention to treat analysis.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low *(Data was available for all those randomised.)*
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low *(Outcome measurement was no inappropriate. Midwives recording outcomes were blinded. Blood loss measurement not described so*

Section	Question	Answer
		could have been subjectively measured, however not at risk of bias due to blinding.)
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Some concerns *(Prespecified protocol not available therefore unable to appropriately assess bias in this domain.)*
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable
Overall bias and Directness	Risk of bias variation across outcomes	No variation

Shaukat 2019

Bibliographic Reference	Shaukat, Shysta, Janjua, Mahham, Iqbal TEA; Comparison of intra-operative hemorrhage by blunt and sharp expansion of uterine incision at the cesarean section. ; Medical Forum Monthly ; 2019; vol. 30 (no. 2); 96-98

Study details

Country/ies where study was carried out	Pakistan
Study type	Randomised controlled trial (RCT)
Study dates	June 2017 to December 2017
Inclusion criteria	• Aged 19 to 38 • primary, elective lower segment caesarean • parity 4 or less

	• placenta located in the upper segment on ultrasonography.
Exclusion criteria	• Factors that can lead to postpartum haemorrhage such as: • multiple pregnancy • anaemia • pregnancy with fibroid • history or thromboembolic disorder in past or family history • severe medical and surgical disorders • bleeding disorders.
Patient characteristics	Age, years - mean (SD): Blunt: 25.44 (4.32) Sharp: 25.02 (4.45) Parity - mean (SD): Blunt: 0.38 (0.87) Sharp: 0.5 (1.04) Gestational age, weeks - mean (SD): Blunt: 38.82 (1.05) Sharp: 38.82 (0.77)
Intervention(s)/control	All women had a transverse uterine incision in the lower uterine segment of approximately 1-2cm in length. Blunt expansion: Uterine incision was expanded by pulling the fingers apart laterally. Sharp expansion: Uterine incision was expanded by cutting laterally with scissors.
Duration of follow-up	Haemoglobin and haematocrit levels 24 hours postoperative.
Sources of funding	Not reported
Sample size	N=100 randomised Blunt: n=50 Sharp: n=50

Other information	Subgroup information: BMI mixed population Primary caesarean birth Elective caesarean birth

Outcomes

Outcome	**Blunt, , N = 50**	**Sharp, , N = 50**
Haemoglobin fall pre-postoperative (lower values better) Mean (SD)	0.79 (0.19)	1.21 (0.19)

Critical appraisal

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	High *(Only mention that study was randomised. No description of methods of randomisation or allocation concealment.)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	High *(There is no information about blinding, deviations from intended interventions or intention to treat analysis.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	High *(Not enough information provided on missing outcome data.)*
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low *(Measurement of the outcome was not inappropriate, and although there is no information on whether outcome assessors*

Section	Question	Answer
		were aware of assignment, the outcome measured was not subjective.)
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Some concerns *(No prespecified protocol available to appropriate assess bias in this domain.)*
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable
Overall bias and Directness	Risk of bias variation across outcomes	No variation

Sunullah, 2013

Bibliographic Reference	Sunullah S; Mustafa U; Var T; Comparison of visual analog pain scores of two different abdominal incisions for cesarean section: A prospective randomized trial. ; Marmara Medical Journal ; 2013; vol. 26 (no. 3); 142-145

Study details

Country/ies where study was carried out	Turkey
Study type	Randomised controlled trial (RCT)
Study dates	November 2009 to June 2010
Inclusion criteria	• Singleton pregnancy • indication for caesarean delivery • older than 18.

Exclusion criteria	• Gestational age lower than 37 weeks • previous myomectomy • previous abdominal incision • previous caesarean section • maternal diseases requiring long-term medical treatments and diseases complicating pregnancy.
Patient characteristics	Age, years - mean (SD): Joel-Cohen: 26.6 (5.8) Pfannenstiel: 25.2 (6.0) Nulliparous - number: Joel-Cohen: 37 Pfannenstiel: 32 Multiparous - number: Joel-Cohen: 13 Pfannenstiel: 18 Types of caesarean birth - number (%): Elective: Joel Cohen: 8 (16) Pfannenstiel: 9 (18) Emergency: Joel Cohen: 42 (84) Pfannenstiel: 41 (82)
Intervention(s)/control	Joel-Cohen: • Straight transverse incision through the skin only, 3 cm below anterior superior iliac spines (higher than Pfannenstiel). • All layers of the abdominal wall were stretched manually. • Myometrium was expanded laterally by finger dissection. Pfannenstiel: • Incision 2cm above symphysis.

	• All layers of the abdominal wall were stretched manually. • Myometrium was expanded laterally by finger dissection.
Duration of follow-up	Haemoglobin levels 6 hours postoperative.
Sources of funding	Not reported
Sample size	N=100 randomised Joel-Cohen: n=50 Pfannenstiel: n=50
Other information	Subgroup information: BMI mixed population Primary caesarean birth. Mixed type of caesarean birth: emergency and elective.

Outcomes

Outcome	**Joel-Cohen, , N = 50**	**Pfannenstiel, , N = 50**
Total operation time (seconds) (lower values better) Median (IQR)	1500 (1140 to 3600)	1740 (1140 to 3600)
Fall in haemoglobin concentration (gr/dl) (lower values better) Mean (SD)	1.3 (0.8)	1 (0.7)

Critical appraisal

Section	**Question**	**Answer**

Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low *(Allocation sequence was randomised using a restricted shuffled approach. Envelopes were sealed and concealed until assignment to intervention.)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Some concerns *(Participants and midwives were unaware of the intervention. The surgeon was only made aware of the intervention at the time of caesarean, however no information on intention to treat analysis.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low *(Outcome data available for all participants)*
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low *(Outcome assessors could have been midwives (blinded) or surgeons (unblinded) however outcomes are not subjective so not at risk of bias.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Some concerns *(Prespecified protocol not available to appropriately assess bias in this domain.)*
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable
Overall bias and Directness	Risk of bias variation across outcomes	No variation

Tahir 2018

Bibliographic Reference	Tahir, Noreen, Khan, Shazia Amir, Aslam REA; Comparison of intraoperative hemorrhage by blunt versus sharp expansion of uterine incision at caesarean delivery.; Rawal Medical Journal ; 2018; vol. 43 (no. 4); 654-657

Study details

Country/ies where study was carried out	Pakistan
Study type	Randomised controlled trial (RCT)
Study dates	July 2016 to December 2016
Inclusion criteria	• Primary caesarean birth • singleton pregnancy with longitudinal lie • term pregnancy.
Exclusion criteria	• Multiple pregnancy • polyhydramnios • morbidly adherent placenta • antepartum haemorrhage • anaemia • pregnancy induced hypertension.
Patient characteristics	Age, years - mean (SD): 27.7 (6.32) Parity - mean (SD): 2.3 (1.27) BMI, kg/m2 - mean (SD): 27.95 (3.44) Groups were not statistically significantly different on the above characteristics.
Intervention(s)/control	Transverse incision in the lower uterine segment of approximately 2cm was made with a scalpel and the incision was expanded according to group assignment:

