Closure versus non-closure of the peritoneum at caesarean section (Review)

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ABSTRACT

Background
Caesarean section is a very common surgical procedure worldwide. Suturing the peritoneal layers at caesarean section may or may not confer benefit, hence the need to evaluate whether this step should be omitted or not.

Objectives
The objective of this review was to assess the effects of non-closure as an alternative to closure of the peritoneum at caesarean section on intraoperative, immediate and long-term postoperative and long-term outcomes.

Search strategy
We searched the Cochrane Pregnancy and Childbirth Group's Trials Register (October 2006).

Selection criteria
Controlled trials comparing leaving the visceral or parietal peritoneum, or both, unsutured at caesarean section with a technique which involves suturing the peritoneum in women undergoing elective or emergency caesarean section.

Data collection and analysis
Two review authors assessed trial quality and extracted the data.

Main results
Fourteen trials, involving 2908 women, were included and analysed. The methodological quality of the trials was variable. Non-closure of the peritoneum reduced operating time whether both or either layer was not sutured. For both layers, the operating time was reduced by 6.05 minutes, 95% confidence interval (CI) -6.74 to -5.37. There was significantly less postoperative fever and reduced postoperative stay in hospital for visceral peritoneum and for both layer non-closure. The number of postoperative analgesic doses was reduced in the peritoneal non-closure group (weighted mean difference -0.20, 95% CI -0.33 to -0.08). There were no other statistically significant differences. The trend for wound infection tended to favour non-closure, while endometritis results were variable. Long-term follow up in one trial showed no significant differences. The power of the study to show differences was low.

Authors' conclusions
There was improved short-term postoperative outcome if the peritoneum was not closed. This in itself can support those who opt not to close the peritoneum. Long-term studies following caesarean section are limited; there is therefore no overall evidence for non-closure until long-term data become available.

PLAIN LANGUAGE SUMMARY

Not stitching the peritoneum after caesarean section shows less fever for mothers and takes less time, but possible disadvantages are unclear

There are many ways of performing a caesarean section, and the techniques used depend on a number factors, including the clinical situation and the preference of the operator. The peritoneum is a thin membrane of cells supported by a thin layer of connective tissue, and during caesarean section these peritoneal surfaces have to be cut through in order for the baby to be born. Following a caesarean section, it has been standard practice to stitch the peritoneum closed, that is to stitch the two layers of tissue lining the abdomen and covering internal organs such as the uterus, bladder and bowel. It has been suggested that peritoneal adhesions may be more likely, rather than less likely, when the peritoneum is closed, possibly as a result of reaction to the suture material. The review of trials assessed whether closing these layers of peritoneal tissue or leaving them unstitched was preferable. Fourteen trials were identified, involving 2698 women, and the methodological quality was variable. Although women suffered less postoperative fever and it saved several minutes when the peritoneum was not stitched, other important outcomes were not adequately assessed, particularly adhesions and longer term outcomes, for example, in subsequent pregnancies and births, but also at other surgeries and in later life. Further studies are at present underway assessing these outcomes further.

BACKGROUND

Caesarean section is one of the most frequently performed major surgical procedures worldwide accounting for anything up to 70% of deliveries, depending on the facility assessed and the country involved. In general, rates around the world are about 5% to over 20% of all deliveries (Lomas 1989). Rates between 20% and 25% have been reported from the UK (Thomas 2001), the United States of America (Menacker 2001), and China (Cai 1998).

There are many possible ways of performing a caesarean section and operative techniques used for caesarean section vary. The techniques used may depend on many factors including the clinical situation and the preference of the operator. Some of these techniques have been evaluated through randomised trials. An overview of the techniques used, indications for caesarean section and postoperative complications will be published as a separate review (Hofmeyr 2004).

Closure of the peritoneum at laparotomy has been a part of 'standard' surgical practice. The peritoneum is a thin membrane made of primitive cells called mesothelium and supported by a thin layer of connective tissue. It lines both the abdominal and pelvic cavities where it is called parietal peritoneum. When it covers the external surface of internal organs like the intestine, the bladder and the uterus, it is termed visceral peritoneum. During caesarean section, these peritoneal surfaces have to be breached before the uterus can be incised.

Cited reasons for closure of the peritoneum include restoration of anatomy and reapproximation of tissues, reduction of infection by re-establishing an anatomical barrier, reduction of wound dehiscence, reducing hemorrhage, minimisation of adhesions and continuation of what was thought as standard (Bamigboye 1999; Duffy 1994). In vivo experiments using dogs (Parulkar 1986) and rats (Kapur 1979; Kyzer 1986) have shown no difference in wound strength whether the peritoneum is closed or not, and have suggested that peritoneal adhesions may be more extensive when the peritoneum is closed, presumably as a result of the foreign body reaction from the suture material.

Randomised controlled trials in general surgery of peritoneal closure or non-closure with vertical abdominal incisions (Ellis 1977; Gilbert 1987; Hugh 1990) have shown no significant short-term differences in postoperative complications or pain scores. In operative gynaecology, controlled trials of peritoneal non-closure in vaginal hysterectomy (Lipscomb 1996), abdominal and radical hysterectomy (Than 1994) and lymphadenectomy (Kananali 1996) have demonstrated no difference, or an improvement in short-term postoperative morbidity if the peritoneum is not closed. In the former study (Kananali 1996) where peritoneal non-closure was compared to closure during lymphadenectomy for ovarian cancer, peritoneal non-closure significantly reduced adhesion formation.

The step of either suturing or not suturing the peritoneal surfaces is one of several surgical techniques of caesarean section addressed in Cochrane reviews. If this step could be omitted without adverse effect or with benefit for the individual patient, and with a reduction in operating time and suture material, this could lead to a meaningful cost saving, given the large numbers of caesarean sections performed worldwide.

OBJECTIVES

To determine whether dispensing with closure of the peritoneum at caesarean section affects the postoperative course and long-term outcomes, and the duration of operation.

CRITERIA FOR CONSIDERING STUDIES FOR THIS REVIEW

Types of studies

All randomised controlled trials comparing leaving the peritoneum unsutured at caesarean section with the conventional approach of suturing the peritoneum. Quasi-random allocation (for example, based on hospital number) were included in the analysis.

Types of participants

Women undergoing caesarean section.

Types of intervention

The peritoneum, either visceral, or parietal, or both visceral and parietal were left unsutured for the experimental group, and were sutured, usually with a continuous suture, in the control group.

Types of outcome measures

Wound infection, wound dehiscence, analgesic requirement, post-operative fever, endometritis, operating time, paralytic ileus, duration of hospital stay and cost implication. Long-term outcome of adhesions formation, chronic pelvic pain, urinary symptoms and subfertility. These latter outcomes were not prespecified at the protocol stage.

SEARCH METHODS FOR IDENTIFICATION OF STUDIES

See: methods used in reviews.

We searched the Cochrane Pregnancy and Childbirth Group's Trials Register by contacting the Trials Search Co-ordinator (October 2006).

The Cochrane Pregnancy and Childbirth Group's Trials Register is maintained by the Trials Search Co-ordinator and contains trials identified from:
(1) quarterly searches of the Cochrane Central Register of Controlled Trials (CENTRAL);
(2) monthly searches of MEDLINE;
(3) handsearches of 30 journals and the proceedings of major conferences;
(4) weekly current awareness search of a further 37 journals.

Details of the search strategies for CENTRAL and MEDLINE, the list of handsearched journals and conference proceedings, and the list of journals reviewed via the current awareness service can be found in the 'Search strategies for identification of studies' section within the editorial information about the Cochrane Pregnancy and Childbirth Group.

