OBSTETRICS

Blunt vs sharp uterine expansion at lower segment cesarean section delivery: a systematic review with metaanalysis

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OBJECTIVE: Blunt vs sharp expansion of the uterine incision at cesarean delivery has been investigated as a technique primarily to reduce intraoperative blood loss. The objective of this systematic review was to compare the effects of either intervention on maternal outcomes.

STUDY DESIGN: A systematic review with metaanalyses that used the DerSimonian and Laird random effects model was performed. The Cochrane Central Register of Controlled Trials (The Cochrane Library 2012, Issue 4), MEDLINE (1948–Apr 2012), EMBASE (1947–Apr 2012), and the reference lists/citation history of articles were searched. Only randomized controlled trials were included.

RESULTS: Four trials (1731 patients) were evaluated. Data from one recently completed trial (535 patients) were not yet available. Metaanalyses revealed a trend towards reduced maternal blood loss with blunt expansion of the uterine incision that was statistically significant when measured by surgeon's estimation of volume lost, but not by comparison of pre- and postoperative hematocrit and hemoglobin levels or a requirement for blood transfusion. There was a trend towards fewer unintended extensions in the blunt group and no difference in the incidence of endometritis.

CONCLUSION: Blunt dissection of the uterine incision at cesarean delivery appears to be superior to sharp dissection in minimizing maternal blood loss. However, this conclusion could change when data from a new unpublished large trial are available.

Key words: cesarean delivery, hemorrhage, hysterotomy, systematic review

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The global rate of cesarean deliveries is approximately 15%[1]; the rate in some developed countries reaches as high as 1 in 3.[2,3] It generally is accepted that a greater amount of blood loss is likely in an operative, compared with vaginal, delivery. As obstetric hemorrhage remains a leading cause of maternal morbidity and death, techniques such as manual placental extraction, in situ uterine repair in the place of exteriorization, and blunt traction in the cephalocaudad, rather than transverse, direction for uterine incision have been proposed to minimize intraoperative blood loss during cesarean delivery.[4-7]

Blunt expansion of the uterine incision with fingers, rather than scissors, is one other such suggestion.[8] Previously, proponents of either the blunt or sharp method would defer to training protocols, personal experience, or theoretic reasoning to explain their choice of technique. To date, a small number of studies specifically have examined the impact of the hysterotomy expansion technique on maternal blood loss during cesarean delivery. The main suggested advantage of the blunt approach includes decreased trauma to the vasculature with less bleeding and ooze from the dissected myometrial edge.[9-12] Secondary potential benefits include less risk of injury to the neonate and cord and increased speed of delivery.[13-15]

However, there are concerns about reduced control of length and direction of the uterine incision that potentially could cause damage of lateral uterine and parametrial blood vessels and increased risk of unintended extensions that could contribute further to hemorrhage.[6,9-12,16] The effect of blunt division of the uterine wall on the incidence of endometritis postcesarean delivery is also of concern.[17]

The aim of this review was to compare the impacts of sharp vs blunt hysterotomy on the primary outcome of maternal blood loss and the secondary outcomes of unintended extension, incidence of postoperative endometritis, injury to the neonate, postoperative pain, and operative time/time to delivery.

Materials and Methods

The Cochrane and Preferred Reporting Items for Systematic Review and Metaanalyses (PRISMA) guidelines were followed for the performance and reporting of this systematic review.[18,19]

Types of studies and outcomes considered

All prospective randomized controlled trials (RCTs) that compared blunt vs sharp expansion of the initial uterine incision at transverse lower segment cesar-

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TABLE 1
Search strategy using MeSH (CENTRAL, MEDLINE) and Emtree (EMBASE) terms

No.	Central	Medline	Embase
1	MeSH descriptor cesarean delivery explode all trees	exp cesarean section or caesarean section.mp or exp uterus	exp cesarean section or caesarean section.mp or exp uterus
2	blunt or finger* or digital or sharp or instrument* or dissection or expansion or extension	blunt.mp or finger$.mp or digital.mp or sharp.mp or instrument$.mp or dissection.mp or expansion.mp or extension.mp	blunt.mp or finger$.mp or digital.mp or sharp.mp or instrument$.mp or dissection.mp or expansion.mp or extension.mp
3	#1 and #2	randomized controlled trial.pt or controlled clinical trial.pt or randomized.ab or placebo.ab or clinical trials as topic.sh or randomly.ab or trial.ti	randomized controlled trial or controlled clinical trial or randomized.ab or placebo.ab or exp clinical trial(topic) or randomly.ab or trial.ti
4		and/1-3	and/1-3
5		exp animals/not humans.sh	exp animals/not humans.sh
6		4 not 5	4 not 5