	Sharp expansion: Lateral extension using bandage scissors Blunt expansion: Lateral and superior expansion using forefingers to split the musculature.
Duration of follow-up	Haematocrit levels 48 hours postoperative.
Sources of funding	Not reported
Sample size	N=140 randomised Sharp: n=70 Blunt: n=70
Other information	Subgroup information: BMI overweight range: 25 to 29.99 kg/m^2Primary caesarean births Undefined type of caesarean

Outcomes

Outcome	**Sharp, , N = 70**	**Blunt, , N = 70**
Mean fall in haematocrit pre to postoperative (%) (lower values better) Mean (SD)	-1.7 (1.84)	-5.2 (2.72)

Critical appraisal

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low *(Allocation was random via open draw method. No baseline differences to suggest imbalance.)*

Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Some concerns *(Participants were not blinded and there is no information on deviations from intended interventions or intention to treat analysis.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	High *(No information on missing outcome data to assess bias in this domain.)*
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low *(Outcome assessors were blinded to the intervention assignment.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Some concerns *(Not enough information to assess bias in this domain.)*
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable
Overall bias and Directness	Risk of bias variation across outcomes	No variation

Yilmaz, 2018

Bibliographic Reference	Yazici Yilmaz F; Aydogan Mathyk B; Yildiz S; Yenigul NN; Saglam C; Postoperative pain and neuropathy after caesarean operation featuring blunt or sharp opening of the fascia: a randomised, parallel group, double-blind study.; Journal of obstetrics and gynaecology : the journal of the Institute of Obstetrics and Gynaecology; 2018; vol. 38 (no. 7)

Study details

Country/ies where study was carried out	Turkey
Study type	Randomised controlled trial (RCT)

Study dates	November 2014 to January 2015
Inclusion criteria	• Women undergoing caesarean sections for the first time • no prior history of lower abdominal surgery.
Exclusion criteria	• Age under 18 years • body mass index over 35 kg/m2 • pregestational diabetes • any disease causing chronic pain • history of any neurological disorder.
Patient characteristics	Age, years - mean (SD): Sharp: 27.9 (5.7) Blunt: 27.7 (6.1) BMI (kg/m2) - mean (SD): Sharp: 29.4 (4.4) Blunt: 27.3 (7.6) Parity, mean (SD): Sharp: 1.0 (1.1) Blunt: 0.8 (1.3) Gestational age at birth, weeks - mean (SD): Sharp: 38.3 (3.3) Blunt: 37.6 (5.6)
Intervention(s)/control	All participants underwent Pfannenstiel skin incision 2cm above the pubic symphysis. Subcutaneous tissue and the anterior rectus sheath were opened bluntly in the midline. Sharp: The fascia was incised sharply using scissors Blunt: The fascia was incised in the midline with a scalpel and then the fascia was bluntly opened by lateral finger pulling.

Duration of follow-up	48 hours postoperative
Sources of funding	Not reported
Sample size	N=140 randomised Blunt: n=70 randomised (62 analysed, 8 lost to follow-up, discontinued or excluded) Sharp: n=70 randomised (61 analysed, 9 lost to follow-up, discontinued or excluded)
Other information	Wound complications were excluded from study. Subgroup information: BMI overweight range: 25 to 29.99 kg/m^2 Primary caesarean births. Undefined type of caesarean birth.

Outcomes

Outcome	**Sharp, , N = 61**	**Blunt, , N = 62**
Additional analgesia requirement No of events	n = 14	n = 9
Operation time (Minutes) (lower values better) Standardised Mean (SD)	48.4 (12.9)	47.3 (9.8)
Blood transfusion No of events	n = 7	n = 4
Pre-postoperative haematocrit decline (%) (lower values better) Mean (SD)	-4.4 (2.9)	-4.2 (2.6)
Pre-postoperative haemoglobin decline (g/dl) (lower values better) Mean (SD)	-1.7 (0.7)	-1.2 (1.6)

Critical appraisal

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low *(Allocation randomisation sequence was computer generation and sealed just before assignment.)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low *(No deviations from intended interventions. Participants received intervention allocated to them.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Some concerns *(between 7-10% missing data due to loss of follow-up, and some postoperative complications. Missingness could depend on the true value of outcomes such as those related to blood loss, as further complications may contribute to reasons for loss of follow-up however not enough information.)*
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low *(Measurement of outcomes was not inappropriate and outcome assessors were blind to the intervention.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Some concerns *(Prespecified protocol unavailable to appropriately assess bias in this domain.)*
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable
Overall bias and Directness	Risk of bias variation across outcomes	No variation.

Appendix E Forest plots

Forest plots for review question: What is the most effective technique for the abdominal opening and subsequent extension of tissue layers in caesarean birth, including in overweight and obese women?

This section includes forest plots only for outcomes that are meta-analysed. Outcomes from single studies are not presented here; the quality assessment for such outcomes is provided in the GRADE profiles in appendix F.

Comparison 1: Joel-Cohen versus Pfannenstiel incision – mixed BMI strata

Figure 2: Postoperative febrile morbidity (follow-up up to 48 hours)

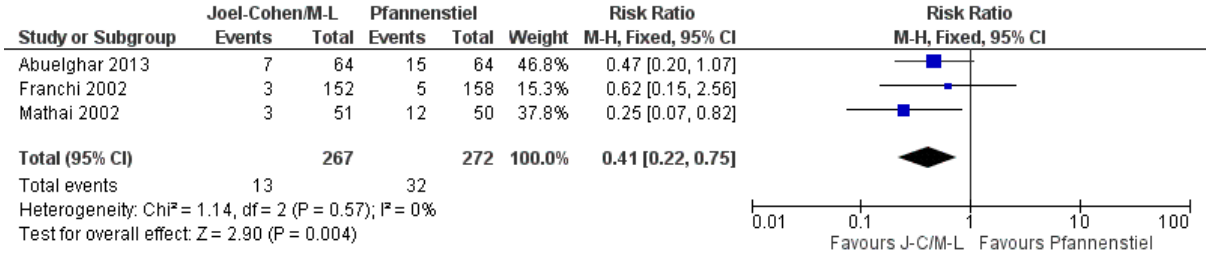


Figure 3: Postoperative analgesia – total number of doses in 24 hours (follow-up up to 48 hours; Better indicated by lower values)