Trials identified through the searching activities described above are given a code (or codes) depending on the topic. The codes are linked to review topics. The Trials Search Co-ordinator searches the register for each review using these codes rather than keywords.

We did not apply any language restrictions.

METHODS OF THE REVIEW

Selection of studies

All potential studies were identified as a result of the search strategy.

Data extraction and management

A form was designed to extract data, which was used by the two review authors. Discrepancies were resolved through discussion. We used Review Manager software (RevMan 2003) to double enter all the data.

There was no need to contact authors of the original reports to provide further details for studies that were judged not to be clear.

Assessment of methodological quality of included studies

The validity of each study was assessed using the criteria outlined in the Cochrane Handbook for Systematic Reviews of Interventions (Higgins 2005). Methods used for generation of the randomisation sequence were described for each trial.

(1) Selection bias (randomisation and allocation concealment)

We assigned a quality score for each trial using the following criteria:
(A) adequate concealment of allocation: such as telephone randomisation, consecutively-numbered, sealed opaque envelopes;
(B) unclear whether adequate concealment of allocation: such as list or table used, sealed envelopes, or study does not report any concealment approach;
(C) inadequate concealment of allocation: such as open list of random-number tables, use of case record numbers, dates of birth or days of the week.

(2) Attrition bias (loss of participants, for example, withdrawals, dropouts, protocol deviations)

We assessed completeness of follow up using the following criteria:
(A) less than 5% loss of participants;
(B) 5% to 9.9% loss of participants;
(C) 10% to 19.9% loss of participants;
(D) more than 20% loss of participants.

(3) Performance bias (blinding of participants, researchers and outcome assessment)

We assessed blinding using the following criteria:
(1) blinding of participants (yes/no/unclear);
(2) blinding of caregiver (yes/no/unclear);
(3) blinding of outcome assessment (yes/no/unclear).

Measures of treatment effect

We carried out statistical analysis using the Review Manager software (RevMan 2003). We used fixed-effect meta-analysis for combining data in the absence of significant heterogeneity if trials were sufficiently similar. Where heterogeneity was found, we explored it by sensitivity analysis followed by random-effects analysis if indicated.

Dichotomous data

For dichotomous data, we presented results as summary relative risk with 95% confidence intervals.

Continuous data

For continuous data, we used weighted mean difference for outcomes measured in the same way between trials. We used standardised mean difference to combine trials that measured the same outcome, but used different methods.

Subgroup analyses
We did not perform subgroup analyses.

Sensitivity analyses
We carried out sensitivity analysis to explore the effect of trial quality. This involved analysis based on an A, B, C, or D rating of selection bias and attrition bias. We excluded studies of poor quality in the analysis (those rating B, C, or D) in order to assess for any substantive difference to the overall result.

DESCRIPTION OF STUDIES

Fourteen trials, involving 2908 women, were included and analysed. *See* table of 'Characteristics of included studies' for details.

For details of the excluded studies, *see* 'Characteristics of excluded studies' .

METHODOLOGICAL QUALITY

See table of 'Characteristics of included studies'. The quality of the trials was variable. In several studies the method of random allocation was not specified. A quasi-random method of allocation was used in the trials of Hull 1991, Pietrantoni 1991, Nagele 1996 and Weerawetwat 2004.

RESULTS

Fourteen trials, involving 2698 women, were included and analysed.

(1) Non-closure of both visceral and parietal peritoneum compared with suturing both visceral and parietal peritoneum
A total of 10 studies with 1521 participants were included. A reduction in operative time was noted in women who had both peritoneal surfaces unsutured (14 studies, 2908 women; weighted mean difference (WMD) -6.05 minutes, 95% confidence interval (CI) -6.74 to -5.37). In four studies with 622 women, the number of postoperative analgesic doses was reduced (WMD -0.20, 95% CI -0.33 to -0.08). In seven studies with 1263 women, there was less postoperative fever in the non-closure group (relative risk (RR) 0.73, 95% CI 0.55 to 0.97). In eight studies with 1203 women, postoperative hospital stay was slightly reduced in the non-closure group (WMD -0.40 days, 95% CI -0.50 to -0.30). Data could be used from only one to six trials for wound infection, endometritis, adhesions and infertility, and there were no statistically significant differences. Analgesia data from Rafique 2002 could not be included as the method was different from other studies. In the latter trial, patient-controlled analgesia was used significantly less in the non-closure group (morphine 0.64 (standard deviation 0.33) versus 0.82 (0.49) mg/kg/24 hours). Sensitivity analysis, excluding the quasi-randomised trials (Hull 1991; Weerawetwat 2004), did not materially alter any of the findings.

In a long-term follow up of one study (Irion 1996), 144 of 280 women responded to a questionnaire at seven years. There were no significant differences in fertility, abdominal pain, urinary symptoms, or adhesions at subsequent surgery. The power of the study to show differences was low.

(2) Non-closure of the visceral peritoneum only compared with suturing both parietal and visceral peritoneum
A total of three studies involving 884 women were involved. One study (Nagele 1996) involving 544 women showed reduction in operating time (WMD -6.30 minutes, 95% CI -9.22 to -3.38), and postoperative days in hospital (WMD -0.70, 95% CI -0.98 to -0.42) in the non-closure group. Three trials showed a reduction in postoperative fever (RR 0.63, 95% CI 0.44 to 0.90), and two showed a reduction in wound infection (RR 0.36, 95% CI 0.14 to 0.89).

(3) Non-closure of parietal peritoneum only compared with closure of both parietal and visceral peritoneum
Two studies (Hojberg 1998; Pietrantoni 1991), involving 288 women, were identified. The latter (Pietrantoni 1991) was a quasi-randomised trial. There were no significant differences in endometritis, fever, wound infection or hospital stay, but the operative time was reduced (WMD -5.10 minutes, 95% CI -8.71 to -1.49).

DISCUSSION

Although the methodological quality of trials was variable, the results were in general consistent between the trials of better and poorer quality. There is evidence of benefit in the immediate postoperative outcomes and duration of surgery for non-closure of the peritoneum at caesarean section compared with routine closure. Shorter duration of the operation may have clinical benefits in terms of reduced risk of infection and postoperative complications such as paralytic ileus due to shorter exposure of the peritoneal cavity. Some women using regional analgesia experience discomfort and anxiety during surgery. Reducing the operative time by several minutes may be beneficial for these reasons.

The difference in morbidity was small, but as caesarean section is so commonly performed, any small improvement in morbidity may have important implications in practice. While cost was not addressed directly in these trials, the use of less suture material would reduce cost, which may be of particular importance

in resource-poor countries. The data in this review on long-term benefits or hazards of leaving the peritoneum unsutured are inadequate to inform practice, though data from other surgical procedures and animal studies suggest long-term benefit from peritoneal non-closure, particularly regarding adhesion formation (*see* 'Background'). More data on the long-term sequelae of leaving the peritoneal surfaces unsutured, specifically at caesarean section, would be useful.

AUTHORS' CONCLUSIONS

Implications for practice

What evidence is available suggests that leaving the peritoneum unsutured is not likely to be hazardous in the short term and may in fact, be of benefit. The long-term implications are not certain.

Implications for research

Further research on the long-term benefits or complications of non-closure of the peritoneum at caesarean section is needed, and findings will be updated in future versions of this review as they become available. Multicentre trials of techniques of caesarean section are in progress (Caesar Study and Coronis Trial - National Perinatal Epidemiology Unit, Oxford, UK (NPEU 2000;CORONIS 2006)).

