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Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

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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 routinely performed.

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 and immediate- and long-term postoperative outcomes.

Search methods

We searched the Cochrane Pregnancy and Childbirth Group’s Trials Register (1 November 2013).

Selection criteria

Randomised 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 independently assessed trials for inclusion and risk of bias, extracted data and checked it for accuracy.

Main results

A total of 29 trials were included in this review and 21 trials (17,276 women) provided data that could be included in an analysis. The quality of the trials was variable.

1. Non-closure of visceral and parietal peritoneum versus closure of both parietal layers

Sixteen trials involving 15,480 women, were included and analysed, when both parietal peritoneum was left unclosed versus when both peritoneal surfaces were closed. Postoperative adhesion formation was assessed in only four trials with 282 women, and no difference
was found between groups (risk ratio (RR) 0.99, 95% confidence interval (CI) 0.76 to 1.29). There was significant reduction in the operative time (mean difference (MD) -5.81 minutes, 95% CI -7.68 to -3.93). The duration of hospital stay in a total of 13 trials involving 14,906 women, was also reduced (MD -0.26, 95% CI -0.47 to -0.05) days. In a trial involving 112 women, reduced chronic pelvic pain was found in the peritoneal non-closure group.

2. Non-closure of visceral peritoneum only versus closure of both peritoneal surfaces

Three trials involving 889 women were analysed. There was an increase in adhesion formation (two trials involving 157 women, RR 2.49, 95% CI 1.49 to 4.16) which was limited to one trial with high risk of bias. There was reduction in operative time, postoperative days in hospital and wound infection. There was no significant reduction in postoperative pyrexia.

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

The two identified trials involved 573 women. Neither study reported on postoperative adhesion formation. There was reduction in operative time and postoperative pain with no difference in the incidence of postoperative pyrexia, endometritis, postoperative duration of hospital stay and wound infection. In only one study, postoperative day one wound pain assessed by the numerical rating scale, (MD -1.60, 95% CI -1.97 to -1.23) and chronic abdominal pain d by the visual analogue score (MD -1.10, 95% CI -1.39 to -0.81) was reduced in the non-closure group.

4. Non-closure versus closure of visceral peritoneum when parietal peritoneum is closed.

There was reduction in all the major urinary symptoms of frequency, urgency and stress incontinence when the visceral peritoneum is left unsutured.

Authors’ conclusions

There was a reduction in operative time across all the subgroups. There was also a reduction in the period of hospitalisation post-caesarean section except in the subgroup where parietal peritoneum only was not sutured where there was no difference in the period of hospitalisation. The evidence on adhesion formation was limited and inconsistent. There is currently insufficient evidence of benefit to justify the additional time and use of suture material necessary for peritoneal closure. More robust evidence on long-term pain, adhesion formation and infertility is needed.

PLAIN LANGUAGE SUMMARY

Closure versus non-closure of the peritoneum at caesarean section: long- and short-term outcome

Not stitching the peritoneum after caesarean section takes less theatre time and therefore has less cost, but information on possible long-term disadvantages are limited.

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 to reach the uterus and for the baby to be born. Following a caesarean section, it has been standard practice to close the peritoneum by stitching (suturing) the two layers of tissue that line the abdomen and cover the internal organs, to restore the anatomy. It has however been suggested that peritoneal adhesions may be more likely rather than less likely when the peritoneum is sutured, possibly as a result of a tissue reaction to the suture material. This review of trials sought to address whether to routinely suture these thin layers of tissue or not after delivering a baby by caesarean section. Twenty-nine randomised controlled trials were identified, with differences in their methodological quality; 21 trials involving over 17,000 women contributing data to the review. Several minutes were saved when the peritoneum was not stitched, and with a shorter period of hospital stay in most of the women. Postoperative adhesion formation was assessed in only four trials with 282 women, and no difference was found when leaving both layers of peritoneum unclosed was compared with closure of both. Longer-term outcomes were not adequately assessed, particularly adhesion formation, subfertility and ease of other surgeries in later life. Although the methodological quality of trials was variable, the results were in general consistent between the trials of better and poorer quality. Further studies are needed to further assess all these outcomes.
BACKGROUND

Description of the condition

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). A rate of 57% was reported from a private hospital in South Africa (Naidoo 2009).

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 is published as a separate review (Hofmeyr 2008).

Description of the intervention

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.

Extraperitoneal caesarean section in which the peritoneum is reflected but not opened, was used in the past in an attempt to limit spread of sepsis from the uterus in septic cases, is seldom if ever used today.

How the intervention might work

Cited reasons for closure of the peritoneum include restoration of anatomy and re-approximation of tissues, reduction of infection by re-establishing an anatomical barrier, reduction of wound dehiscence, reducing haemorrhage, 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. The suture may cause peritoneal tissue ischaemia at the edges, which may delay healing and serve as a cause of intraperitoneal adhesions and febrile morbidity. Non-closure of the peritoneum will eliminate these potential complications of performing caesarean section.

Why it is important to do this review

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 with 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, taking into cognizance 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 the operation.

METHODS

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 trials (for example, based on hospital number) were included in the analysis. Cluster-randomised trials are eligible for inclusion. Cross-over trials are not appropriate for this intervention.

Types of participants
Women undergoing caesarean section.

Types of interventions
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

Primary outcomes
- Postoperative adhesions (not prespecified in original protocol).

Secondary outcomes
- Wound infection.
- Wound dehiscence.
- Analgesic requirement.
- Postoperative fever.
- Endometritis.
- Operating time.
- Paralytic ileus.
- Duration of hospital stay.
- Cost.

Long-term outcomes (not prespecified at the protocol stage)
- Chronic pelvic pain.
- Urinary symptoms.
- Subfertility.

Outcomes not prespecified
- Blood transfusion > 1 unit.
- Maternal death.
- Intervention for postpartum haemorrhage.
- Readmission to hospital within six weeks.
- Mobilisation time in hours.
- Time to oral intake in hours.
- Drop in haemoglobin g/dL.
- Blood loss mL.
- Time to flatus.

Search methods for identification of studies
The following methods sections of this review is based on a standard template used by the Cochrane Pregnancy and Childbirth Group.