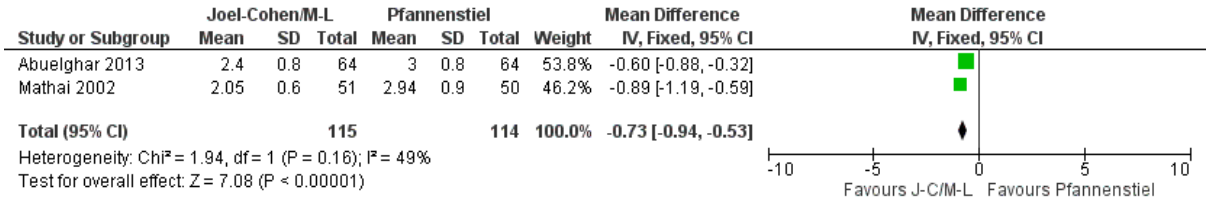


Figure 4: Fall in haematocrit (%) (follow-up up to 72 hours postoperative; Better indicated by lower values)

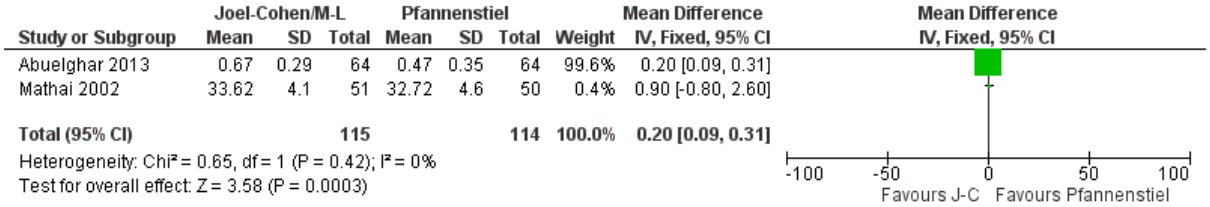
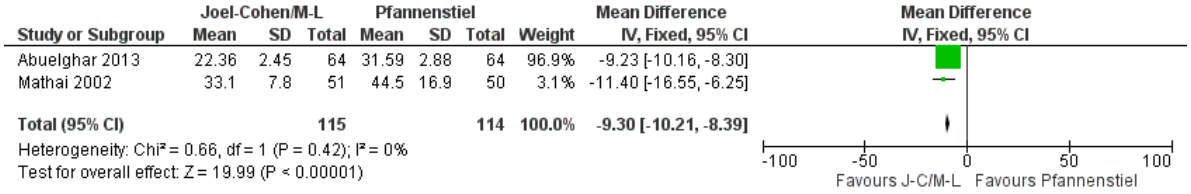


Figure 5: Duration of surgery (minutes) (follow-up intraoperative; Better indicated by lower values)



Comparison 8: Sharp versus blunt dissection – BMI overweight range 25 to 29.99 kg/m²

Figure 6: Change in haematocrit (%) pre to postoperative; elective (follow-up 72 hours; Better indicated by higher values)

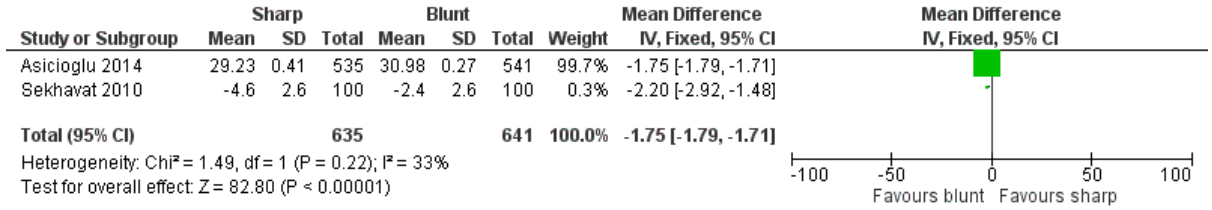


Figure 7: Blood transfusion

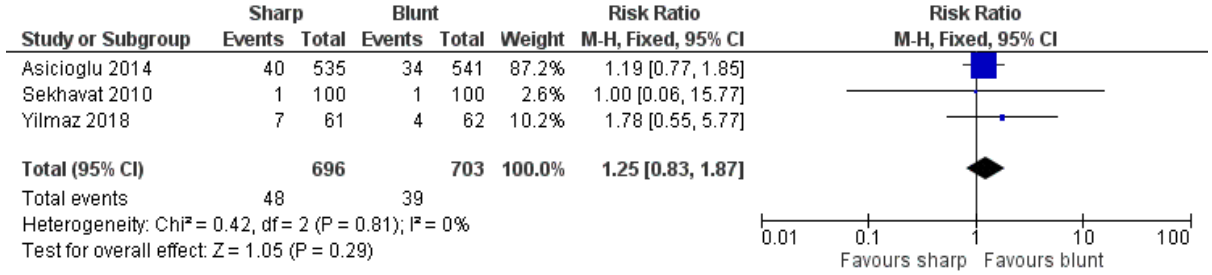
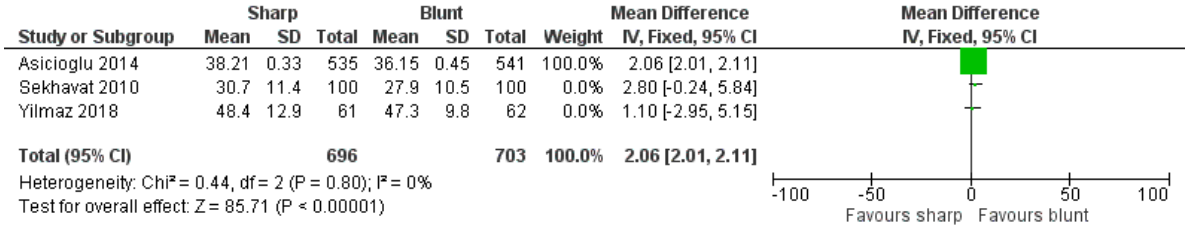


Figure 8: Duration of surgery (minutes) (follow-up intraoperative; Better indicated by lower values)