POTENTIAL CONFLICT OF INTEREST

None known.

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* *Indicates the major publication for the study*

TABLES

Characteristics of included studies

Study	**Chanrachakul 2002**
Methods	Allocation was made randomly using sealed opaque envelopes in computer-generated random sequence.
Participants	60 women to undergo caesarean section.
Interventions	1. Experimental (30): non-closure of both peritoneal surfaces. 2. Control (30): closure of both peritoneal surfaces.
Outcomes	Operating time, intraoperative blood loss, length of hospitalisation and analgesic doses required.
Notes	No difference in the amount of analgesic dosages required.
Allocation concealment	A – Adequate

Study	**Galaal 2000**
Methods	Prospective randomised trial. Allocation by numbered envelope technique.

Characteristics of included studies (*Continued*)

Participants	60 women undergoing caesarean section.
Interventions	1. 30 women in the experimental group: non-closure of both peritoneal surfaces. 2. 30 women with both peritoneal surfaces closed serving as controls.
Outcomes	Operating time, length of stay, blood loss, blood transfusion, drop in haemoglobin, postoperative pyrexia, and wound infection.
Notes	
Allocation concealment	A – Adequate

Study	**Grundsell 1998**
Methods	A random-selection table was used to assign groups.
Participants	361 women "who were to undergo caesarean section".
Interventions	1. Experimental (179): both visceral and parietal peritoneum were left unsutured. 2. Control (182): both the visceral and parietal peritoneum were closed with a running, delayed absorbable suture.
Outcomes	Operating time, febrile morbidity, wound infection, urinary tract infection, fever of unknown origin, wound dehiscence, opening of bowels, admission days and postoperative paralytic ileus.
Notes	
Allocation concealment	B – Unclear

Study	**Hojberg 1998**
Methods	Telephone-randomisation via a computer program.
Participants	40 women referred for elective caesarean section.
Interventions	1. 21 women with non-closure of parietal peritoneum and closure of visceral peritoneum. 2. 19 women had both peritoneal surfaces closed.
Outcomes	Analgesic requirement (less used in non-closure group, data not included as non-parametric data given), blood loss, febrile morbidity, return of bowel action and days in hospital.
Notes	
Allocation concealment	A – Adequate

Study	**Hull 1991**
Methods	Allocation based on last digit of medical record.
Participants	113 women "who were to undergo caesarean section".
Interventions	1. Experimental (54): both visceral and parietal peritoneum were left unsutured. 2. Control (59): both the visceral and parietal peritoneum were closed with a running, delayed absorbable suture.
Outcomes	Operating time, postoperative morbidity, hospital stay.
Notes	4 women excluded because had vertical uterine incisions.
Allocation concealment	C – Inadequate

Study	**Irion 1996**
Methods	Random allocation in blocks of varying size at the beginning of the operation by computer-generated random numbers. Sequentially numbered opaque sealed envelopes were used.
Participants	280 women "were recruited" undergoing elective or emergency caesarean section.
Interventions	1. Experimental (137): both the visceral and parietal peritoneum were left unsutured.

	2. Control (143): both the visceral and parietal peritoneum were re-approximated using continuous, running, delayed absorbable sutures.
Outcomes	Length of postoperative hospital stay (from operation notes), pain (visual analogue scale, analgesics on first postoperative day), duration of ileus (auscultation of bowel sounds) and febrile morbidity (sublingual temperature > 38 degrees centigrade lasting at least 24 hours). 7 years following the clinical study, a cohort of this women were contacted to assess the long-term follow up (Roset E et al) Assessment for postsurgical adhesions and subfertility amongst others were made.
Notes	The data in the American Journal of Obstetrics and Gynecology 2001 have not been included because the numbers of women randomised into each of the two groups were not mentioned in the data.
Allocation concealment	A – Adequate

Study	**Nagele 1996**
Methods	Pseudo-randomised based on days of the week.
Participants	549 women undergoing caesarean section were randomised.
Interventions	262 non-closure versus 287 closure visceral peritoneum.
Outcomes	Operating time, postoperative morbidity, hospital stay.
Notes	
Allocation concealment	C – Inadequate

Study	**Pietrantoni 1991**
Methods	Allocation by last digit of hospital number (odd or even).
Participants	248 women undergoing caesarean section through a Pfannenstiel incision.
Interventions	1. Experimental (127): non-closure of parietal peritoneum but closure of the visceral peritoneum. 2. Control (121): both visceral and parietal peritoneum were sutured.
Outcomes	Postoperative morbidity, days in hospital. Standard errors of the mean converted to standard deviation for this analysis.
Notes	6 women were excluded.
Allocation concealment	C – Inadequate

Study	**Rafique 2002**
Methods	Randomised controlled trial. Randomisation generated by computer and allocation by opaque sealed numbered envelopes.
Participants	100 women undergoing caesarean section.
Interventions	1. Experimental group, non-closure: 50. 2. Control group: 50.
Outcomes	Operative time, number of days to discharge, postoperative haemoglobin, use of analgesia.
Notes	
Allocation concealment	A – Adequate

Study	**Saha 2001**
Methods	Randomised controlled trial. Method of randomisation not stated.
Participants	100 women undergoing caesarean section.
Interventions	1. Experimental group, non-closure: 50. 2. Control group: 50 women who had non-closure of visceral peritoneum.

Outcomes	Operative time, number of days to discharge, postoperative febrile illness, use of additional narcotics analgesia.
Notes	
Allocation concealment	B – Unclear

Study	**Sood 2004**
Methods	Randomised controlled trial. Method of randomisation not stated.
Participants	149 women undergoing caesarean section.
Interventions	1. Experimental (71): non-closure of both parietal and visceral peritoneum. 2. Control (78): both visceral and parietal peritoneum were closed.
Outcomes	Anaesthesia time, operating time, postoperative pain, no of analgesic doses, febrile morbidity, endomyometritis, cystitis, wound infection and days of hospitalisation.
Notes	
Allocation concealment	B – Unclear

Study	**Tuncer 2003**
Methods	Randomised controlled trial. Method of randomisation not stated.
Participants	80 women undergoing caesarean section.
Interventions	1. 40 women with non-closure of parietal peritoneum and visceral peritoneum. 2. 40 women had both peritoneal surfaces closed.
Outcomes	Operative time, anesthesia time, length of hospital stay, morphine consumption and visual analogue pain scores.
Notes	
Allocation concealment	B – Unclear

Study	**Weerawetwat 2004**
Methods	'Each surgeon randomised and separated the women by running number into 3 groups'.
Participants	360 women undergoing caesarean section.
Interventions	3 groups-non closure of both peritoneum, closure of only parietal peritoneum, closure of both peritoneum.
Outcomes	Short- and long-term assessments including adhesions at repeat caesarean section.
Notes	An important study that looks at the issue of adhesions during repeat caesarean section.
Allocation concealment	C – Inadequate

Study	**Zhang 2000**
Methods	Randomised controlled trial. Method of randomisation not stated.
Participants	Pregnant women 36-43 weeks undergoing caesarean section.
Interventions	Peritoneal non-closure in 158 women compared with 160 women with closure.
Outcomes	Postoperative morbidity, bowel movement, analgesic requirement, infection, Apgar score, neonatal outcome.
Notes	
Allocation concealment	B – Unclear

Characteristics of excluded studies

Study	**Reason for exclusion**
Ayres-de-campos 2000	No data on the control group given. Information on the first 37 cases assigned to the experimental non-closure group was available.