Electronic searches
We searched the Cochrane Pregnancy and Childbirth Group's Trials Register by contacting the Trials Search Co-ordinator (1 November 2013). The Cochrane Pregnancy and Childbirth Group's Trials Register is maintained by the Trials Search Co-ordinator and contains trials identified from:
1. monthly searches of the Cochrane Central Register of Controlled Trials (CENTRAL);
2. weekly searches of MEDLINE;
3. weekly searches of Embase;
4. handsearches of 30 journals and the proceedings of major conferences;
5. weekly current awareness alerts for a further 44 journals plus monthly BioMed Central email alerts.
Details of the search strategies for CENTRAL, MEDLINE and Embase, the list of handsearched journals and conference proceedings, and the list of journals reviewed via the current awareness service can be found in the ‘Specialized Register’ section within the editorial information about the Cochrane Pregnancy and Childbirth Group.
We did not apply any language restrictions.

Data collection and analysis
For the methods used when assessing the trials identified in the previous version of this review, see Bamigboye 2003.
For this update, we used the following methods when assessing the reports identified by the updated search.
The following methods sections of this review is based on a standard template used by the Cochrane Pregnancy and Childbirth Group.

Selection of studies
Two review authors independently assessed for inclusion, all the potential studies we identified as a result of the search strategy. There was no need to consult a third party regarding any disagreement.

Data extraction and management
We designed a form to extract data. Two review authors extracted data using the agreed form. We resolved discrepancies through discussion. Data were entered into Review Manager software (
Assessment of risk of bias in included studies

Two review authors independently assessed risk of bias for each study using the criteria outlined in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011). We resolved disagreement by discussion.

(1) Random sequence generation (checking for possible selection bias)

We described for each included study the method used to generate the allocation sequence in sufficient detail to allow an assessment of whether it should produce comparable groups.

We assessed the method as:
- low risk of bias (any truly random process, e.g. random number table; computer random number generator);
- high risk of bias (any non-random process, e.g. odd or even date of birth; hospital or clinic record number);
- unclear risk of bias.

(2) Allocation concealment (checking for possible selection bias)

We described for each included study the method used to conceal the allocation sequence and determine whether intervention allocation could have been foreseen in advance of, or during recruitment, or changed after assignment.

We assessed the methods as:
- low risk (e.g. telephone or central randomisation; consecutively numbered sealed opaque envelopes);
- high risk of bias (open random allocation; unsealed or non-opaque envelopes, alternation; date of birth);
- unclear risk of bias.

(3.1) Blinding of participants and personnel (checking for possible performance bias)

We described for each included study the methods used, if any, to blind study participants and personnel from knowledge of which intervention a participant received. We considered that studies were at low risk of bias if they were blinded, or if we judged that the lack of blinding could not have affected the results. Blinding the surgeon in these trials was not possible but the data collectors and analyst were blinded from allocation.

We assessed the methods as:
- low, high or unclear risk of bias for participants;
- low, high or unclear risk of bias for personnel.

(3.2) Blinding of outcome assessment (checking for possible detection bias)

We described for each included study the methods used, if any, to blind outcome assessors from knowledge of which intervention a participant received. We assessed blinding separately for different outcomes or classes of outcomes.

We assessed methods used to blind outcome assessment as:
- low, high or unclear risk of bias.

(4) Incomplete outcome data (checking for possible attrition bias due to the amount, nature and handling of incomplete outcome data)

We described for each included study, and for each outcome or class of outcomes, the completeness of data including attrition and exclusions from the analysis. We stated whether attrition and exclusions were reported, the numbers included in the analysis at each stage (compared with the total randomised participants), reasons for attrition or exclusion where reported, and whether missing data were balanced across groups or were related to outcomes.

We assessed methods as:
- low risk of bias (e.g. no missing outcome data; missing outcome data balanced across groups);
- high risk of bias (e.g. numbers or reasons for missing data imbalanced across groups; ‘as treated’ analysis done with substantial departure of intervention received from that assigned at randomisation);
- unclear risk of bias.

(5) Selective reporting bias

We described for each included study how we investigated the possibility of selective outcome reporting bias and what we found.

We assessed the methods as:
- low risk of bias (where it was clear that all of the study’s pre-specified outcomes and all expected outcomes of interest to the review have been reported);
- high risk of bias (where not all the study’s pre-specified outcomes have been reported; one or more reported primary outcomes were not pre-specified; outcomes of interest are reported incompletely and so cannot be used; study fails to include results of a key outcome that would have been expected to have been reported);
- unclear risk of bias.

(6) Other bias (checking for bias due to problems not covered by (1) to (5) above)

We described for each included study any important concerns we have about other possible sources of bias.

We assessed whether each study was free of other problems that could put it at risk of bias.
(7) Overall risk of bias

We made explicit judgements about whether studies were at high
risk of bias, according to the criteria given in the Handbook (Higgins 2011). With reference to (1) to (6) above, we assessed the
likely magnitude and direction of the bias and whether it was likely
to impact on the findings. We explored the impact of the level
of bias through undertaking sensitivity analyses - see Sensitivity
analysis.

Measures of treatment effect

Dichotomous data

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

Continuous data

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

Unit of analysis issues

Cluster-randomised trials

We will include cluster-randomised trials if identified in future
updates. We will include cluster-randomised trials in the analyses
along with individually-randomised trials. We will adjust their
sample sizes using the methods described in the Handbook using an
estimate of the intracluster correlation co-efficient (ICC) derived
from the trial (if possible), from a similar trial or from a study of
a similar population. If we use ICCs from other sources, we will
report this and conduct sensitivity analyses to investigate the effect
of variation in the ICC. If we identify both cluster-randomised
trials and individually-randomised trials, we plan to synthesise the
relevant information. We will consider it reasonable to combine
the results from both if there is little heterogeneity between the
study designs and the interaction between the effect of intervention
and the choice of randomisation unit is considered to be unlikely.
We will also acknowledge heterogeneity in the randomisation unit
and perform a sensitivity analysis to investigate the effects of the
randomisation unit.

Cross-over trials

Cross-over trials are not appropriate for this intervention.