Comparison 10: Sharp versus blunt dissection – mixed BMI strata

Figure 9: Postoperative febrile morbidity

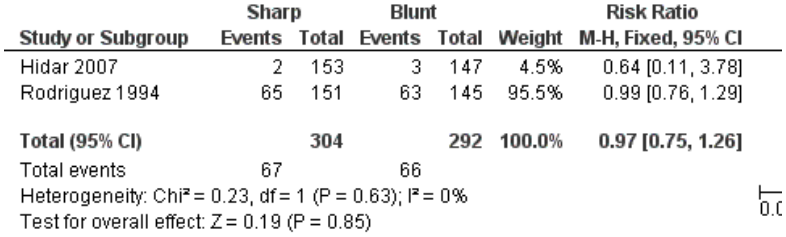
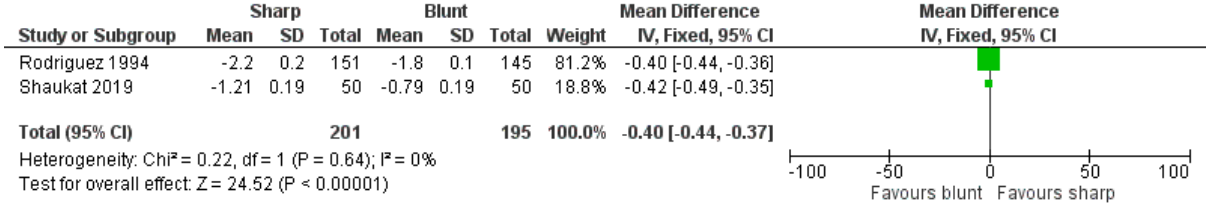
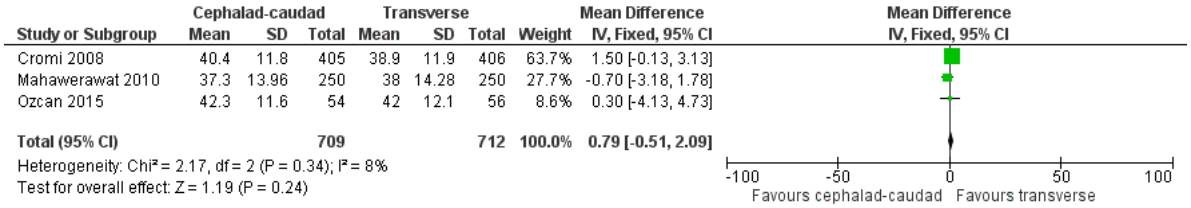


Figure 10: Change in haemoglobin level pre to postoperative g/dL (follow-up NR; Better indicated by higher values)



Comparison 11: Cephalad-caudad versus transverse expansion - BMI overweight range 25 to 29.99 kg/m^2

Figure 11: Duration of surgery (minutes) (follow-up NR; Better indicated by lower values)



Appendix F GRADE tables

GRADE tables for review question: What is the most effective technique for the abdominal opening and subsequent extension of tissue layers in caesarean birth, including in overweight and obese women?

Table 4: Comparison 1: Joel-Cohen versus Pfannenstiel incision - mixed BMI strata

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Joel-Cohen	Pfannenstiel	Relative (95% CI)	Absolute		
Postoperative febrile morbidity (follow-up up to 48 hours; assessed with: 38 or more deg C)												
3 (Abuelghar 2013; Franchi 2002; Mathai 2002)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	13/267 (4.9%)	32/272 (11.8%)	RR 0.41 (0.22 to 0.75)	69 fewer per 1000 (from 29 fewer to 92 fewer)	MODERATE	CRITICAL
Postoperative analgesia on demand (follow-up mean 4 hours postoperative; assessed with: number of women requesting analgesia)												
1 (Mathai 2002)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	23/51 (45.1%)	41/50 (82%)	RR 0.55 (0.4 to 0.76)	369 fewer per 1000 (from 197 fewer to 492 fewer)	MODERATE	CRITICAL
Total number of doses of analgesics in 24 hours (follow-up up to 48 hours; Better indicated by lower values)												
2 (Abuelghar 2013; Mathai 2002)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision[2]	none	115	114	-	MD 0.73 lower (0.94 to 0.53 lower)	MODERATE	CRITICAL
Fall in haemoglobin g/dL (follow-up intraoperative; Better indicated by lower values)												
1 (Abuelghar 2013)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision[2]	none	64	64	-	MD 0.01 higher (0.07 lower to 0.09 higher)	MODERATE	CRITICAL
Estimated blood loss (mL) (follow-up intraoperative; Better indicated by lower values)												
1 (Mathai 2002)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	51	50	-	MD 58 lower (108.51 to 7.49 lower)	LOW	CRITICAL
Fall in haematocrit (%) (follow-up up to 72 hours postoperative; Better indicated by lower values)												

2 (Abuelghar 2013; Mathai 2002)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision[2]	none	115	114	-	MD 0.2 higher (0.09 to 0.31 higher)[4]	MODERATE	CRITICAL
Blood transfusion (follow-up intraoperative)												
1 (Franchi 2002)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[5]	none	0/152 (0%)	0/158 (0%)	RD 0 (-0.01 to 0.01)	0 fewer per 1000 (from 10 fewer to 10 more)	LOW	CRITICAL
Duration of surgery (minutes) (follow-up intraoperative; Better indicated by lower values)												
2 (Abuelghar 2013; Mathai 2002)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	115	114	-	MD 9.3 lower (10.21 to 8.39 lower)	MODERATE	IMPORTANT
Wound infection as defined by trial authors (follow-up NR)												
1 (Franchi 2002)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[6]	none	6/152 (3.9%)	4/158 (2.5%)	RR 1.56 (0.45 to 5.42)	14 more per 1000 (from 14 fewer to 112 more)	VERY LOW	IMPORTANT
Time (hours) from surgery to start of breastfeeding (follow-up NR; Better indicated by lower values)												
1 (Mathai 2002)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	51	50	-	MD 5.5 lower (13.62 lower to 2.62 higher)	LOW	IMPORTANT
Admissions to special care baby unit (follow-up NR)												
1 (Franchi 2002)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[6]	none	8/152 (5.3%)	7/158 (4.4%)	RR 1.19 (0.44 to 3.2)	8 more per 1000 (from 25 fewer to 97 more)	VERY LOW	CRITICAL

CI: confidence interval; MD: mean difference; NR: not reported; RD: risk difference; RR: risk ratio
1 Serious risk of bias in the evidence contributing to the outcomes as per RoB 2
2 MID (0.5 x control SD) for: total number doses: 0.43; fall in haemoglobin: 0.11; fall in haematocrit: 1.24; duration of surgery: 4.95
3 95% CI crosses 1 MID (0.5x control SD for: estimated blood loss = 75.5; for time to breastfeeding = 6.9)
4 Change in scores from baseline to final and final scores have been meta-analysed
5 Sample size between 200-400
6 95% CI crosses 2 MIDs for dichotomous outcomes (0.8 to 1.25)

Table 5: Comparison 2: Joel-Cohen versus Pfannenstiel incision - BMI healthy weight range 18.5 to 24.9 kg/m^2