The *asterisk* and the *dollar sign* indicate truncation.
ab, abstract; *exp*, explode; *mp*, multiple postings; *pt*, publication term; *sh*, subject heading; *ti*, title.
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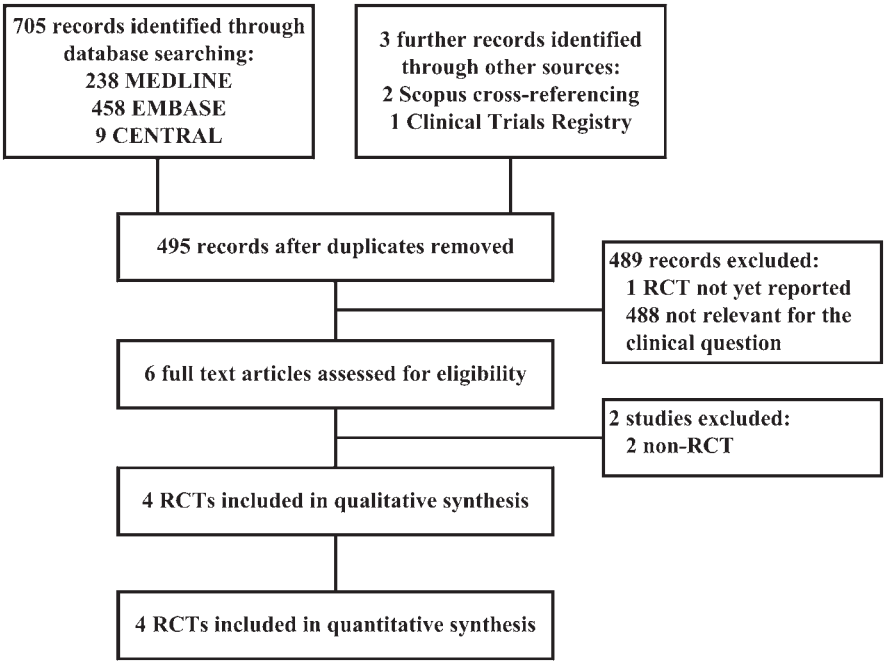
ean delivery were considered. Quasirandomized trials and studies that assessed vertical lower-segment or classic upper-segment uterine incisions were excluded. Ongoing or recently completed trials with no data yet available were noted for future analyses. Our primary outcome was maternal blood loss. Our secondary outcomes were incidence of extension, endometritis, neonatal morbidity, postoperative pain, and time to delivery.

FIGURE 1
PRISMA diagram of study identification, inclusion and exclusion



Preferred reporting items for systematic review and metaanalyses flow diagram of study identification, inclusion, and exclusion of blunt vs sharp uterine expansion at cesarean delivery.
PRISMA, Preferred Reporting Items for Systematic Review and Metaanalyses; *RCT*, randomized controlled trial.
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Search strategy

A literature search of the Cochrane Central Register of Controlled Trials (The Cochrane Library 2012, Issue 4), Medline (via Ovid; 1948–April 2012), and Embase (via Ovid) (1947–April 2012) was performed in week 4, April 2012. The prospective search protocol for each database is given in Table 1. No language restrictions were used. All titles were assessed; where the abstract suggested a potentially eligible study, the full text was retrieved. Scopus was used to cross-reference the references and citation history of full-text articles. A search for ongoing or recently completed trials was performed in week 4, April 2012, with the Australia/New Zealand, United Kingdom, and United States Clinical Trials registries (www.anzctr.org.au, www.controlled-trials.com, www.clinicaltrials.gov, respectively). Studies were evaluated critically for design and risk of bias, according to criteria set out in the Cochrane handbook for systematic reviews of interventions.[18]