Dealing with missing data

For included studies, we noted levels of attrition. We explored the
impact of including studies with high levels of missing data in the
overall assessment of treatment effect by using sensitivity analysis.
For all outcomes, we carried out analyses, as far as possible, on
an intention-to-treat basis, i.e. we attempted to include all partici-
pants randomised to each group in the analyses, and all partici-
pants were analysed in the group to which they were allocated, reg-
ardless of whether or not they received the allocated intervention.
The denominator for each outcome in each trial was the number
randomised minus any participants whose outcomes are known
to be missing.

Assessment of heterogeneity

We assessed statistical heterogeneity in each meta-analysis using
the Tau², I² and Chi² statistics. We regarded heterogeneity as sub-
stantial if a Tau² was greater than zero and either an I² was greater
than 30% or there was a low P value (< 0.10) in the Chi² test for
heterogeneity.

Assessment of reporting biases

If there were 10 or more studies in the meta-analysis we inves-
tigated reporting biases (such as publication bias) using funnel
plots. We assessed funnel plot asymmetry visually. If asymmety
was suggested by a visual assessment, we performed exploratory
analyses to investigate it.

Data synthesis

We carried out statistical analysis using the Review Manager soft-
ware (RevMan 2014). We used fixed-effect meta-analysis for com-
bining data where it is reasonable to assume that studies were esti-
mating the same underlying treatment effect: i.e. where trials were
examining the same intervention, and the trials’ populations and
methods were judged sufficiently similar. If there was clinical het-
erogeneity sufficient to expect that the underlying treatment ef-
fects differed between trials, or if substantial statistical heterogene-
ity was detected, we used random-effects meta-analysis to produce
an overall summary, if an average treatment effect across trials was
considered clinically meaningful. The random-effects summary
was treated as the average range of possible treatment effects and
we discussed the clinical implications of treatment effects differing
between trials. If the average treatment effect was not clinically
meaningful, we did not combine trials.
In random-effects analyses, the results were presented as the av-
erage treatment effect with its 95% confidence interval, and the
estimates of Tau² and I².
Subgroup analysis and investigation of heterogeneity

When substantial heterogeneity was identified, we used random-effects analysis. Subgroup analysis will be carried out in future updates. In future updates, we will carry out the following subgroup analysis:

- Vertical versus transverse incisions

We will use all outcomes in subgroup analysis. We will assess subgroup differences by interaction tests available within RevMan (RevMan 2014). We will report the results of subgroup analyses quoting the Chi² statistic and P value, and the interaction test I² value.

Sensitivity analysis

We did not perform sensitivity analysis. In future updates, we will perform sensitivity analyses to look at the effect of quasi-randomised versus truly randomised studies on primary outcomes.

RESULTS

Description of studies

Results of the search

We included 29 and excluded 32 studies. One study is awaiting classification and one study is an ongoing study.

Included studies

See table of Characteristics of included studies for details.

Excluded studies

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

Risk of bias in included studies

See table of Characteristics of included studies and Figure 1; Figure 2 for a summary of ‘Risk of bias’ assessments.

Figure 1. ‘Risk of bias’ graph: review authors’ judgements about each risk of bias item presented as percentages across all included studies.
Figure 2. 'Risk of bias' summary: review authors' judgements about each risk of bias item for each included study.
The quality of the trials was variable. The general finding of studies that predated year 2000 was lack of adequate information to allocate the degree of bias. With more trials in future, studies of low quality will be sub-analysed. This was not done with the current update because there were few trials that assessed the primary outcome.

**Allocation**

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, Komoto 2005, Moraes 1999, Nagele 1996, and Pietrantoni 1991. The method of allocation in many of the older trials (pre year 2000) were poor. The trials were not properly concealed or allocation methods were not detailed in more than 50% of the included trials.

**Blinding**

Blinding of the procedure itself is not feasible, but outcome assessment could be blinded. However, in this review, more than 80% of trials were noted to have an unclear risk of performance and detection bias.

**Incomplete outcome data**

Attrition was less than 10% in the meta-analysis.

**Selective reporting**

In the majority of studies assessed, the published reports included all expected outcomes.

**Other potential sources of bias**

Due to lack of information, there might have been some other yet to be identified sources of error in the review.

**Effects of interventions**

A total of 29 trials were included in this review and 21 trials (17,276 women) provided data that could be included in an analysis. Thirty-eight meta-analyses were performed.

**Primary outcomes**

Postoperative adhesion formation was assessed in only four trials with 282 women, and no difference was found between groups (risk ratio (RR) 0.99, 95% confidence interval (CI) 0.76 to 1.29) Analysis 1.1.

**Secondary outcomes**

Non-closure of the peritoneum reduced operating time by -5.81 minutes, 95% CI -7.68 to -3.93, Analysis 1.8 (Heterogeneity: Tau² = 12.63; I² = 95%). There was also a reduction in duration of hospitalisation post caesarean section when both visceral and parietal peritoneum were left unsutured compared to closure of both peritoneal layers, though the difference of 0.26 days may not be clinically meaningful (13 trials, 14, 096 women, mean difference (MD) in days -0.26, 95% CI -0.47 to -0.05), Analysis 1.9 (Heterogeneity: Tau² = 0.11; I² = 90%). As regards chronic pelvic pain, a recent trial involving 112 women was included. There was an improvement in the outcome when both peritoneal surfaces were left unsutured (RR 0.49, 95% CI 0.25 to 0.98, one trial, 112 women) Analysis 1.10. There was no difference in the number of narcotic analgesics used, infectious morbidity, endometritis, wound infection, chronic pelvic pain, need for transfusion more than 1 unit of blood (not prespecified outcome), and maternal death (not pre-specified outcome). Equally there was no difference in the pain six weeks postpartum and readmission to hospital (not prespecified outcome).

**(2) Non-closure of the visceral peritoneum only compared with suturing both parietal and visceral peritoneum**

Only three studies involving 889 women examined non-closure of visceral peritoneum versus closure of both peritoneal layers.

**Primary outcomes**

In two trials involving 157 women, adhesions formation was increased in the visceral peritoneal non-closure group (Malvasi 2009; Weerawetwat 2004) (RR 2.49 and 95% CI 1.49 to 4.16), Analysis 2.1. This effect was seen only in one of the trials (Malvasi 2009), which was at high risk of bias.