Balat 2000	Excluded because intervention include non-closure of the rectus muscle and subcutaneous fascia, as well as peritoneum. Allocation was made 'randomly' (using odd and even days). Participants: 266 women undergoing caesarean section. Interventions: 1. experimental (134), both visceral and parietal peritoneum and rectus muscle and subcutaneous fascia were unsutured. 2. control (132), all layers were sutured. Outcomes: Operation time, hospitalisation time and postoperative complications.
Behrens 1997	Allocation was effected in alternating order; no adequate randomisation.
Bjorklund 2000	Excluded because several aspects of caesarean section were compared, not only peritoneal non-closure. Allocation was based on last digit of medical record. 339 women "who were to undergo caesarean section" were enrolled. 1. Experimental (169) Misgav-Ladach technique, both visceral and parietal peritoneum were left unsutured. 2. Control (170) routine technique, both the visceral and parietal peritoneum were closed. Outcomes: Apgar scores at 5 and 10 minutes, postoperative course and use of antibiotics, number of sutures used, febrile morbidity, wound infection, urinary tract infection, wound dehiscence, opening of bowels, admission days and postoperative ileus.
Dani 1998	This study did not demonstrate any difference in short-term outcome of newborn infants born by caesarean section whether the peritoneal surfaces are closed or not. Exclusion is on the basis of the outcome reported not being in the protocol.
Darj 1999	Excluded because the whole Misgav-Ladach technique was compared with the Pfannenstiel method. Random allocation. Participants: 50 women undergoing caesarean section electively. Interventions: 1. experimental group, Joel-Cohen technique including non-closure of peritoneal surfaces (25). 2. control group with Pfannenstiel technique and closure of both peritoneal surfaces (25). Outcomes: duration of operation, amount of bleeding, analgesic doses required, scar appearance, and length of hospitalisation.
Decavalas 1997	This well-conducted randomised trial was ambiguous as to whether the peritoneum was closed in the control Pfannenstiel group. It appears that the outcome measured was the technique of opening the abdomen and may not evaluate closure versus non-closure of peritoneum even though the original description of Pfannenstiel includes closure of peritoneal surfaces. This may therefore not be assumed. Letters have been written to the author for clarification but no response as at November 2006.
Ferrari 2001	Excluded because whole Misgav-Ladach technique compared with Pfannenstiel. Allocation was made randomly using sealed envelopes. Participants: 158 women to undergo caesarean section. Interventions: 1. experimental (83), Joel-Cohen technique including non-closure of both peritoneal surfaces and single layered closure of uterine incision 2. control (75), Pfannenstiel technique with closure of both peritoneal surfaces. Outcomes: operating time, extraction time, intra-operative blood loss, length of hospitalisation, total sutures used.
Franchi 1998	Excluded because intervention included Joel-Cohen incision as well as peritoneal non-closure. Allocation was made "randomly". Participants: 299 women to undergo caesarean section. Interventions: 1. experimental (149), Joel-Cohen incision and non-closure of both peritoneal surfaces. 2. control (150), Pfannenstiel incision and closure of both peritoneal surfaces. Outcomes: operating time, intraoperative blood loss, blood transfusion, bladder injuries, wound dehiscence, endometritis, sepsis, febrile morbidity, and urinary tract infections.

Gaucherand 2001	Excluded because whole Misgav-Ladach technique compared with Pfannenstiel technique. A prospective randomised trial. Participants: 104 women undergoing caesarean section. Interventions: 1. 49 women in experimental group, Misgav-Ladach technique with non-closure of both peritoneal surfaces. 2. 55 women in Pfannenstiel group with closure of both peritoneal surfaces-control. Outcomes: duration of surgery, duration of time between incision - birth, blood loss rate, postoperative pain, the delay before flatus passed, number of days with postoperative fever and duration of hospitalisation.
Ghezzi 2001	Excluded because whole Joel-Cohen technique compared with Pfannenstiel technique. A prospective randomised trial. Participants: 310 women undergoing caesarean section. Interventions: 1. experimental 152 Joel-Cohen with non-closure of both peritoneal surfaces. 2. 158 women who had Pfannenstiel technique with both peritoneal surfaces closed. Outcomes: operative time, opening time, laparomy wound length, intraoperative complications and postoperative morbidity.
Hagen 1999	Excluded because several techniques were compared, not only peritoneal non-closure. Women were "randomly allocated". Participants: 98 women to undergo caesarean section. Interventions: 1. experimental (48) Misgav-Ladach, non-closure of both visceral and parietal peritoneum. 2. control (50) Pfannenstiel method, women had both peritoneal surfaces closed. Outcomes: time from skin incision to delivery, duration of operation, analgesics required, wound healing problems, bowel and bladder function, urinary tract infection and length of hospital stay.
Heimann 2000	Excluded because it is a comparison of Misgav-Ladach versus Pfannenstiel techniques, not only peritoneal non-closure.
Ho 1997	Excluded because not clear which data refer to which group, and appear to have used standard error of the mean rather than standard deviations (differences stated to be non-significant would be significant if the figures were standard deviations). Prospective randomised trial, "randomly allocated". Participants: 190 women who underwent caesarean section. Interventions: 1. 96 women with non-closure of both peritoneal surfaces. 2. 94 women with closure of both peritoneal surfaces. Outcomes: duration of operation, length of hospitalisation, pain visual analogue score, amount of analgesia required, fever, wound infection.
Hojberg 1996	No difference in analgesic doses was found between the two groups. However, the study did not include numerical information hence the exclusion. Letter written in November 2006 to author for information.
Jacobson 1992	This prospective study did not provide data for analysis.
Moreira 2002	Comparison of entire Misgav-Ladach versus traditional technique, not only peritoneal non-closure.
Ohel 1996	This was a well-conducted randomised controlled trial examining the use of closure or non-closure of peritoneum at caesarean section along with the use of a double or single layer uterine closure. Unfortunately, it was not possible to separate the effect of double or single layer uterine closure from the closure or non-closure of peritoneum on operation time and morbidity because of the methodology used.
Rathnamala 2000	A well-reported trial unfortunately, the method of group selection was not stated hence the exclusion. There is an imbalance in the proportions with a vertical abdominal incision (45% in the non-closure vs 65% in the closure group).
Sodowski 2000	Method of randomisation was not stated, and data were not provided in a usable format. However, the outcomes in this study followed the general trend of favouring peritoneal non-closure as regards operating time and complication rate.
Stark 1995	Retrospective analysis of two different operating techniques by two groups of surgeons, using different techniques of uterine and peritoneal closure. There was significant reduction in febrile morbidity and adhesions

Characteristics of excluded studies (*Continued*)

	in repeat sections when the peritoneum was not closed, without differences in haematocrit or haemoglobin changes. Although analysis of the two groups showed no differences in age, gestation, gravidity, parity, previous caesarean section or rupture of membranes, this was not a randomised controlled trial, and is thus excluded. The direction of effect is consistent with the included studies.
Wallin 1999	Excluded because peritoneal non-closure was not the only intervention studied. Allocation was by last digit of hospital number (odd or even). 72 women undergoing caesarean section through a Pfannenstiel incision. 1. Experimental (36), non-closure of parietal and visceral peritoneum. 2. Control (36), both visceral and parietal peritoneum were sutured. Postoperative morbidity, days in hospital.
Woyton 2000	Participants were divided into two groups without randomisation (307 no closure of visceral peritoneum, 270 closure. It is noteworthy that non-closure of peritoneum was associated with less bladder peritoneal adhesions.
Xavier 1999	Excluded because whole Joel-Cohen technique used. Randomised trial with pre-allocation concealment. Participants: 46 women undergoing caesarean section. Interventions: 1. 23 women in the experimental Joel Cohen group including non-closure of both peritoneal surfaces. 2. 23 women in the control group with Pfannenstiel technique, where both surfaces were closed. Outcomes: duration of operation, analgesic dosages, bowel emptying, postoperative fever and antibiotics, scar complications.