Statistical analysis

Data were extracted onto a standardized collection form by 2 independently working authors (L.X., A.C.) and entered into RevMan (version 5.1, 2011; The Nordic Cochrane Centre, The Cochrane Collaboration, Copenhagen, Denmark). Data were analyzed with the

TABLE 2
Study characteristics

Study and location	Women randomly assigned, n	Mean age at delivery, y	Inclusion criteria	Exclusion criteria	Intervention
Rodriguez et al,[11] Florida	286	Blunt, 25.8; sharp, 25.7	All patients undergoing primary or repeat transverse lower segment cesarean delivery; indications included arrest, malpresentation, previous cesarean delivery, fetal distress	Patients unable to give informed consent because of emergency surgery or communication difficulties	Uterine incision extended by fingers or control extended with bandage scissors; operator: 2nd- to 4th-year resident under direct supervision
Magann et al,[10] Mississippi	975	Blunt, 24.7; sharp, 24.4	All patients undergoing primary or repeat transverse lower segment cesarean delivery	Women declining participation, emergency surgery, use of vertical lower segment or classical upper segment uterine incision	Uterine incision extended by fingers or control extended with scissors; 20 units oxytocin in 1000 mL Ringer's lactate rapid infusion after placental delivery; operator: 2nd- to 4th-year residents with assistance of attending staff
Hidar et al,[9] Sousse, Tunisia	300	Blunt, 31.52; sharp, 31.6	All patients with a singleton pregnancy undergoing transverse lower segment cesarean delivery at gestation of >36 wk	Age <20 y; known coagulopathy; placenta previa; transverse presentations; preoperative bleeding	Uterine incision extended by fingers or control extended with scissors; manual placental delivery/in situ uterine repair; operator: 3rd- or 4th-year resident under senior supervision
Sekhavat et al,[12] Yazd, Iran	200	Blunt, 24.3; sharp, 25.1	Primiparous patients undergoing elective transverse lower segment cesarean delivery with fundal placenta	Severe medical and surgical disorders; blood disorder/ anemia; known thromboembolic disorder; multiple gestation; fetal macrosomia; polyhydramnios; emergency surgery for placental abruption; placenta previa, and severe preeclampsia	Uterine incision extended by fingers or control extended with scissors; manual delivery of placenta, 10 units oxytocin in 500 mL normal saline solution >10 minutes; all patients underwent general anesthesia; operator: 2nd-year resident under supervision

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use of a random-effects metaanalysis (DerSimonian and Laird model) with risk ratio as the pooled estimate for dichotomous data and mean difference for continuous data. Mantel-Haenszel and inverse variance methods were used, respectively. Analysis was performed on an intention-to-treat basis. Substantial statistical heterogeneity was considered to be present when there was inconsistency between trials in the direction or magnitude of effects. This was assessed visually from the forest plots or when the I^2 statistic was >50%, respectively. Statistical significance was defined as a probability value < .05.