Quality assessment	No of patients	Effect	Quality	Importance

No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Joel-Cohen	Pfannenstiel	Relative (95% CI)	Absolute		
Postoperative febrile morbidity (follow-up 48 hours)												
1 (Ferrari 2001)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	5/83 (6%)	4/75 (5.3%)	RR 1.13 (0.31 to 4.05)	7 more per 1000 (from 37 fewer to 163 more)	VERY LOW	CRITICAL
Fall in haemoglobin g/dL (follow-up 48 hours; Better indicated by lower values)												
1 (Ferrari 2001)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision[3]	none	83	75	-	MD 0.17 lower (0.21 to 0.13 lower)	MODERATE	CRITICAL
Estimated blood loss (mL) (follow-up Intraoperative; Better indicated by lower values)												
1 (Ferrari 2001)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision[3]	none	83	75	-	MD 22.6 lower (82.63 lower to 37.43 higher)	MODERATE	CRITICAL
Fall in haematocrit (%) (follow-up 48 hours; Better indicated by lower values)												
1 (Ferrari 2001)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision[3]	none	83	75	-	MD 0.01 lower (0.13 lower to 0.11 higher)	MODERATE	CRITICAL
Duration of surgery (minutes) (follow-up intraoperative; Better indicated by lower values)												
1 (Ferrari 2001)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision[3]	none	83	75	-	MD 12.8 lower (16.71 to 8.89 lower)	MODERATE	IMPORTANT

CI: confidence interval; MD: mean difference; RR: risk ratio
1 Serious risk of bias in the evidence contributing to the outcomes as per RoB 2
2 95% CI crosses 2 MIDs for dichotomous outcomes (0.8 to 1.25)
3 MID (0.5 x control SD) for: fall in haemoglobin: 0.06; blood loss: 95.53; fall in haematocrit: 0.2; duration of surgery: 6.25

Table 6: Comparison 3: Modified Joel-Cohen versus Pfannenstiel incision - mixed BMI strata

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Modified Joel-Cohen	Pfannenstiel	Relative (95% CI)	Absolute		
Fall in haemoglobin (g/dL) (follow-up 48 hours postoperative; Better indicated by lower values)												

1 (Saha 2013)	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision[1]	none	151	151	-	MD 0.25 lower (0.28 to 0.22 lower)	HIGH	CRITICAL
Postoperative analgesia requirement (follow-up NR)												
1 (Saha 2013)	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	none	33/151 (21.9%)	81/151 (53.6%)	RR 0.41 (0.29 to 0.57)	316 fewer per 1000 (from 231 fewer to 381 fewer)	HIGH	CRITICAL
Duration of surgery (mins) (follow-up intraoperative; Better indicated by lower values)												
1 (Saha 2013)	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision[1]	none	151	151	-	MD 2.86 lower (3.46 to 2.26 lower)	HIGH	IMPORTANT
Wound complications (follow-up NR)												
1 (Saha 2013)	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	serious[2]	none	5/151 (3.3%)	12/151 (7.9%)	RR 0.42 (0.15 to 1.15)	46 fewer per 1000 (from 68 fewer to 12 more)	MODERATE	IMPORTANT

CI: confidence interval; MD: mean difference; NR: not reported; RR: risk ratio
1 MID (0.5 x control SD) for: fall in haemoglobin: 0.07; duration of surgery: 1.39
2 95% CI crosses 1 MID for dichotomous outcomes (0.8 to 1.25)

Table 7: Comparison 4: Pfannenstiel versus transverse abdominal incision - BMI Obesity 3: >40 kg/m^2

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Pfannenstiel**	**Transverse abdominal incision**	**Relative (95% CI)**	**Absolute**		
Duration of surgery (mins) (follow-up intraoperative; Better indicated by lower values)												
1 (El-Sayed 2018)	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	36	36	-	MD 2.5 higher (1.42 lower to 6.42 higher)	VERY LOW	IMPORTANT
Wound complications (follow-up NR)												
1 (El-Sayed 2018)	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	21/36 (58.3%)	4/36 (11.1%)	RR 5.25 (2 to 13.77)	472 more per 1000 (from 111 more to 1000 more)	LOW	IMPORTANT

CI: confidence interval; MD: mean difference; NR: not reported; RR: risk ratio
1 Very serious risk of bias in the evidence contributing to the outcomes as per ROBIS
2 95% CI crosses 1 MID (0.5x control group SD, for duration of surgery = 3.85)

Table 8: Comparison 5: Modified Misgav-Ladach versus Pfannenstiel Kerr incision - BMI overweight range 25 to 29.99 kg/m2

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Modified Misgav-Ladach**	**Pfannenstiel Kerr**	**Relative (95% CI)**	**Absolute**		
Blood loss (ml) (follow-up intraoperative; Better indicated by lower values)												
1 (Sahin 2018)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	126	126	-	MD 165 lower (215.7 to 114.3 lower)	LOW	CRITICAL
Duration of surgery (mins) (follow-up intraoperative; Better indicated by lower values)												
1 (Sahin 2018)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision[3]	none	126	126	-	MD 18.35 lower (19.29 to 17.41 lower)	MODERATE	IMPORTANT

CI: confidence interval; MD: mean difference
1 Serious risk of bias in the evidence contributing to the outcomes as per RoB2
2 95% CI crosses 1 MID (0.5x control group SD, for blood loss = 125.5)
3 MID (0.5 x control group) for duration of surgery: 2.41

Table 9: Comparison 6: Misgav-Ladach versus Pfannenstiel Incision - mixed BMI strata

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Misgav-Ladach**	**Pfannenstiel**	**Relative (95% CI)**	**Absolute**		
Postoperative febrile morbidity (including endometritis) (follow-up 4 days postoperative)												
1 (Poonam 2006)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	7/200 (3.5%)	14/200 (7%)	RR 0.5 (0.21 to 1.21)	35 fewer per 1000 (from 55 fewer to 15 more)	LOW	CRITICAL
Analgesia requirement (follow-up 4 days postoperative)												

1 (Poonam 2006)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	8/200 (4%)	38/200 (19%)	RR 0.21 (0.1 to 0.44)	150 fewer per 1000 (from 106 fewer to 171 fewer)	MODERATE	CRITICAL
Blood transfusion (follow-up intraoperative)												
1 (Poonam 2006)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	1/200 (0.5%)	2/200 (1%)	RR 0.5 (0.05 to 5.47)	5 fewer per 1000 (from 9 fewer to 45 more)	VERY LOW	CRITICAL
NICU admission (follow-up 4 days)												
1 (Poonam 2006)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	3/200 (1.5%)	16/200 (8%)	RR 0.19 (0.06 to 0.63)	65 fewer per 1000 (from 30 fewer to 75 fewer)	MODERATE	CRITICAL

CI: confidence interval; RR: risk ratio
1 Serious risk of bias in the evidence contributing to the outcomes as per ROB2
2 95% CI crosses 1 MID for dichotomous outcomes (0.8 to 1.25)
3 95% CI crosses 2 MIDs for dichotomous outcomes (0.8 to 1.25)

Table 10: Comparison 7: Maylard versus Pfannenstiel incision - BMI healthy weight range 18.5 to 24.9 kg/m^2