vs: versus

Characteristics of ongoing studies

Study	**CORONIS 2006**
Trial name or title	International study of caesarean section surgical techniques: a randomised factorial trial
Participants	Women in Argentina, Ghana, India, Kenya, Pakistan and Sudan will be eligible for trial entry if they are undergoing delivery by lower segment caesarean section through a transverse abdominal incision.
Interventions	There are 5 pairs of interventions being tested; however, each participating hospital will only take part in 3 of these 5 possible comparisons. The interventions being compared are: 1. blunt vs sharp abdominal entry; 2. exteriorisation of the uterus vs intra-abdominal repair; 3. single vs double layer closure of the uterus; 4. closure vs non-closure of the peritoneum (pelvic and parietal); 5. chromic catgut vs Vicryl for uterine closure.
Outcomes	The primary outcome is death or serious maternal morbidity (one or more of the following: antibiotic use for maternal febrile morbidity during postnatal hospital stay, antibiotic use for endometritis or wound infection; further operative procedures on the wound; blood transfusion).
Starting date	1 September 2006
Contact information	Dr Brocklehurst National Perinatal Epidemiology Unit University of Oxford Old Road Campus Oxford OX3 7LF
Notes	

Study	**NPEU 2000**
Trial name or title	The CAESAR Study.

Characteristics of ongoing studies (*Continued*)

Participants	Women undergoing their first caesarean delivery, 16 years old or more without indication for any particular technique of surgery.
Interventions	Single vs double layer closure of the uterus, closure vs non-closure of the pelvic peritoneum, liberal vs restricted use of subrectus sheath drain.
Outcomes	Primary outcome: antibiotic use for maternal febrile morbidity. Secondary outcomes: endometritis, wound infection, transfusion, pain, breastfeeding, etc.
Starting date	1 September 2000.
Contact information	Dr Brocklehurst National Perinatal Epidemiology Unit University of Oxford Old Road Campus Oxford OX3 7LF
Notes	

vs: versus

ANALYSES

Comparison 01. Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

Outcome title	No. of studies	No. of participants	Statistical method	Effect size
01 Operating time (minutes)	9	1521	Weighted Mean Difference (Fixed) 95% CI	-6.05 [-6.74, -5.37]
02 Analgesic doses required	4	622	Weighted Mean Difference (Fixed) 95% CI	-0.20 [-0.33, -0.08]
03 Postoperative fever	7	1263	Relative Risk (Fixed) 95% CI	0.73 [0.55, 0.97]
04 Endometritis	4	863	Relative Risk (Fixed) 95% CI	1.11 [0.60, 2.02]
05 Postoperative days in hospital	8	1203	Weighted Mean Difference (Fixed) 95% CI	-0.40 [-0.50, -0.30]
06 Wound infection	5	923	Relative Risk (Fixed) 95% CI	0.63 [0.35, 1.12]
07 Postoperative adhesions	2	73	Relative Risk (Fixed) 95% CI	1.44 [0.73, 2.83]
08 Secondary infertility	1	144	Relative Risk (Fixed) 95% CI	0.89 [0.23, 3.44]

Comparison 02. Non-closure of visceral peritoneum only versus closure of both peritoneal layers

Outcome title	No. of studies	No. of participants	Statistical method	Effect size
01 Operating time (minutes)	1	544	Weighted Mean Difference (Fixed) 95% CI	-6.30 [-9.22, -3.38]
02 Adhesion formation	1	45	Relative Risk (Fixed) 95% CI	1.25 [0.28, 5.54]
03 Postoperative fever	3	889	Relative Risk (Fixed) 95% CI	0.63 [0.44, 0.90]
04 Endometritis	1	240	Relative Risk (Fixed) 95% CI	3.00 [0.12, 72.91]
05 Postoperative days in hospital	1	549	Weighted Mean Difference (Fixed) 95% CI	-0.70 [-0.98, -0.42]
06 Wound infection	2	789	Relative Risk (Fixed) 95% CI	0.36 [0.14, 0.89]

Comparison 03. Non-closure of parietal peritoneum only versus closure of both peritoneal layers

Outcome title	No. of studies	No. of participants	Statistical method	Effect size
01 Operating time (minutes)	1	248	Weighted Mean Difference (Fixed) 95% CI	-5.10 [-8.71, -1.49]
02 Postoperative fever	1	40	Relative Risk (Fixed) 95% CI	0.18 [0.01, 3.56]
03 Endometritis	1	248	Relative Risk (Fixed) 95% CI	0.88 [0.53, 1.46]
04 Postoperative days in hospital	2	288	Weighted Mean Difference (Fixed) 95% CI	0.22 [-0.05, 0.48]
05 Wound infection	1	248	Relative Risk (Fixed) 95% CI	0.95 [0.14, 6.66]

INDEX TERMS

Medical Subject Headings (MeSH)

Cesarean Section [*methods]; Peritoneum [*surgery]; Randomized Controlled Trials; *Suture Techniques

MeSH check words

Female; Humans; Pregnancy

COVER SHEET

Title	Closure versus non-closure of the peritoneum at caesarean section
Authors	Bamigboye AA, Hofmeyr GJ
Contribution of author(s)	Anthony Bamigboye wrote the initial protocol, mentored and checked by Justus Hofmeyr. The first version of the review and the 2006 update were prepared by Anthony Bamigboye and Justus Hofmeyr. Anthony Bamigboye is the guarantor of the review.
Issue protocol first published	1995/1
Review first published	1995/1
Date of most recent amendment	15 February 2007
Date of most recent SUBSTANTIVE amendment	01 July 2003
What's New	December 2006 Search updated. We identified nine new trials; five have been included and four excluded. The inclusion of the new trials has not changed the conclusions. The result of large randomised multicentre trials of surgical techniques for caesarean section (CAESAR, CORONIS) are awaited.
Date new studies sought but none found	Information not supplied by author
Date new studies found but not yet included/excluded	Information not supplied by author
Date new studies found and included/excluded	30 October 2006
Date authors' conclusions section amended	Information not supplied by author
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GRAPHS AND OTHER TABLES

Analysis 01.01. Comparison 01 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 01 Operating time (minutes)

Review: Closure versus non-closure of the peritoneum at caesarean section

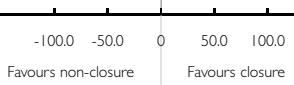
Comparison: 01 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

Outcome: 01 Operating time (minutes)