RESULTS

Evidence base

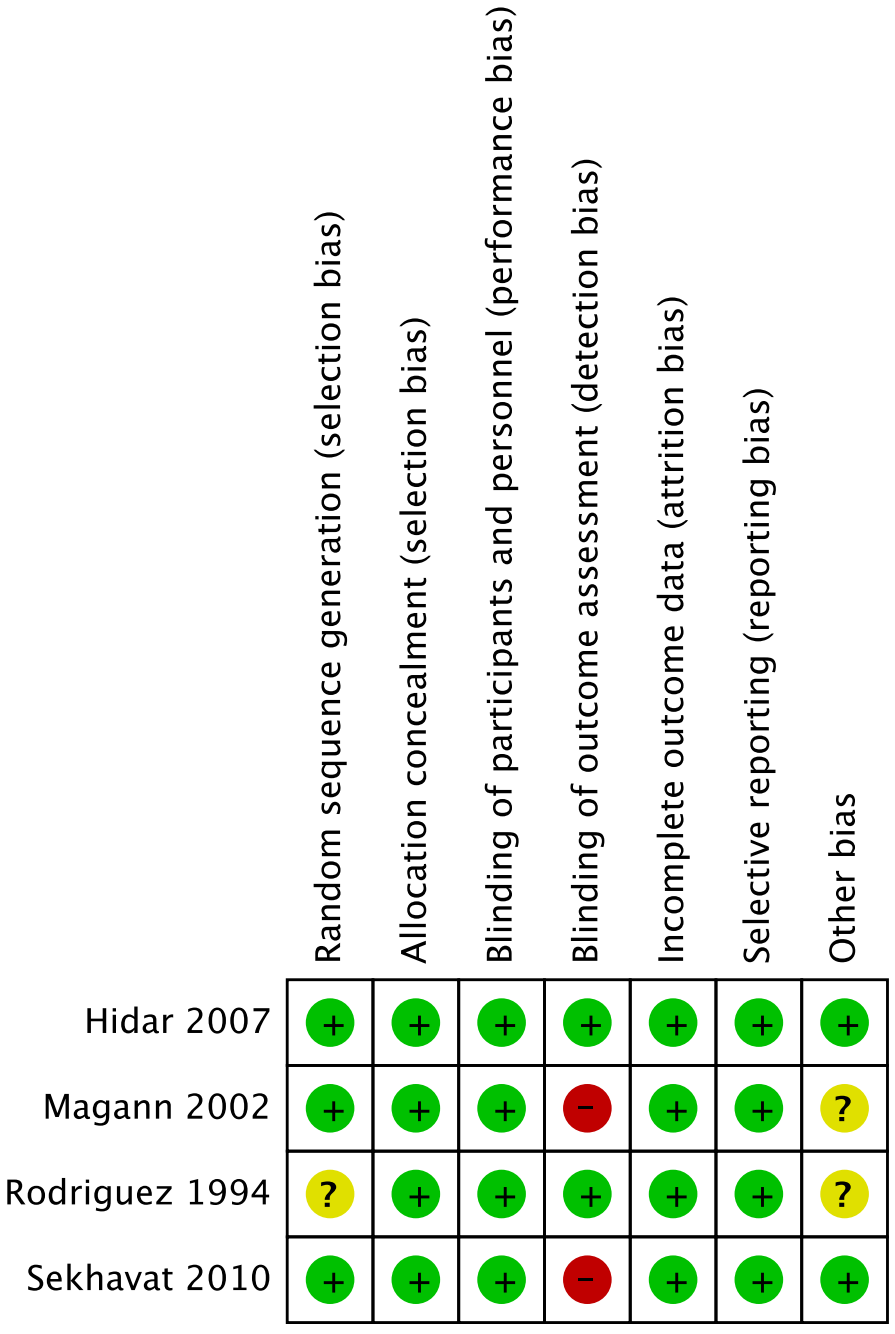
The literature search returned 495 articles (Figure 1). From these, 4 RCTs (1731 patients) that reported data appropriate for the clinical question (Tables 2)[9-12] were included in the study. One recently completed RCT had not yet reported the results, so it could not be included. Two studies were not RCTs.[13,15]

Study design

Hysterotomy in the blunt expansion groups was performed after an initial 1-2cm incision was made through the uterine wall and then extended by insertion of the surgeon's index fingers laterally and cephalad. In the sharp expansion groups, the extension was achieved by cutting with bandage scissors laterally and cephalad.

There were some differences in study design between the trials. Of the studies that specified cesarean technique, 1

FIGURE 2
Summary assessment demonstrates the low risk of bias of included randomized controlled trials



Green denotes low risk; *yellow* denotes unclear risk; *red* denotes high risk.
Adapted, with permission, from the Cochrane handbook (The Nordic Cochrane Centre, The Cochrane Collaboration, Copenhagen, Denmark).

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study used the Pfannenstiel incision[12] and the other Joel-Cohen incision.[9] Two studies described the implementation of manual delivery of the placenta.[9,12] An oxytocin infusion after placental delivery was used in 2 studies (20 units in 1000 mL Ringer's lactate; 10 units in 500 mL normal saline solution).[10,12] Prophylactic antibiotics were given to all patients in 1 study and to patients in active labor after cord clamping in another.[9,11]

Women who underwent lower-segment cesarean delivery were included in these trials; however, there were differing additional enrolment criteria. Three studies excluded women who underwent emergency surgery.[10-12] One study enrolled exclusively nulliparous women because of the risk of uterine inertia with multiparity.[12] General anesthesia was also used in all patients in this study.[12] Two studies excluded patients with known coagulopathy and multiple gestations.[9,12] From the 2 studies that provided data, the most common indications for cesarean delivery were arrest of labor, malpresentation, previous cesarean delivery, and fetal distress.[11,12]