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Maylard**	**Pfannenstiel**	**Relative (95% CI)**	**Absolute**		
Postoperative febrile morbidity (follow-up 2 occasions 4 hours apart)												
1 (Giacalone 2002)	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	1/43 (2.3%)	1/54 (1.9%)	RR 1.26 (0.08 to 19.5)	5 more per 1000 (from 17 fewer to 343 more)	VERY LOW	CRITICAL
Blood transfusion (follow-up intraoperative)												
1 (Giacalone 2002)	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	0/43 (0%)	1/54 (1.9%)	Peto OR 0.17 (0 to 8.58)[3]	20 fewer per 1000 (from 70 fewer to 30 more)	VERY LOW	CRITICAL
Wound complication (follow-up NR)												
1 (Giacalone 2002)	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	3/43 (7%)	3/54 (5.6%)	RR 1.26 (0.27 to 5.91)	14 more per 1000 (from 41 fewer to 273 more)	VERY LOW	IMPORTANT

CI: confidence interval; NR: not reported; OR: odds ratio; RR: risk ratio
1 Very serious risk of bias in the evidence contributing to the outcomes as per ROB2

2 95% CI crosses 2 MIDs for dichotomous outcomes (0.8 to 1.25)
3 Peto odds ratio used as 0 events in one arm

Table 11: Comparison 8: Sharp versus blunt dissection - BMI overweight range 25 to 29.99 kg/m^2

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Sharp	Blunt	Relative (95% CI)	Absolute		
Blood loss (ml), by number of CB (all elective) - Primary caesarean birth (follow-up intraoperative; Better indicated by lower values)												
1 (Sekhavat 2010)	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	serious[1]	none	100	100	-	MD 68 higher (42.88 to 93.12 higher)[2]	MODERATE	CRITICAL
Blood loss (ml), by number of CB (all elective) - Mixed primary and repeat caesarean birth (follow-up intraoperative; Better indicated by lower values)												
1 (Asicioglu 2014)	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision[3]	none	535	541	-	MD 188.87 higher (184.08 to 193.66 higher)[2]	HIGH	CRITICAL
Blood loss >1000ml (follow-up intraoperative)												
1 (Asicioglu 2014)	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	serious[4]	none	61/535 (11.4%)	37/541 (6.8%)	RR 1.67 (1.13 to 2.46)	46 more per 1000 (from 9 more to 100 more)	MODERATE	CRITICAL
Postoperative haemoglobin level (g/dL) (follow-up 72 hours; Better indicated by higher values)												
1 (Asicioglu 2014)	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision[3]	none	535	541	-	MD 0.35 lower (0.38 to 0.32 lower)[2]	HIGH	CRITICAL
Change in haemoglobin level pre to postoperative (g/dL) (follow-up 24 hours; Better indicated by lower values)												
1 (Sekhavat 2010)	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision[3]	none	100	100	-	MD 1.9 lower (2.19 to 1.61 lower)[2]	HIGH	CRITICAL
Change in haemoglobin level pre to postoperative (g/dL) (follow-up 48 hours; Better indicated by lower values)												
1 (Yilmaz 2018)	randomised trials	serious[5]	no serious inconsistency	no serious indirectness	serious[6]	none	61	62	-	MD 0.5 lower (0.94 to 0.06 lower)[2]	VERY LOW	CRITICAL
Change in haematocrit (%) pre to postoperative, elective (follow-up 72 hours; Better indicated by higher values)												

2 (Asicioglu 2014; Sekhavat 2010)	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision[3]	none	635	641	-	MD 1.75 lower (1.79 to 1.71 lower)	HIGH	CRITICAL
Change in haematocrit level pre to postoperative (%), undefined type (follow-up NR) (Better indicated by lower values)												
1 (Tahir 2018)	randomised trials	very serious[7]	no serious inconsistency	no serious indirectness	no serious imprecision[3]	none	70	70	-	MD 3.5 higher (2.73 to 4.27 higher)[2]	VERY LOW	CRITICAL
Change in haematocrit level pre to postoperative (%), undefined type (follow-up NR) (Better indicated by lower values)												
1 (Yilmaz 2018)	randomised trials	serious[5]	no serious inconsistency	no serious indirectness	no serious imprecision[3]	none	61	62	-	MD 0.2 lower (1.17 lower to 0.77 higher)[2]	MODERATE	CRITICAL
Blood transfusion (follow-up intraoperative)												
3 (Asicioglu 2014; Sekhavat 2010; Yilmaz 2018)	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	serious[4]	none	48/696 (6.9%)	39/703 (5.5%)	RR 1.25 (0.83 to 1.87)	14 more per 1000 (from 9 fewer to 48 more)	MODERATE	CRITICAL
Duration of surgery (mins) (follow-up intraoperative; Better indicated by lower values)												
3 (Asicioglu 2014; Sekhavat 2010; Yilmaz 2018)	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision[3]	none	696	703	-	MD 2.06 higher (2.01 to 2.11 higher)	HIGH	IMPORTANT
Wound complications (including endometritis) (follow-up 72 hours)												
1 (Asicioglu 2014)	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	very serious[8]	none	30/535 (5.6%)	27/541 (5%)	RR 1.12 (0.68 to 1.86)	6 more per 1000 (from 16 fewer to 43 more)	LOW	IMPORTANT
Admission to NICU (follow-up 72 hours)												
1 (Asicioglu 2014)	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	very serious[8]	none	3/535 (0.56%)	3/541 (0.55%)	RR 1.01 (0.21 to 4.99)	0 more per 1000 (from 4 fewer to 22 more)	LOW	IMPORTANT

CI: confidence interval; MD: mean difference; RR: risk ratio
1 95% CI crosses 1 MID (0.5x control group SD, for blood loss primary CB = 47.5)
2 Study analysed separately due to heterogeneity >80% when meta-analysed

3 MID (0.5 x control SD) for: blood loss: 19; postoperative haemoglobin: 0.12; change in haemoglobin 24 hours: 0.45; change in haematocrit elective: 0.72; change in haematocrit Tahir 2018: 1.36; change in haematocrit Yilmaz 2018: 1.3; duration of surgery: 0.23
4 95% CI crosses 1 MID for dichotomous outcomes (0.8 to 1.25)

5 Serious risk of bias in the evidence contributing to outcomes as per ROB2
6 95% CI crosses 1 MID (0.5x control group SD, for change in haemoglobin 48 hours = 0.8)
6 Very serious risk of bias in the evidence contributing to outcomes as per ROB2
7 Serious risk of bias in the evidence contributing to outcomes as per ROB2
8 95% CI crosses 2 MIDs for dichotomous outcomes (0.8 to 1.25)

Table 12: Comparison 9: Sharp versus blunt expansion - BMI Obesity 1: 30 to 34.99 kg/m^2