Study	Periton. non-closure		Periton. closure		Weighted Mean Difference (Fixed)	Weight	Weighted Mean Difference (Fixed)
	N	Mean(SD)	N	Mean(SD)	95% CI	(%)	95% CI
Chanrachakul 2002	30	51.60 (10.50)	30	55.30 (12.10)		1.4	-3.70 [-9.43, 2.03]
Galaal 2000	30	53.56 (11.21)	30	61.90 (11.73)		1.4	-8.34 [-14.15, -2.53]
Grundsell 1998	179	33.40 (6.20)	182	41.30 (6.90)		25.5	-7.90 [-9.25, -6.55]
Hull 1991	54	50.00 (13.50)	59	57.90 (13.90)		1.8	-7.90 [-12.95, -2.85]
Irion 1996	137	47.30 (19.40)	143	53.20 (15.50)		2.7	-5.90 [-10.02, -1.78]
Rafique 2002	50	32.80 (6.80)	50	38.80 (7.60)		5.8	-6.00 [-8.83, -3.17]
Sood 2004	71	30.90 (6.13)	78	38.40 (6.30)		11.7	-7.50 [-9.50, -5.50]
Tuncer 2003	40	19.05 (3.13)	40	25.05 (4.94)		14.2	-6.00 [-7.81, -4.19]
Zhang 2000	160	20.20 (4.80)	158	24.40 (5.60)		35.4	-4.20 [-5.35, -3.05]
Total (95% CI)	751		770			100.0	-6.05 [-6.74, -5.37]

Test for heterogeneity chi-square=20.97 df=8 p=0.007 I^2 =61.9%

Test for overall effect z=17.38 p<0.00001



Analysis 01.02. Comparison 01 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 02 Analgesic doses required

Review: Closure versus non-closure of the peritoneum at caesarean section

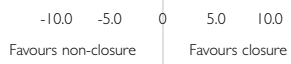
Comparison: 01 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

Outcome: 02 Analgesic doses required

Study	Periton. non-closure		Peritoneal closure		Weighted Mean Difference (Fixed)	Weight	Weighted Mean Difference (Fixed)
	N	Mean(SD)	N	Mean(SD)	95% CI	(%)	95% CI
Hull 1991	54	8.60 (4.90)	59	11.10 (6.30)		0.3	-2.50 [-4.57, -0.43]
Irion 1996	137	2.50 (1.80)	143	2.70 (1.70)		8.9	-0.20 [-0.61, 0.21]
Sood 2004	71	3.30 (0.40)	78	3.40 (0.50)		71.5	-0.10 [-0.24, 0.04]
Tuncer 2003	40	1.25 (0.59)	40	1.80 (0.68)		19.3	-0.55 [-0.83, -0.27]
Total (95% CI)	302		320			100.0	-0.20 [-0.33, -0.08]

Test for heterogeneity chi-square=12.61 df=3 p=0.006 I^2 =76.2%

Test for overall effect z=3.26 p=0.001



Analysis 01.03. Comparison 01 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 03 Postoperative fever

Review: Closure versus non-closure of the peritoneum at caesarean section

Comparison: 01 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

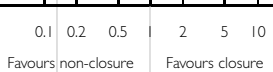
Outcome: 03 Postoperative fever

Study	Perit. non-closure	Peritoneal closure	Relative Risk (Fixed)	Weight	Relative Risk (Fixed)
	n/N	n/N	95% CI	(%)	95% CI
× Chanrachakul 2002	0/30	0/30		0.0	Not estimable
Galaal 2000	7/30	9/30		9.3	0.78 [0.33, 1.82]
Grundsell 1998	14/179	35/182		35.7	0.41 [0.23, 0.73]
Hull 1991	9/54	8/59		7.9	1.23 [0.51, 2.96]
Irion 1996	11/137	12/143		12.1	0.96 [0.44, 2.10]
Sood 2004	7/71	18/78		17.6	0.43 [0.19, 0.96]
Weerawetwat 2004	22/120	17/120		17.5	1.29 [0.72, 2.31]
Total (95% CI)	621	642		100.0	0.73 [0.55, 0.97]

Total events: 70 (Perit. non-closure), 99 (Peritoneal closure)

Test for heterogeneity chi-square=11.09 df=5 p=0.05 I^2 =54.9%

Test for overall effect z=2.16 p=0.03



Analysis 01.04. Comparison 01 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 04 Endometritis

Review: Closure versus non-closure of the peritoneum at caesarean section

Comparison: 01 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

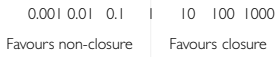
Outcome: 04 Endometritis

Study	Periton. non-closure n/N	Peritoneal closure n/N	Relative Risk (Fixed) 95% CI	Weight (%)	Relative Risk (Fixed) 95% CI
Grundsell 1998	9/179	9/182		47.1	1.02 [0.41, 2.50]
Hull 1991	6/54	3/59		15.1	2.19 [0.57, 8.31]
Sood 2004	3/71	7/78		35.2	0.47 [0.13, 1.75]
Weerawetwat 2004	2/120	0/120		2.6	5.00 [0.24, 103.06]
Total (95% CI)	424	439		100.0	1.11 [0.60, 2.02]

Total events: 20 (Periton. non-closure), 19 (Peritoneal closure)

Test for heterogeneity chi-square=3.61 df=3 p=0.31 I^2 =16.9%

Test for overall effect z=0.33 p=0.7



Analysis 01.05. Comparison 01 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 05 Postoperative days in hospital

Review: Closure versus non-closure of the peritoneum at caesarean section

Comparison: 01 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

Outcome: 05 Postoperative days in hospital

Study	Periton. non-closure N	Mean(SD)	Peritoneal closure N	Mean(SD)	Weighted Mean Difference (Fixed) 95% CI	Weight (%)	Weighted Mean Difference (Fixed) 95% CI
Chanrachakul 2002	30	4.10 (0.40)	30	4.10 (0.30)		31.0	0.00 [-0.18, 0.18]
Galaal 2000	30	5.50 (1.14)	30	6.00 (0.91)		3.6	-0.50 [-1.02, 0.02]
Grundsell 1998	179	5.30 (1.00)	182	6.40 (1.00)		23.3	-1.10 [-1.31, -0.89]
Hull 1991	54	4.02 (0.79)	59	4.25 (0.98)		9.3	-0.23 [-0.56, 0.10]
Irion 1996	137	6.50 (1.90)	143	6.80 (2.20)		4.3	-0.30 [-0.78, 0.18]
Rafique 2002	50	4.10 (1.20)	50	3.90 (1.10)		4.9	0.20 [-0.25, 0.65]
Sood 2004	71	6.10 (0.50)	78	6.50 (1.00)		15.8	-0.40 [-0.65, -0.15]
Tuncer 2003	40	4.30 (0.90)	40	4.80 (0.70)		7.9	-0.50 [-0.85, -0.15]
Total (95% CI)	591		612			100.0	-0.40 [-0.50, -0.30]

Test for heterogeneity chi-square=71.86 df=7 p=<0.0001 I^2 =90.3%

Test for overall effect z=7.91 p<0.00001

Analysis 01.06. Comparison 01 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 06 Wound infection

Review: Closure versus non-closure of the peritoneum at caesarean section

Comparison: 01 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

Outcome: 06 Wound infection

Study	Periton. non-closure n/N	Peritoneal closure n/N	Relative Risk (Fixed) 95% CI	Weight (%)	Relative Risk (Fixed) 95% CI
Galaal 2000	4/30	7/30		25.5	0.57 [0.19, 1.75]
Grundsell 1998	4/179	7/182		25.3	0.58 [0.17, 1.95]
Hull 1991	3/54	5/59		17.4	0.66 [0.16, 2.61]
Sood 2004	2/71	5/78		17.3	0.44 [0.09, 2.19]
Weerawetwat 2004	4/120	4/120		14.6	1.00 [0.26, 3.91]
Total (95% CI)	454	469		100.0	0.63 [0.35, 1.12]
Total events: 17 (Periton. non-closure), 28 (Peritoneal closure)					
Test for heterogeneity chi-square=0.68 df=4 p=0.95 I^2 =0.0%					
Test for overall effect z=1.57 p=0.1					