**Secondary outcomes**

One study (Nagele 1996) involving 544 women showed reduction in operating time (MD -6.30 minutes, 95% CI -9.22 to -3.38) Analysis 2.5, and postoperative days in hospital (MD -0.70, 95% CI -0.98 to -0.42), Analysis 2.6, in the non-closure group. Three
trials involving 889 women showed no reduction in postoperative fever (average RR 0.60, 95% CI 0.29 to 1.27; Heterogeneity: Tau² = 0.28; Chi² = 6.26, df = 2; P = 0.04); Analysis 2.3, and two showed a reduction in wound infection (RR 0.36, 95% CI 0.14 to 0.89), Analysis 2.2. There was no difference in the one trial (Weerawetwat 2004), that assessed for endometritis, (RR 3.00, 95% CI 0.12 to 72.91), Analysis 2.4.

(3) Non-closure of parietal peritoneum only compared with closure of both parietal and visceral peritoneum

Two studies involving 573 women were identified (Pietrantoni 1991; Shahin 2009).

Primary outcomes
Neither study reported on postoperative adhesion formation.

Secondary outcomes
One study (Pietrantoni 1991) was a quasi-randomised trial. In this study, there were no significant differences in endometritis, fever, wound infection or hospital stay, but the operative time was reduced (MD -5.10 minutes, 95% CI -8.71 to -1.49), Analysis 3.5. The second study involved 325 women where postoperative pain was the outcome assessed. There was a reduction in pain in the non-closure group (RR 0.45, 95% CI 0.31 to 0.66), Analysis 3.2. The women were able to mobilise earlier in the non-closure group (not prespecified outcome) Analysis 3.7 (MD -1.89, 95% CI -3.18 to -0.60) and time to oral intake (not prespecified outcome) (MD -3.21, 95% CI -3.76 to -0.66) Analysis 3.8. However, there was no drop in haemoglobin (not prespecified outcome) Analysis 3.9 (MD 0.28, 95% CI -0.03 to 0.59), no difference in blood loss (not prespecified outcome) Analysis 3.10 and no improvement in time to flatus (not prespecified outcome) Analysis 3.11. There was more incidence of acute wound pain measured by visual analogue score (MD -1.60, 95% CI -1.97 to -1.23), Analysis 3.12, and persistent abdominal pain after eight months measured by numerical rating scale (MD -1.10, 95% CI -1.39 to -0.81) Analysis 3.13 in the closure group.

(4) Non-closure versus closure of visceral peritoneum when parietal peritoneum is closed

Primary outcome
No study reported on postoperative adhesion formation.

Secondary outcome
Only one study of (Shahin 2010) was identified. There was a reduction in frequency (RR 0.24, 95% CI 0.13 to 0.45), Analysis 4.1, urgency (RR 0.30, 95% CI 0.18 to 0.51), Analysis 4.2, and incontinence (RR 0.45, 95% CI 0.21 to 0.96), Analysis 4.3, when the visceral peritoneum was left unsutured. Funnel plots for outcomes with more than 10 studies did not show any obvious asymmetry (Figure 3; Figure 4; Figure 5; Figure 6).
Figure 3. Funnel plot of comparison: 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, outcome: 1.2 Wound infection.
Funnel plot of comparison: Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, outcome: Infectious morbidity.
Figure 5. Funnel plot of comparison: Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, outcome: Operating time (minutes).
DISCUSSION

Summary of main results

Although the methodological quality of trials was variable, the results were in general, consistent between the trials of better and poorer quality. The results of two recent very large multicentre trials (CAESAR 2010; CORONIS 2013) were consistent with the overall results for those outcomes reported, except that in the CAESAR 2010 study the reduction in hospital stay did not reach statistical significance. There appears to be no difference in the immediate postoperative outcomes for non-closure of both peritoneum at caesarean section compared with routine closure of both. There was however, noticeable difference in the operating time and the duration of hospital stay in women who had non-closure of either peritoneum compared to those who had both peritoneal layers (subgroup 1) closed as well as those who had non-closure of the visceral peritoneum only compared with suturing both parietal and visceral peritoneum (subgroup 2). In this subgroup 2, a reduction in postoperative fever, wound infection and adhesions formation was noted. The only adverse outcome recorded was an increase in adhesion formation in one small trial at high risk of bias. Adhesion formation will be an important outcome in any future trial, which might be a long-term prospective randomised study with particular emphasis on long-term morbidity. The implication of adhesion formation could be legion from a vague abdominal pain to intestinal obstruction and subfertility. An outcome that was consistently reduced with the three subgroups was duration of surgery. While cost was not addressed directly in these trials, the use of less suture material and reduced operating time 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 variable 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).

This scope of this review does not include the possible effect of methods of opening the peritoneum (e.g. sharp, blunt, cautery) on outcomes.
Overall completeness and applicability of evidence
The evidence includes a large number of trials from various settings, including two large multicentre trials. However, many outcomes, particularly long-term outcomes, were not reported in most trials.

Quality of the evidence
The later trials are of better quality than earlier trials. Future analysis will include a sensitivity analysis excluding pseudo-randomised trials. Although there was high heterogeneity for outcomes such as 1.6 (operating time) and 1.7 (postoperative stay), this was due to quantitative differences rather than differences in direction of effect.

Potential biases in the review process
None noted.

Agreements and disagreements with other studies or reviews
The review findings are in general consistent with those of two recent large multicentre trials.

AUTHORS’ CONCLUSIONS

Implications for practice
Leaving the peritoneum unsutured reduces operative time and use of suture material. What evidence is available suggests that leaving the peritoneum unsutured is not likely to be hazardous in the short term, and may have some benefits such as reduced pain and infection (low-quality evidence). There was limited, inconsistent evidence on the risk of adhesions formation. There is currently insufficient evidence of benefit to justify the additional time and use of suture material necessary for peritoneal closure.

Implications for research
Further research on the long-term benefits or complications of non-closure of the peritoneum at caesarean section (particularly adhesion formation and infertility) is needed, and findings will be updated as they become available.