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Sharp	Blunt	Relative (95% CI)	Absolute		
Postoperative febrile morbidity (including endometritis)												
1 (Magann 2002)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	66/470 (14%)	51/475 (10.7%)	RR 1.31 (0.93 to 1.84)	33 more per 1000 (from 8 fewer to 90 more)	LOW	CRITICAL
Blood loss (ml) (follow-up intraoperative; Better indicated by lower values)												
1 (Magann 2002)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision[3]	none	470	475	-	MD 43 higher (19.88 to 66.12 higher)	MODERATE	CRITICAL
Postoperative haematocrit (%) (follow-up 48 hours postoperative; Better indicated by higher values)												
1 (Magann 2002)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision[3]	none	470	475	-	MD 0.6 lower (1 to 0.2 lower)	MODERATE	CRITICAL
Blood transfusion (follow-up intraoperative)												
1 (Magann 2002)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	9/470 (1.9%)	2/475 (0.42%)	RR 4.55 (0.99 to 20.94)	15 more per 1000 (from 0 fewer to 84 more)	LOW	CRITICAL

CI: confidence interval; MD: mean difference; RR: risk ratio
1 Serious risk of bias in the evidence contributing to outcomes as per ROB2
2 95% CI crosses 1 MID for dichotomous outcomes (0.8 to 1.25)
3 MID (0.5 x control SD) for: blood loss: 82; haematocrit: 1.5

Table 13: Comparison 10: Sharp versus blunt expansion - mixed BMI strata

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Sharp	Blunt	Relative (95% CI)	Absolute		
Postoperative febrile morbidity (including endometritis)												
2 (Hidar 2007; Rodriguez 1994)	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	67/304 (22%)	66/292 (22.6%)	RR 0.97 (0.75 to 1.26)	7 fewer per 1000 (from 57 fewer to 59 more)	VERY LOW	CRITICAL
Blood loss (ml) (follow-up intraoperative; Better indicated by lower values)												
1 (Razzaq 2016)	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	106	106	-	MD 41.9 higher (24.74 to 59.06 higher)	VERY LOW	CRITICAL
Change in haemoglobin level pre to postoperative (g/dL) (follow-up NR; Better indicated by higher values)												
2 (Rodriguez 1994; Shaukat 2019)	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision[4]	none	201	195	-	MD 0.4 lower (0.44 to 0.37 lower)	LOW	CRITICAL
Duration of surgery (mins) (follow-up NR; Better indicated by lower values)												
1 (Rodriguez 1994)	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	151	145	-	MD 0.2 higher (0.11 to 0.29 higher)	VERY LOW	IMPORTANT

CI: confidence interval; MD: mean difference; NR: not reported; RR: risk ratio
1 Very serious risk of bias in the evidence contributing to outcomes as per ROB2
2 95% CI crosses 2 MIDs for dichotomous outcomes (0.8 to 1.25)
3 95% CI crosses 1 MID (0.5x control group SD, for blood loss = 32.39; for duration of surgery = 0.2)
4 MID (0.5 x control SD) for haemoglobin: 0.07

Table 14: Comparison 11: Cephalad-caudad versus transverse expansion - BMI overweight range 25 to 29.99 kg/m^2

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Cephalad-caudad	Transverse	Relative (95% CI)	Absolute		
Blood loss (ml) (follow-up intraoperative; Better indicated by lower values)												

1 (Cromi 2008)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision[2]	none	405	406	-	MD 42 lower (82.69 to 1.31 lower)[3]	VERY LOW	CRITICAL
Blood loss (ml) (follow-up intraoperative; Better indicated by lower values)												
1 (Mahawerawat 2010)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision[2]	none	250	250	-	MD 25.20 higher (12.31 lower to 62.71 higher)[3]	VERY LOW	CRITICAL
Blood loss (ml) (follow-up intraoperative; Better indicated by lower values)												
1 (Ozcan 2015)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[4]	none	54	56	-	MD 143.7 lower (213.83 to 73.57 lower)[3]	VERY LOW	CRITICAL
Blood loss >1500ml (follow-up intraoperative)												
1 (Cromi 2008)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[5]	none	1/405 (0.25%)	8/406 (2%)	RR 0.13 (0.02 to 1)	17 fewer per 1000 (from 19 fewer to 0 more)	LOW	CRITICAL
Change in haemoglobin level pre to postoperative g/dL (follow-up 24 hours postoperative; Better indicated by lower values)												
1 (Cromi 2008)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision[2]	none	405	406	-	MD 0.2 higher (0.08 to 0.32 higher)[3]	VERY LOW	CRITICAL
Change in haemoglobin level pre to postoperative g/dL (follow-up 24 hours postoperative; Better indicated by lower values)												
1 (Mahawerawat 2010)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision[2]	none	250	250	-	MD 0.1 lower (0.23 lower to 0.03 higher)[3]	VERY LOW	CRITICAL
Change in haemoglobin level pre to postoperative g/dL (follow-up 24 hours postoperative; Better indicated by lower values)												
1 (Ozcan 2015)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[4]	none	54	56	-	MD 0.42 higher (0.17 to 0.67 higher)[3]	VERY LOW	CRITICAL
Postoperative haematocrit % (follow-up 24 hours postoperative; Better indicated by higher values)												

1 (Ozcan 2015)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	54	56	-	MD 1.13 higher (0.46 to 1.8 higher)	LOW	CRITICAL
Blood transfusion (follow-up intraoperative)												
1 (Cromi 2008)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[6]	none	3/405 (0.74%)	3/406 (0.74%)	RR 1 (0.2 to 4.93)	0 fewer per 1000 (from 6 fewer to 29 more)	VERY LOW	CRITICAL
Duration of surgery (mins) (follow-up NR; Better indicated by lower values)												
3 (Cromi 2008; Mahawerawat 2010; Ozcan 2015)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision[2]	none	709	712	-	MD 0.79 higher (0.51 lower to 2.09 higher)	MODERATE	IMPORTANT

CI: confidence interval; MD: mean difference; NR: not reported; RR: risk ratio
1 Serious risk of bias in the evidence contributing to the outcomes as per ROB2
2 MID (0.5 x control SD) for: blood loss Cromi 2008; 170.5; blood loss Mahawerawat 2010: 66.35; change in haemoglobin Cromi 2008: 0.5; change in haemoglobin Mahawerawat 2010: 0.34; duration of surgery: 6.38
3 Study analysed separately due to heterogeneity >80% when meta-analysed
4 95% CI crosses 1 MID (0.5x control group SD, for: blood loss Ozcan 2015= 89.3; for haemoglobin Ozcan 2015 = 0.33; for haematocrit = 0.91)
5 95% CI crosses 1 MID for dichotomous outcomes (0.8 to 1.25)
6 95% CI crosses 2 MIDs for dichotomous outcomes (0.8 to 1.25)

Table 15: Comparison 12: Cephalad-caudad versus transverse expansion - BMI Obesity 1: 30 to 34.99 kg/m^2