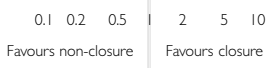
Analysis 01.07. Comparison 01 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 07 Postoperative adhesions

Review: Closure versus non-closure of the peritoneum at caesarean section

Comparison: 01 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

Outcome: 07 Postoperative adhesions

Study	Periton. non-closure n/N	Peritoneal Closure n/N	Relative Risk (Fixed) 95% CI	Weight (%)	Relative Risk (Fixed) 95% CI
Irion 1996	8/14	6/14		69.2	1.33 [0.63, 2.84]
Weerawetwat 2004	4/20	3/25		30.8	1.67 [0.42, 6.60]
Total (95% CI)	34	39		100.0	1.44 [0.73, 2.83]
Total events: 12 (Periton. non-closure), 9 (Peritoneal Closure)					
Test for heterogeneity chi-square=0.08 df=1 p=0.77 I^2 =0.0%					
Test for overall effect z=1.04 p=0.3					

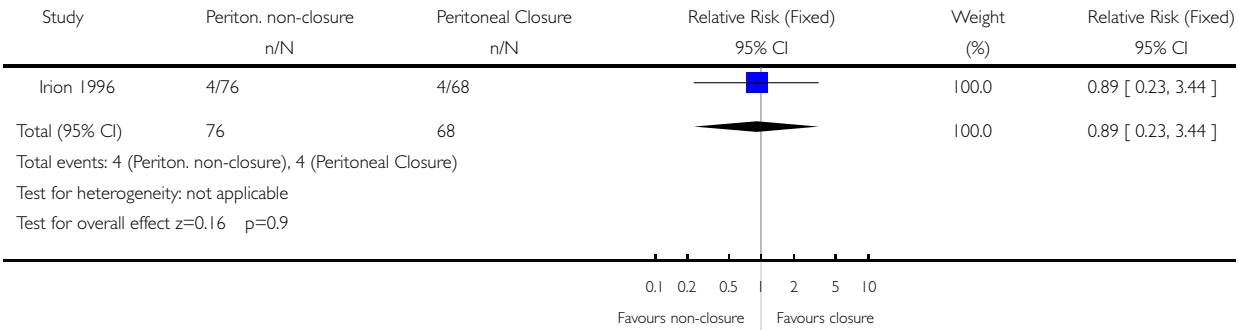


Analysis 01.08. Comparison 01 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 08 Secondary infertility

Review: Closure versus non-closure of the peritoneum at caesarean section

Comparison: 01 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

Outcome: 08 Secondary infertility

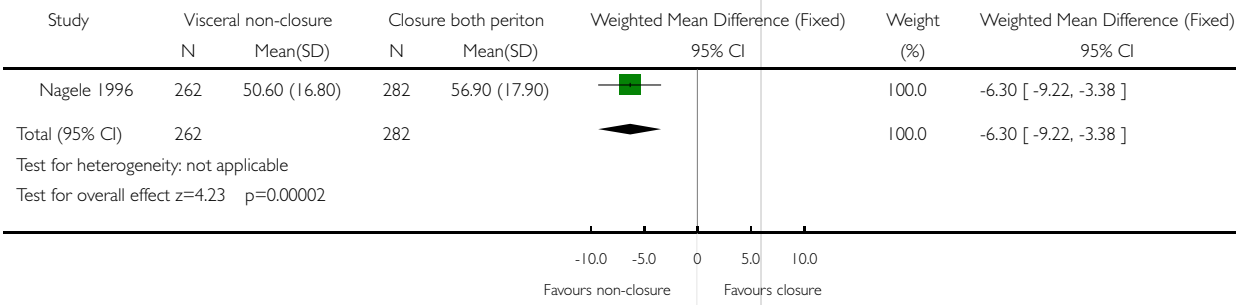


Analysis 02.01. Comparison 02 Non-closure of visceral peritoneum only versus closure of both peritoneal layers, Outcome 01 Operating time (minutes)

Review: Closure versus non-closure of the peritoneum at caesarean section

Comparison: 02 Non-closure of visceral peritoneum only versus closure of both peritoneal layers

Outcome: 01 Operating time (minutes)

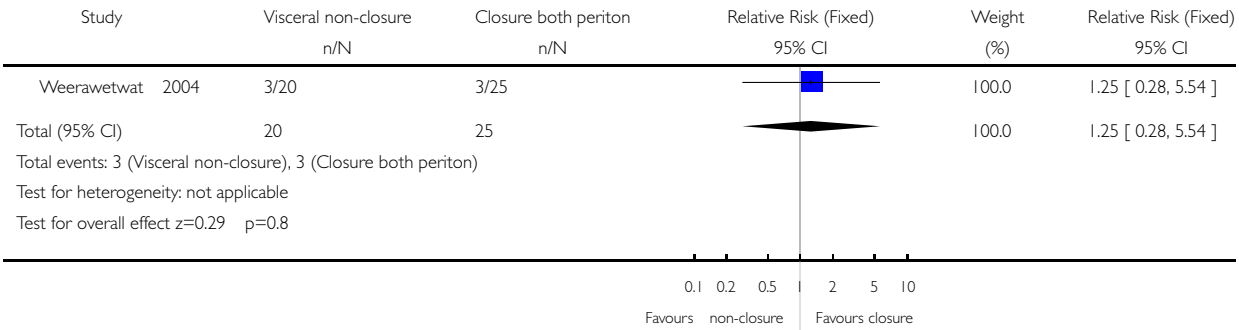


Analysis 02.02. Comparison 02 Non-closure of visceral peritoneum only versus closure of both peritoneal layers, Outcome 02 Adhesion formation

Review: Closure versus non-closure of the peritoneum at caesarean section

Comparison: 02 Non-closure of visceral peritoneum only versus closure of both peritoneal layers

Outcome: 02 Adhesion formation

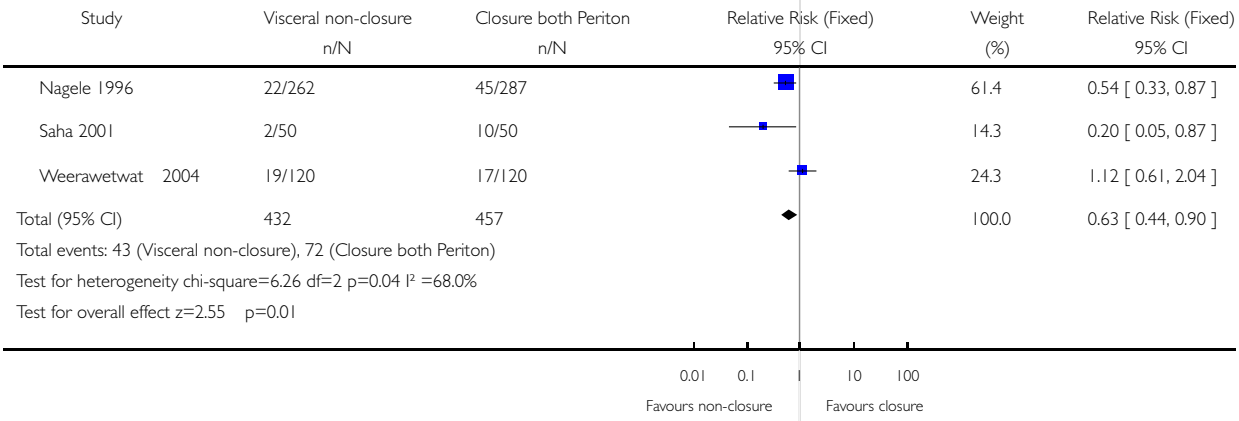


Analysis 02.03. Comparison 02 Non-closure of visceral peritoneum only versus closure of both peritoneal layers, Outcome 03 Postoperative fever