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* Indicates the major publication for the study
# Characteristics of Studies

**Characteristics of included studies**  
[ordered by study ID]

### Altinbas 2013

| Methods          | Randomised trial.                      |
|------------------|----------------------------------------|
| Participants     | Women for caesarean section.           |
| Interventions    | 55 women were randomised to have caesarean section with closure of parietal peritoneum and 55 women had non-closure of the peritoneum |
| Outcomes         | Drop in haemoglobin, blood loss, extra suture needed, operating time, time to passage of flatus, immobilisation, oral intake and postoperative pain |

**Notes**

**Risk of bias**

| Bias                                      | Authors’ judgement | Support for judgement                   |
|-------------------------------------------|--------------------|-----------------------------------------|
| Allocation concealment (selection bias)   | Low risk           | Concealed envelope.                     |
| Blinding of participants and personnel (performance bias) | Unclear risk | Impossible to blind a surgical procedure. |
| All outcomes                              |                    |                                         |
| Blinding of outcome assessment (detection bias) | Unclear risk | Lack of information.                  |
| All outcomes                              |                    |                                         |
| Incomplete outcome data (attrition bias)  | Low risk           | No loss found.                          |
| All outcomes                              |                    |                                         |
| Selective reporting (reporting bias)      | Low risk           | No bias.                                |
| Random sequence generation (selection bias) | Unclear risk | Method of generation, not stated.       |
| Other bias                                | Low risk           | No obvious bias noted.                  |

### Antebay 2009

| Methods          | A prospective randomised trial.         |
|------------------|----------------------------------------|
| Participants     | 533 women at term who were caesarean section naive. |
| Interventions    | Closure versus non-closure of peritoneum at caesarean section |
Antebay 2009  (Continued)

| Outcomes | Short-term outcomes of analgesic need, febrile illness and surgical wound infection |
|----------|---------------------------------------------------------------------------------|
| Notes    | None.                                                                           |

**Risk of bias**

| Bias                                         | Authors' judgement | Support for judgement |
|----------------------------------------------|--------------------|-----------------------|
| Allocation concealment (selection bias)      | Unclear risk       | Random allocation but no mention of the method of concealment |
| Blinding of participants and personnel (performance bias) All outcomes | Unclear risk       | Lack of information. |
| Blinding of outcome assessment (detection bias) All outcomes | Unclear risk       | Lack of information. |
| Incomplete outcome data (attrition bias) All outcomes | Low risk           | Data of all women were included. |
| Selective reporting (reporting bias)         | Low risk           | None observed.        |
| Random sequence generation (selection bias)  | Low risk           | Computer-generated sequence. |
| Other bias                                   | Low risk           | None.                 |

**CAESAR 2010**

| Methods | This is a multicentre, randomised controlled trial of techniques of performing caesarean section |
|---------|------------------------------------------------------------------------------------------------|
| Participants | 30,033 women undergoing caesarean delivery. |
| Interventions | Single versus double layer uterine closure; closure of the peritoneum and the use of sub rectus sheath drain |
| Outcomes | Febrile infectious morbidity. |
| Notes | None. |

**Risk of bias**

| Bias                                         | Authors' judgement | Support for judgement |
|----------------------------------------------|--------------------|-----------------------|
| Allocation concealment (selection bias)      | Low risk           | Téléphonic allocation. |
### CAESAR 2010

| Bias                                         | Authors’ judgement | Support for judgement                                                                 |
|----------------------------------------------|--------------------|---------------------------------------------------------------------------------------|
| Allocation concealment (selection bias)      | Low risk           | Allocation by sealed opaque envelopes.                                                 |
| Blinding of participants and personnel       | Unclear risk       | Surgeon could not be blinded.                                                          |
| (performance bias) All outcomes              |                    |                                                                                       |
| Blinding of outcome assessment (detection    | Low risk           | Data collectors and analyst were blinded but the surgeon could not be blinded.         |
| bias) All outcomes                           |                    |                                                                                       |
| Incomplete outcome data (attrition bias)     | Low risk           | The analysed women were only those who have any follow-up data.                       |
| All outcomes                                 |                    |                                                                                       |
| Selective reporting (reporting bias)         | Low risk           | None.                                                                                 |
| Random sequence generation (selection bias)  | Low risk           | Computer-generated randomisation.                                                      |
| Other bias                                   | Low risk           | None.                                                                                 |

### 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.                                  |

### Risk of bias

| Bias                                         | Authors’ judgement | Support for judgement                                                                 |
|----------------------------------------------|--------------------|---------------------------------------------------------------------------------------|
| Allocation concealment (selection bias)      | Low risk           | Allocation by sealed opaque envelopes.                                                 |
| Blinding of participants and personnel       | Unclear risk       | Surgeon could not be blinded.                                                          |
| (performance bias) All outcomes              |                    |                                                                                       |
| Blinding of outcome assessment (detection    | Unclear risk       | Lack of information.                                                                    |
| bias) All outcomes                           |                    |                                                                                       |
### Chanrachakul 2002  *(Continued)*

| **Incomplete outcome data (attrition bias)** | **Authors' judgement** | **Support for judgement** |
|---------------------------------------------|------------------------|---------------------------|
| All outcomes                                | Low risk               | No loss of data.          |

| **Selective reporting (reporting bias)** | **Authors' judgement** | **Support for judgement** |
|-----------------------------------------|------------------------|---------------------------|
|                                        | Low risk               | None noted.               |

| **Random sequence generation (selection bias)** | **Authors' judgement** | **Support for judgement** |
|-------------------------------------------------|------------------------|---------------------------|
|                                                | Low risk               | Computer generated.       |

| **Other bias** | **Authors' judgement** | **Support for judgement** |
|----------------|------------------------|---------------------------|
|                | Low risk               | None.                     |

### CORONIS 2013

- **Methods**: Fractional, factorial trial.
- **Participants**: 15,935 women for caesarean section.
- **Interventions**: 1 of the 5 intervention pairs was closure versus non-closure of peritoneum of parietal and visceral peritoneum.
- **Outcomes**: Maternal mortality, infectious morbidity, further operative procedures, blood transfusion of more than 1 unit within 6 weeks of follow-up.