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Cephalad-caudad**	**Transverse**	**Relative (95% CI)**	**Absolute**		
Postoperative haemoglobin g/dL (follow-up 24 hours postoperative; Better indicated by higher values)												
1 (Dikmen 2017)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision[2]	none	93	90	-	MD 0.18 higher (0.06 lower to 0.42 higher)	MODERATE	CRITICAL
Postoperative haematocrit % (follow-up 24 hours postoperative; Better indicated by higher values)												
1 (Dikmen 2017)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	93	90	-	MD 1.1 higher (0.41 to 1.79 higher)	LOW	CRITICAL
Blood transfusion (follow-up 24 hours postoperative)												

1 (Dikmen 2017)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[4]	none	0/93 (0%)	2/90 (2.2%)	Peto OR 0.13 (0.01 to 2.09)[5]	19 fewer per 1000 (from 22 fewer to 24 more)	VERY LOW	CRITICAL
Duration of surgery (mins) (follow-up NR; Better indicated by lower values)												
1 (Dikmen 2017)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision[2]	none	93	90	-	MD 1.96 lower (4.46 lower to 0.54 higher)	MODERATE	IMPORTANT

CI: confidence interval; MD: mean difference; NR: not reported; OR: odds ratio
1 Serious risk of bias in the evidence contributing to the outcomes as per ROB2
2 MID (0.5 x control SD) for: haemoglobin: 0.43; duration of surgery: 5
3 95% CI crosses 1 MID (0.5x control group SD, for haematocrit = 1.24)
4 95% CI crosses 2 MIDs for dichotomous outcomes (0.8 to 1.25)
5 Peto odds ratio used as 0 events in one arm

Table 16: Comparison 13: Cephalad-caudad versus transverse expansion - mixed BMI strata

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Cephalad-caudad versus Transverse expansion - mixed BMI strata**	**Control**	**Relative (95% CI)**	**Absolute**		
Blood loss (ml) (follow-up intraoperative; Better indicated by lower values)												
1 (Morales 2019)	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision[1]	none	425	414	-	MD 5 lower (20.27 lower to 10.27 higher)	HIGH	CRITICAL
Postoperative haemoglobin g/dL (follow-up hospital discharge; Better indicated by higher values)												
1 (Morales 2019)	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision[1]	none	425	414	-	MD 0.1 higher (0.04 lower to 0.24 higher)	HIGH	CRITICAL
Blood transfusion (follow-up intraoperative)												
1 (Morales 2019)	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	very serious[2]	none	4/425 (0.94%)	7/414 (1.7%)	RR 0.56 (0.16 to 1.89)	7 fewer per 1000 (from 14 fewer to 15 more)	LOW	CRITICAL
Wound complications (haematoma) (follow-up hospital discharge)												

1 (Morales 2019)	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	serious[3]	none	17/425 (4%)	26/414 (6.3%)	RR 0.64 (0.35 to 1.16)	23 fewer per 1000 (from 41 fewer to 10 more)	MODERATE	IMPORTANT

CI: confidence interval; MD: mean difference; RR: risk ratio
1 MID (0.5 x control SD) for: blood loss: 60; haemoglobin: 0.55
2 95% CI crosses 2 MIDs for dichotomous outcomes (0.8 to 1.25)
3 95% CI crosses 1 MID for dichotomous outcomes (0.8 to 1.25)

Appendix G Economic evidence study selection

Study selection for: What is the most effective technique for the abdominal opening and subsequent extension of tissue layers in caesarean birth, including in overweight and obese women?

No economic evidence was identified which was applicable to this review question.

Appendix H Economic evidence tables

Economic evidence tables for review question: What is the most effective technique for the abdominal opening and subsequent extension of tissue layers in caesarean birth, including in overweight and obese women?

No evidence was identified which was applicable to this review question.

Appendix I Economic model

Economic model for review question: What is the most effective technique for the abdominal opening and subsequent extension of tissue layers in caesarean birth, including in overweight and obese women?

No economic analysis was conducted for this review question.

Appendix J Excluded studies

Excluded studies for review question: What is the most effective technique for the abdominal opening and subsequent extension of tissue layers in caesarean birth, including in overweight and obese women?

Excluded effectiveness studies

Table 17: Excluded studies and reasons for their exclusion

Study	Code [Reason]
Cardona-Osuna ME, Avila-Vergara MA, Peraza-Garay F et al. (2016) [Comparison of pregnancy outcomes Caesarean techniques: modified Misgav-Ladach, Pfannenstiel-Kerr and Kerr-half infraumbilical]. Ginecologia y obstetricia de Mexico 84(8): 514-522	- Study not reported in English
Chicaud B, Roux C, Rudigoz RC et al. (2013) [Blunt or sharp expansion of cesarean section: a comparative study]. Journal de gynecologie, obstetrique et biologie de la reproduction 42(4): 366-371	- Study not reported in English
Gizzo S, Andrisani A, Noventa M et al. (2015) Caesarean section: could different transverse abdominal incision techniques influence postpartum pain and subsequent quality of life? A systematic review. PloS one 10(2): e0114190	- Systematic review used as source of primary studies *Ferrari RCT identified and extracted separately. Other studies not relevant therefore the SR has not been used to extract the data.*
Marrs C, Blackwell S, Hester A et al. (2019) Pfannenstiel versus Vertical Skin Incision for Cesarean Delivery in Women with Class III Obesity: A Randomized Trial. American journal of perinatology 36(1): 97-104	- Comparator in study does not match that specified in this review protocol *Midline technique*
Puttanavijarn L and Phupong V (2013) Comparisons of the morbidity outcomes in repeated cesarean sections using midline and Pfannenstiel incisions. The journal of obstetrics and gynaecology research 39(12): 1555-1559	- Comparator in study does not match that specified in this review protocol *Midline technique*
Saad AF, Rahman M, Costantine MM et al. (2014) Blunt versus sharp uterine incision expansion during low transverse cesarean delivery: a metaanalysis. American journal of obstetrics and gynecology 211(6): 684.e1	- More recent systematic review included that covers the same topic *2 additional studies have been included separately as primary studies: Sekhavat 2010 and Javaria 2012*
Xodo S, Saccone G, Cromi A et al. (2016) Cephalad-caudad versus transverse blunt	- More recent systematic review included that covers the same topic

Study	Code [Reason]
expansion of the low transverse uterine incision during cesarean delivery. European journal of obstetrics, gynecology, and reproductive biology 202: 75-80	
Xu LL; Chau AM; Zuschmann A (2013) Blunt vs. sharp uterine expansion at lower segment cesarean section delivery: a systematic review with metaanalysis. American journal of obstetrics and gynecology 208(1): 62.e1	- More recent systematic review included that covers the same topic

Excluded economic studies

No economic evidence was identified for this review.

Appendix K Research recommendations – full details

Research recommendations for review question: What is the most effective technique for the abdominal opening and subsequent extension of tissue layers in caesarean birth, including in overweight and obese women?

No research recommendations were made for this review question.