Review: Closure versus non-closure of the peritoneum at caesarean section

Comparison: 02 Non-closure of visceral peritoneum only versus closure of both peritoneal layers

Outcome: 03 Postoperative fever



Analysis 02.04. Comparison 02 Non-closure of visceral peritoneum only versus closure of both peritoneal layers, Outcome 04 Endometritis

Review: Closure versus non-closure of the peritoneum at caesarean section

Comparison: 02 Non-closure of visceral peritoneum only versus closure of both peritoneal layers

Outcome: 04 Endometritis

Study	Visceral non-closure n/N	Closure both Periton n/N	Relative Risk (Fixed) 95% CI	Weight (%)	Relative Risk (Fixed) 95% CI
Weerawetwat 2004	1/120	0/120		100.0	3.00 [0.12, 72.91]
Total (95% CI)	120	120		100.0	3.00 [0.12, 72.91]

Total events: 1 (Visceral non-closure), 0 (Closure both Periton)

Test for heterogeneity: not applicable

Test for overall effect z=0.67 p=0.5

Analysis 02.05. Comparison 02 Non-closure of visceral peritoneum only versus closure of both peritoneal layers, Outcome 05 Postoperative days in hospital

Review: Closure versus non-closure of the peritoneum at caesarean section

Comparison: 02 Non-closure of visceral peritoneum only versus closure of both peritoneal layers

Outcome: 05 Postoperative days in hospital

Study	Visceral non-closure N	Mean(SD)	Closure both periton N	Mean(SD)	Weighted Mean Difference (Fixed) 95% CI	Weight (%)	Weighted Mean Difference (Fixed) 95% CI
Nagele 1996	262	7.20 (1.60)	287	7.90 (1.80)		100.0	-0.70 [-0.98, -0.42]
Total (95% CI)	262		287			100.0	-0.70 [-0.98, -0.42]

Test for heterogeneity: not applicable

Test for overall effect z=4.82 p<0.00001

Analysis 02.06. Comparison 02 Non-closure of visceral peritoneum only versus closure of both peritoneal layers, Outcome 06 Wound infection

Review: Closure versus non-closure of the peritoneum at caesarean section

Comparison: 02 Non-closure of visceral peritoneum only versus closure of both peritoneal layers

Outcome: 06 Wound infection

Study	Visceral non-closure n/N	Closure both periton n/N	Relative Risk (Fixed) 95% CI	Weight (%)	Relative Risk (Fixed) 95% CI
Nagele 1996	5/262	14/287		77.0	0.39 [0.14, 1.07]
Weerawetwat 2004	1/120	4/120		23.0	0.25 [0.03, 2.20]
Total (95% CI)	382	407		100.0	0.36 [0.14, 0.89]

Total events: 6 (Visceral non-closure), 18 (Closure both periton)

Test for heterogeneity chi-square=0.13 df=1 p=0.71 I^2 =0.0%

Test for overall effect z=2.20 p=0.03

Analysis 03.01. Comparison 03 Non-closure of parietal peritoneum only versus closure of both peritoneal layers, Outcome 01 Operating time (minutes)

Review: Closure versus non-closure of the peritoneum at caesarean section

Comparison: 03 Non-closure of parietal peritoneum only versus closure of both peritoneal layers

Outcome: 01 Operating time (minutes)

Study	Parietal non-closure N	Mean(SD)	Closure both periton N	Mean(SD)	Weighted Mean Difference (Fixed) 95% CI	Weight (%)	Weighted Mean Difference (Fixed) 95% CI
Pietrantoni 1991	127	48.10 (13.52)	121	53.20 (15.40)		100.0	-5.10 [-8.71, -1.49]
Total (95% CI)	127		121			100.0	-5.10 [-8.71, -1.49]

Test for heterogeneity: not applicable

Test for overall effect z=2.77 p=0.006

Analysis 03.02. Comparison 03 Non-closure of parietal peritoneum only versus closure of both peritoneal layers, Outcome 02 Postoperative fever

Review: Closure versus non-closure of the peritoneum at caesarean section

Comparison: 03 Non-closure of parietal peritoneum only versus closure of both peritoneal layers

Outcome: 02 Postoperative fever

Study	Parietal non-closure n/N	Closure both periton n/N	Relative Risk (Fixed) 95% CI	Weight (%)	Relative Risk (Fixed) 95% CI
Hojberg 1998	0/21	2/19		100.0	0.18 [0.01, 3.56]
Total (95% CI)	21	19		100.0	0.18 [0.01, 3.56]
Total events: 0 (Parietal non-closure), 2 (Closure both periton)					
Test for heterogeneity: not applicable					
Test for overall effect z=1.12 p=0.3					

Analysis 03.03. Comparison 03 Non-closure of parietal peritoneum only versus closure of both peritoneal layers, Outcome 03 Endometritis

Review: Closure versus non-closure of the peritoneum at caesarean section

Comparison: 03 Non-closure of parietal peritoneum only versus closure of both peritoneal layers

Outcome: 03 Endometritis

Study	Parietal non-closure n/N	Closure both periton n/N	Relative Risk (Fixed) 95% CI	Weight (%)	Relative Risk (Fixed) 95% CI
Pietrantoni 1991	23/127	25/121		100.0	0.88 [0.53, 1.46]
Total (95% CI)	127	121		100.0	0.88 [0.53, 1.46]
Total events: 23 (Parietal non-closure), 25 (Closure both periton)					
Test for heterogeneity: not applicable					
Test for overall effect z=0.51 p=0.6					

Analysis 03.04. Comparison 03 Non-closure of parietal peritoneum only versus closure of both peritoneal layers, Outcome 04 Postoperative days in hospital

Review: Closure versus non-closure of the peritoneum at caesarean section

Comparison: 03 Non-closure of parietal peritoneum only versus closure of both peritoneal layers

Outcome: 04 Postoperative days in hospital

Study	Parietal non-closure N	Mean(SD)	Closure both periton N	Mean(SD)	Weighted Mean Difference (Fixed) 95% CI	Weight (%)	Weighted Mean Difference (Fixed) 95% CI
Hojberg 1998	21	6.30 (1.37)	19	7.10 (1.74)		7.5	-0.80 [-1.78, 0.18]
Pietrantoni 1991	127	4.80 (1.13)	121	4.50 (1.10)		92.5	0.30 [0.02, 0.58]
Total (95% CI)	148		140			100.0	0.22 [-0.05, 0.48]

Test for heterogeneity chi-square=4.50 df=1 p=0.03 I^2 =77.8%

Test for overall effect z=1.60 p=0.1

Analysis 03.05. Comparison 03 Non-closure of parietal peritoneum only versus closure of both peritoneal layers, Outcome 05 Wound infection

Review: Closure versus non-closure of the peritoneum at caesarean section

Comparison: 03 Non-closure of parietal peritoneum only versus closure of both peritoneal layers

Outcome: 05 Wound infection

Study	Parietal non-closure n/N	Closure both periton n/N	Relative Risk (Fixed) 95% CI	Weight (%)	Relative Risk (Fixed) 95% CI
Pietrantoni 1991	2/127	2/121		100.0	0.95 [0.14, 6.66]
Total (95% CI)	127	121		100.0	0.95 [0.14, 6.66]

Total events: 2 (Parietal non-closure), 2 (Closure both periton)

Test for heterogeneity: not applicable

Test for overall effect z=0.05 p=1