### Risk of bias

| **Bias**                                           | **Authors' judgement** | **Support for judgement** |
|----------------------------------------------------|------------------------|---------------------------|
| Allocation concealment (selection bias)            | Low risk               | Envelopes which contain allocation sheet. |
| Blinding of participants and personnel (performance bias) | Unclear risk | Surgeons could not be masked but unlikely to affect the outcome as in most surgical procedures |
| All outcomes                                       |                        |                           |
| Blinding of outcome assessment (detection bias)    | Unclear risk          | Lack of information.      |
| All outcomes                                       |                        |                           |
| Incomplete outcome data (attrition bias)           | Low risk               | Percentage of data loss was low. |
| All outcomes                                       |                        |                           |
| Selective reporting (reporting bias)               | Unclear risk          | None.                     |
| Random sequence generation (selection bias)        | Low risk               | Web-based randomisation.  |
| Other bias                                         | Unclear risk          | Unclear.                  |
### Galaal 2000

| Methods     | Prospective randomised trial. Allocation by numbered envelope technique |
|-------------|----------------------------------------------------------------------------|
| 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 |

#### Risk of bias

| Bias                                      | Authors’ judgement | Support for judgement |
|-------------------------------------------|--------------------|-----------------------|
| Allocation concealment (selection bias)   | Low risk           | Adequate by sealed numbered envelopes. |
| Blinding of participants and personnel (performance bias) | Unclear risk | Lack of information. |
| All outcomes                             |                    |                       |
| Blinding of outcome assessment (detection bias) | Low risk   | Cannot be blinded but data collection blinded. |
| All outcomes                             |                    |                       |
| Incomplete outcome data (attrition bias)  | Low risk           | None.                 |
| All outcomes                             |                    |                       |
| Selective reporting (reporting bias)      | Low risk           | None.                 |
| Random sequence generation (selection bias) | Unclear risk   | Random allocation.    |
| Other bias                               | Low risk           | None noted.           |

### Geemer 2006

| Methods     | Prospective randomised trial. |
|-------------|-----------------------------|
| Participants| 387 women at term were randomised. |
| Interventions| Closure versus non-closure. |
| Outcomes    | Short-term outcomes - duration of surgery analgesic usage and febrile morbidity |
| Notes       | This trial appears to precede the CORONIS trial. |
### Risk of bias

| Bias                                           | Authors' judgement | Support for judgement |
|------------------------------------------------|--------------------|-----------------------|
| Allocation concealment (selection bias)        | Unclear risk       | No details.           |
| Blinding of participants and personnel (performance bias) All outcomes | Unclear risk       | Lack of information.  |
| Blinding of outcome assessment (detection bias) All outcomes | Unclear risk       | Lack of information.  |
| Incomplete outcome data (attrition bias) All outcomes | Unclear risk       | No information.       |
| Selective reporting (reporting bias)           | Low risk           | No details to suggest reporting was biased. |
| Random sequence generation (selection bias)    | Unclear risk       | Only the abstract could be obtained. |
| Other bias                                     | Unclear risk       | No information.       |

### Ghahiry 2012

**Methods**
Randomised trial.

**Participants**
108 women undergoing caesarean section.

**Interventions**
52 women undergoing caesarean section randomised into the Misgav Ladach and 60 women randomised into traditional Pfannenstiel incision.

**Outcomes**
Filmy and dense adhesions formation and chronic pelvic pain.

**Notes**

### Risk of bias

| Bias                                           | Authors' judgement | Support for judgement |
|------------------------------------------------|--------------------|-----------------------|
| Allocation concealment (selection bias)        | Unclear risk       | Method of allocation not stated. |
| Blinding of participants and personnel (performance bias) All outcomes | Unclear risk       | Lack of information. |

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**Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes (Review)**

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### Ghahiry 2012 (Continued)

| Bias                                           | Authors’ judgement | Support for judgement     |
|------------------------------------------------|--------------------|---------------------------|
| Blinding of outcome assessment (detection bias)| Unclear risk       | Lack of information.      |
| All outcomes                                   |                    |                           |
| Incomplete outcome data (attrition bias)      | Low risk           | Complete.                 |
| All outcomes                                   |                    |                           |
| Selective reporting (reporting bias)          | Low risk           | No evidence of bias.      |
| Random sequence generation (selection bias)   | Unclear risk       | Method of generation, not stated. |
| Other bias                                     | Unclear risk       | None.                     |

### Ghongdemath 2011

| Methods                                      | Prospective randomised study. |
| Participants                                 | 200 women undergoing caesarean section. |
| Interventions                                | Closure versus non-closure of the peritoneum. |
| Outcomes                                     | Operative time, pain score, febrile illness, wound infection and hospital stay |

### Risk of bias

| Bias                                           | Authors’ judgement | Support for judgement     |
|------------------------------------------------|--------------------|---------------------------|
| Allocation concealment (selection bias)        | Low risk           | Opaque envelope.          |
| Blinding of participants and personnel (performance bias) | Unclear risk | Lack of information. |
| All outcomes                                   |                    |                           |
| Blinding of outcome assessment (detection bias)| Low risk           | Data collectors and analysts blinded. |
| All outcomes                                   |                    |                           |
| Incomplete outcome data (attrition bias)      | Low risk           | Data completed.           |
| All outcomes                                   |                    |                           |
| Selective reporting (reporting bias)          | Low risk           | None.                     |
| Random sequence generation (selection bias)   | Low risk           | Computer-generated sequence. |
Ghongdemath 2011  \textit{(Continued)}

| Other bias          | Low risk | None.          |

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 unclosed.  
|                      | 2. Control (182): both 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                | None.                                               |

\textit{Risk of bias}

| Bias                              | Authors' judgement | Support for judgement |
|-----------------------------------|--------------------|-----------------------|
| Allocation concealment (selection bias) | Unclear risk       | Unclear as to how allocation was concealed. |
| Blinding of participants and personnel (performance bias) All outcomes | Unclear risk       | No information. |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk           | Blinding of data collectors. |
| Incomplete outcome data (attrition bias) All outcomes | Low risk           | No data loss. |
| Selective reporting (reporting bias) | Low risk           | None. |
| Random sequence generation (selection bias) | Low risk           | Random generated tables. |
| Other bias                        | Low risk           | None. |
**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 |