Critical appraisal of included RCTs

All 4 trials were judged to have low overall risk of bias (Figure 2). Two trials had a high risk of detection bias in subjective outcome measures because of lack of blinding.[10,12] One study had an unclear risk of selection bias because the authors did not specify the method of randomization; however, there were no statistically significant differences between the experimental and control groups in all recorded characteristics.[11]

Primary outcome: impact on maternal blood loss

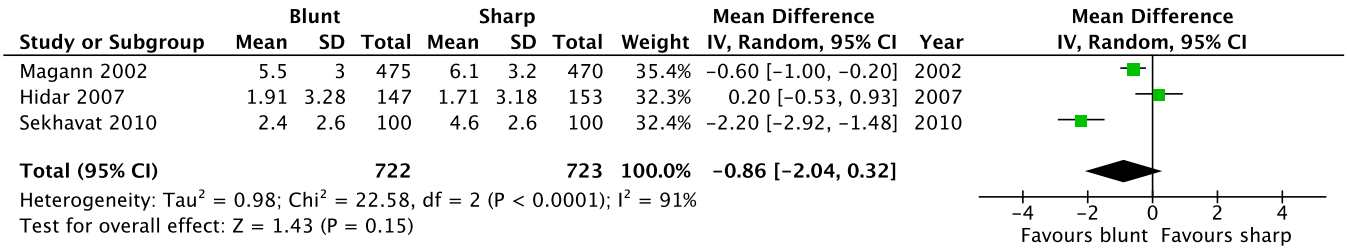
Mean drop in hematocrit level

Three studies evaluated maternal blood loss by reduction in hematocrit level before and after the operation.[9,10,12]

Magann et al[10] compared immediate preoperative hematocrit level with that 48 hours after the operation. A statistically significant reduction in hematocrit drop was found favoring the blunt group ($P = .003$). Consistent with this, the incidence of women who experienced a >10% decrease in hematocrit level was also significantly smaller in the blunt, rather than the sharp, group ($P = .03$; author calculated with χ^2 test).

Hidar et al[9] compared immediate preoperative hematocrit level with that 24-48 hours after the operation and found no difference in the average reduction in hematocrit level between the 2 groups ($P = .58$). The incidence of >10% reduction in hematocrit level was also comparable ($P > .05$).

FIGURE 3
Mean drop in hematocrit level



df, degrees of freedom; *IV*, inverse variance.

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Sekhavat et al[12] measured hematocrit level immediately before the operation and 24 hours after the operation. A decreased drop in pre- to post-operative hematocrit level in the blunt group that was detected when the data were compared with the sharp group was significant ($P < .05$).

Combined results from the 3 trials revealed a trend that favored blunt hysterotomy for reduced drop in hematocrit level after the operation (Figure 3); however, this did not reach statistical significance (mean difference [MD], −0.86%; 95% CI, −2.04 to 0.32; 3 trials; 1445 patients). There was substantial statistical heterogeneity across studies ($I^2 = 91\%$).

Mean drop in hemoglobin

Three studies recorded change in pre- and postoperative hemoglobin levels.[9,11,12]

Rodriguez et al[11] found no difference in mean hemoglobin level decrease when they compared the hemoglobin level that was measured at admission and the 24 hours postoperative measurement in the 2 groups ($P = .08$; author calculated with unpaired *t* test).

Hidar et al[9] found the 2 groups comparable in mean hemoglobin level drop when they compared the values that were measured immediately before and 24-48 hours after surgery ($P = .51$).

Sekhavat et al[12] found a significantly smaller mean hemoglobin level difference when they compared the values measured before and 24 hours after surgery in the blunt group ($P < .05$).

Pooled results showed a trend toward a reduced drop in hemoglobin level that favored the blunt dissection group (Figure 4), although this was not statistically significant (MD, 7.41 g/L; 95% CI, −20.53 to 5.72; 3 trials; 786 patients). There was substantial heterogeneity across studies ($I^2 = 98\%$).