**Risk of bias**

| Bias                                      | Authors’ judgement | Support for judgement |
|-------------------------------------------|--------------------|-----------------------|
| Allocation concealment (selection bias)   | Low risk           | Adequate.             |
| Blinding of participants and personnel (performance bias) All outcomes | Unclear risk | No information. |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Blinding of assessors. |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | None. |
| Selective reporting (reporting bias)      | Low risk           | None.                 |
| Random sequence generation (selection bias) | Low risk | Telephone random sequence. |
| Other bias                                | Low risk           | None.                 |

**Huchon 2005**

| Methods          | Randomised trial. |
|------------------|--------------------|
| Participants     | 240 women for caesarean section. 138 randomised. |
| Interventions    | Closure versus non-closure of the peritoneum for caesarean section. 63 women versus 75 women respectively |
| Outcomes         | Wound infection, haematoma, time for ileus,durations of surgery and hospitalisation, postoperative pain and analgesic requirements |
Huchon 2005  (Continued)

| Bias                                | Authors’ judgement | Support for judgement |
|-------------------------------------|--------------------|-----------------------|
| Allocation concealment (selection bias) | Low risk           | Sealed envelopes.     |
| Blinding of participants and personnel (performance bias) | Unclear risk | No information. |
| Blinding of outcome assessment (detection bias) | Low risk | Assessors blinded. |
| Incomplete outcome data (attrition bias) | Low risk           | None.                 |
| Selective reporting (reporting bias) | Low risk           | None.                 |
| Random sequence generation (selection bias) | Unclear risk | Randomised but method not stated. |
| Other bias                          | Low risk           | None.                 |

**Notes**

30 Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes (Review)

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Hull 1991  
(Continued)

| Bias                                                                 | Authors' judgement | Support for judgement |
|----------------------------------------------------------------------|--------------------|-----------------------|
| Blinding of participants and personnel (performance bias) All outcomes | Unclear risk       | Lack of information.  |
| Blinding of outcome assessment (detection bias) All outcomes         | Low risk           | Impossible to blind the surgeon but outcome assessors blinded |
| Incomplete outcome data (attrition bias) All outcomes                | Low risk           | Outcome data.         |
| Selective reporting (reporting bias)                                | Low risk           | None.                 |
| Random sequence generation (selection bias)                         | High risk          | Allocation based on last digit of medical record. |
| Other bias                                                          | Low risk           | None.                 |

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

Risk of bias

| Bias                                                                 | Authors' judgement | Support for judgement |
|----------------------------------------------------------------------|--------------------|-----------------------|
| Allocation concealment (selection bias)                             | Low risk           | Sequentially-labelled opaque envelope. |
| Blinding of participants and personnel (performance bias) All outcomes | Unclear risk       | Lack of information.  |
### Irion 1996  (Continued)

| Bias                                             | Authors' judgement | Support for judgement |
|--------------------------------------------------|--------------------|-----------------------|
| Blinding of outcome assessment (detection bias)  | Low risk           | Surgeon could not be blinded but the assessors. |
| All outcomes                                     |                    |                       |
| Incomplete outcome data (attrition bias)         | Low risk           | None.                 |
| All outcomes                                     |                    |                       |
| Selective reporting (reporting bias)             | Unclear risk       | None.                 |
| Random sequence generation (selection bias)      | Low risk           | Computer-generated random sequence. |
| Other bias                                       | Low risk           | None.                 |

### Kapustian 2012

| Methods                                          | Randomised controlled trial. |
|--------------------------------------------------|-------------------------------|
| Participants                                     | 533 women undergoing caesarean section. |
| Interventions                                    | Closure versus non-closure of peritoneum. |
| Outcomes                                         | Adhesions were scored in repeat caesarean section. |

### Risk of bias

| Bias                                             | Authors' judgement | Support for judgement |
|--------------------------------------------------|--------------------|-----------------------|
| Allocation concealment (selection bias)          | Unclear risk       | Not stated.            |
| Blinding of participants and personnel (performance bias) | Low risk          | Surgeon was blinded during repeat caesarean section. |
| All outcomes                                     |                    |                       |
| Blinding of outcome assessment (detection bias)  | Unclear risk       | Lack of information.  |
| All outcomes                                     |                    |                       |
| Incomplete outcome data (attrition bias)         | Low risk           | Complete.             |
| All outcomes                                     |                    |                       |
| Selective reporting (reporting bias)             | Low risk           | None.                 |
| Random sequence generation (selection bias)      | Low risk           | Computer-generated sequence. |
Kapustian 2012  
(Continued)

| Other bias | Low risk | None. |
|------------|----------|-------|

Komoto 2005

| Methods | Pseudo-randomisation. |
|---------|-----------------------|
| Participants | Women undergoing caesarean section. |
| Interventions | Closure of both peritoneal layers versus non-closure. |
| Outcomes | Operative time and number of analgesic doses required. |
| Notes | |

Risk of bias

| Bias | Authors’ judgement | Support for judgement |
|------|--------------------|-----------------------|
| Allocation concealment (selection bias) | Unclear risk | Unknown. |
| Blinding of participants and personnel (performance bias) All outcomes | Unclear risk | Lack of information. |
| Blinding of outcome assessment (detection bias) All outcomes | Unclear risk | Lack of information. |
| Incomplete outcome data (attrition bias) All outcomes | High risk | Non-closure, 53 versus 70 closure. |
| Selective reporting (reporting bias) | Unclear risk | Not evident. |
| Random sequence generation (selection bias) | High risk | Hospital record. |
| Other bias | Unclear risk | Unknown. |

Malomo 2006

| Methods | Prospective randomised trial of uncomplicated women at term. |
|---------|-------------------------------------------------------------|
| Participants | 54 women who required delivery by caesarean section. |
| Interventions | Closure versus non-closure of both visceral and parietal peritoneum |
Malomo 2006 (Continued)

| Outcomes                        | Anaesthetic time, duration of operation, analgesic requirement, wound infection and ileus |
|---------------------------------|-----------------------------------------------------------------------------------------|
| Notes                           | None.                                                                                   |

**Risk of bias**

| Bias                                          | Authors’ judgement | Support for judgement |
|-----------------------------------------------|--------------------|-----------------------|
| Allocation concealment (selection bias)       | Low risk           | Opaque envelopes.      |
| Blinding of participants and personnel (performance bias) | Unclear risk | Lack of information. |
| Blinding of outcome assessment (detection bias) | Unclear risk | Lack of information. |
| Incomplete outcome data (attrition bias)      | Low risk           | Complete.              |
| Selective reporting (reporting bias)          | Low risk           | None.                  |
| Random sequence generation (selection bias)   | Low risk           | Table of random numbers was used. |
| Other bias                                    | Low risk           | None.                  |