Requirement for blood transfusion

Three studies reported on the number of patients who required blood transfusion after surgery.[9,10,12]

Magann et al[10] specified a hematocrit level of <24% and hemodynamic instability as criteria for transfusion. A significantly smaller number of women in the blunt group than in the sharp group required transfusion ($P = .03$; author calculated with Fisher exact test).

Hidar et al[9] did not specify indications for transfusion, and no patients required transfusion in this study.

Sekhavat et al[12] described a hematocrit level of <24% and a change of ≥10% in hematocrit level from admission to the postpartum period as indication for transfusion. There was no difference detected in requirement for transfusion between the 2 groups ($P > .05$).

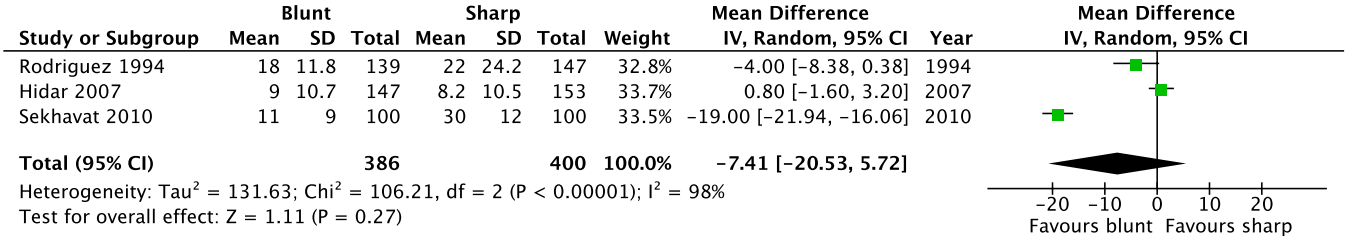
Combined data suggested a strong trend towards decreased incidence of blood transfusion in patients who underwent blunt dissection, although this did not reach significance (relative risk, 0.31; 95% CI, 0.08–1.19; 3 trials; 1445 patients). There was low statistical heterogeneity ($I^2 = 0\%$; Figure 5).

Blood loss by estimated volume

Two studies examined blood loss by estimated volume.[10,12]

Magann et al[10] measured volume by the estimation of the surgeon and attending staff based on the blood in the suction apparatus, plastic steridrapes,

FIGURE 4
Mean drop in hemoglobin level



df, degrees of freedom; *IV*, inverse variance.

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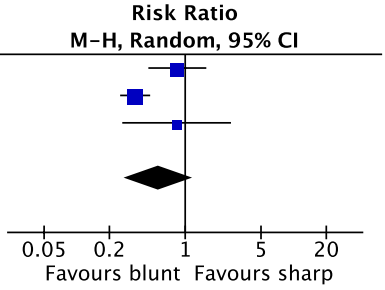
FIGURE 7
Incidence of unintended extensions

Study or Subgroup	Blunt Events	Blunt Total	Sharp Events	Sharp Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
Rodriguez 1994	16	139	20	147	35.2%	0.85 [0.46, 1.57]	1994
Magann 2002	44	475	126	470	43.5%	0.35 [0.25, 0.48]	2002
Sekhavat 2010	5	100	6	100	21.2%	0.83 [0.26, 2.64]	2010
Total (95% CI)		**714**		**717**	**100.0%**	**0.57 [0.28, 1.17]**	
Total events	65		152				

Heterogeneity: $Tau^2 = 0.28$; $Chi^2 = 7.73$, df = 2 (P = 0.02); $I^2 = 74\%$
Test for overall effect: Z = 1.54 (P = 0.12)



df, degrees of freedom; *M-H*, Mantel-Haenszel.

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Neonatal injury

No studies reported on the incidence of intraoperative injury to the neonate.

Postoperative pain

No studies compared differences in maternal postoperative pain.

Operative time/time to delivery

Rodriguez et al[11] reported on time to delivery, and Sekhavat et al[12] recorded total operative time.

Rodriguez et al[11] found no differences in the time from the start of surgery to the delivery of the neonate between the sharp (mean, 11.7 min) and blunt groups (11.5 min; $P = .72$; author calculated with unpaired *t* test).

Similarly, Sekhavat et al[12] found that there was no difference in total operating time when they compared the sharp (mean, 30.7 min) and blunt (mean, 27.9 min) hysterotomy ($P > .05$).

COMMENT

The effect of sharp vs blunt hysterotomy on maternal blood loss, injury to local structures, and occurrence of endometritis were evaluated in this review. As far as the authors are aware, this is the most comprehensive attempt to review the literature systematically in relation to this clinical question.

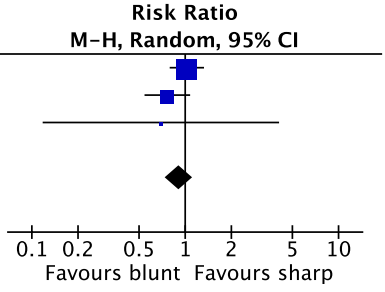
Five randomized controlled trials were identified, of which data from 4 relatively heterogeneous studies were available for metaanalysis (1731 patients).[9-12] It was found that the estimated volume of blood loss was significantly less in the blunt than the sharp dissection group. Trends that favored blunt dissection for reduced blood loss (measured through laboratory values and maternal requirement for transfusion) and unintended extensions were also detected; however, these did not reach statistical significance. The incidence of endometritis occurred equally after either procedure.

From collated evidence in the current literature, it appears that blunt dissection of the hysterotomy at cesarean delivery is superior to sharp dissection. Three of 4 proxy measures of blood loss favored the use of blunt dissection without reaching statistical significance. The fourth measure (blood loss by estimation of volume) was significantly reduced with the use of blunt dissection. However, volume estimation methods that were used in the studies were partly subjective and did not account for amniotic or other fluids that had also accumulated in the suction apparatus and absorptive material. This measure therefore is subject to a degree of inaccuracy and detection bias because of the lack of assessor blinding.[20] With further data from the recently completed Turkish RCT (535 women) (unpublished data) and future studies, the true significance of this trend could be better elucidated.

FIGURE 8
Incidence of endometritis

Study or Subgroup	Blunt Events	Blunt Total	Sharp Events	Sharp Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
Rodriguez 1994	63	139	65	147	62.9%	1.03 [0.79, 1.33]	1994
Magann 2002	51	475	66	470	35.7%	0.76 [0.54, 1.08]	2002
Hidar 2007	2	147	3	153	1.3%	0.69 [0.12, 4.09]	2007
Total (95% CI)		**761**		**770**	**100.0%**	**0.92 [0.75, 1.13]**	
Total events	116		134				

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 2.01$, df = 2 (P = 0.37); $I^2 = 0\%$
Test for overall effect: Z = 0.81 (P = 0.42)



df, degrees of freedom; *M-H*, Mantel-Haenszel.

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The strength of any systematic review lies in the quality of the studies that are examined. We used a sensitive prospective search strategy with no language limitations, extensive cross-referencing, and a search for recently completed or ongoing trials.

Critical evaluation of the RCTs that were included in this review determined a low overall risk of bias with good internal validity. Results across studies for some outcomes were able to be synthesized convincingly for quantitative metaanalysis; however, there was notable statistical heterogeneity across studies in other outcomes. The small number of studies that were involved prohibited further investigation with sensitivity analysis. The differences between study findings likely stem from a variation in patient selection, surgical techniques, and diverse peripartum management (eg, use of oxytocin postplacental delivery).

It has been suggested in the literature that blunt dissection of the uterus may contribute to a faster operative time and time to delivery of the infant.[15] With only one of the studies examining this outcome, there were limited data found that related to the effects of hysterotomy technique on the speed of execution. There are some data from a nonrandomized, retrospective study that compared mean operative times that could not be included in this review.[15]

Another suggested theoretic advantage of blunt dissection is decreased injury to the neonate.[14] This outcome has not been evaluated in any studies to date. It would be valuable to explore these aspects in future research.

The results of this systematic review revealed blunt dissection of the uterine incision at lower-segment cesarean delivery is associated with a significant reduction in blood loss when compared with sharp dissection. Blood loss by estimation of volume was significantly lower with the use of blunt dissection. Laboratory-based outcomes of drop in hemoglobin/hematocrit level and maternal requirement for blood transfusion supported this finding but did not reach statistical significance. The addition of data from a new unpublished large trial could further clarify the clinical differences between the 2 techniques. ■

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