Malvasi 2009

| Methods                                    | Prospective randomised trial. |
|--------------------------------------------|-------------------------------|
| Participants                               | Women who consented for elective caesarean section and for a repeat caesarean section in their next pregnancy |
| Interventions                              | Closure of visceral peritoneum versus non-closure. |
| Outcomes                                   | Adhesions formation using the adhesions scoring system, fibrosis and neoangiogenesis of mesothelial cells under electron microscopy |
| Notes                                      | None.                         |

**Risk of bias**

| Bias                        | Authors’ judgement | Support for judgement |
|-----------------------------|--------------------|-----------------------|
|                             |                    |                       |
Malvasi 2009  

| Bias                                           | Authors’ judgement | Support for judgement                                                                 |
|------------------------------------------------|--------------------|----------------------------------------------------------------------------------------|
| Allocation concealment (selection bias)        | Unclear risk       | No mention of the method used to conceal initial allocation of women during repeat caesarean section |
| Blinding of participants and personnel (performance bias) All outcomes | Unclear risk       | Lack of information.                                                                    |
| Blinding of outcome assessment (detection bias) All outcomes | Unclear risk       | Lack of information.                                                                    |
| Incomplete outcome data (attrition bias) All outcomes | Low risk           | All outcomes were clearly sought for and documented.                                    |
| Selective reporting (reporting bias)           | Low risk           | None.                                                                                  |
| Random sequence generation (selection bias)    | Unclear risk       | Patients ’were consecutively allocated into 2 groups by the clinicians...’ . method of allocation was not stated |
| Other bias                                     | Low risk           | None.                                                                                  |

Moraes 1999

| Methods                                         | Prospective pseudo-randomised trial. |
|------------------------------------------------|-------------------------------------|
| Participants                                    | 698 pregnant women for caesarean section. |
| Interventions                                   | Closure versus non-closure of both peritoneal layers. |
| Outcomes                                        | Duration of surgery, number of sutures used, postoperative pyrexia, wound infection, number of doses of analgesic, antiemetic and antiseptic requirement, and number of days spent in the hospital |
| Notes                                           | None.                               |

Risk of bias

| Bias                                           | Authors’ judgement | Support for judgement                                                                 |
|------------------------------------------------|--------------------|----------------------------------------------------------------------------------------|
| Allocation concealment (selection bias)        | Unclear risk       | Method of concealment not stated.                                                      |
| Blinding of participants and personnel (performance bias) All outcomes | Unclear risk       | Surgeon not blinded but would not have affected the result.                            |
| Blinding of outcome assessment (detection bias) All outcomes | Unclear risk       | Lack of information.                                                                    |
**Moraes 1999**  (Continued)

| Bias                                                                 | Authors’ judgement | Support for judgement |
|----------------------------------------------------------------------|--------------------|-----------------------|
| Incomplete outcome data (attrition bias) All outcomes               | Low risk           | Complete data.        |
| Selective reporting (reporting bias)                                 | Low risk           | None.                 |
| Random sequence generation (selection bias)                         | High risk          | Sequential allocation.|
| Other bias                                                           | Low risk           | None.                 |

**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                                                                 | None.                                       |

**Risk of bias**

| Bias                                                                 | Authors’ judgement | Support for judgement |
|----------------------------------------------------------------------|--------------------|-----------------------|
| Allocation concealment (selection bias) All outcomes                 | High risk          | Inadequate.           |
| Blinding of participants and personnel (performance bias) All outcomes| Unclear risk       | Lack of information.  |
| Blinding of outcome assessment (detection bias) All outcomes          | Unclear risk       | Lack of information.  |
| Incomplete outcome data (attrition bias) All outcomes                 | Low risk           | Complete.             |
| Selective reporting (reporting bias)                                  | Low risk           | None.                 |
| Random sequence generation (selection bias)                          | High risk          | Pseudo-randomisation. |
| Other bias                                                           | Low risk           | None.                 |
### 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. |

**Risk of bias**

| Bias                                      | Authors’ judgement | Support for judgement |
|-------------------------------------------|--------------------|-----------------------|
| Allocation concealment (selection bias)   | High risk          | Inadequate.           |
| Blinding of participants and personnel (performance bias) | Unclear risk | Lack of information. |
| All outcomes                              |                     |                       |
| Blinding of outcome assessment (detection bias) | Unclear risk | Lack of information. |
| All outcomes                              |                     |                       |
| Incomplete outcome data (attrition bias)  | Low risk           | None.                 |
| All outcomes                              |                     |                       |
| Selective reporting (reporting bias)      | Low risk           | None.                 |
| Random sequence generation (selection bias) | High risk          | Allocation by using hospital number. |
| Other bias                                | Low risk           | None.                 |

### 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 |
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
None.

Risk of bias

| Bias                                              | Authors’ judgement | Support for judgement                                                        |
|---------------------------------------------------|--------------------|--------------------------------------------------------------------------------|
| Allocation concealment (selection bias)            | Low risk           | Adequate.                                                                     |
| Blinding of participants and personnel (performance bias) All outcomes | Unclear risk | Lack of information.                                                           |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Not blinded but surgeon could not have been blinded. Assessor blinded |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | None.                                                                         |
| Selective reporting (reporting bias)               | Low risk           | None.                                                                         |
| Random sequence generation (selection bias)        | Low risk           | Computer-generated random sequence.                                           |
| Other bias                                         | Low risk           | None.                                                                         |

Rafique 2002  *(Continued)*
Saha 2001

| Blinding of participants and personnel (performance bias) | Unclear risk | Lack of information. |
|----------------------------------------------------------|--------------|----------------------|
| All outcomes                                              |              |                      |

| Blinding of outcome assessment (detection bias)          | Unclear risk | Lack of information. |
|----------------------------------------------------------|--------------|----------------------|
| All outcomes                                              |              |                      |

| Incomplete outcome data (attrition bias)                 | Low risk     | None.                |
|----------------------------------------------------------|--------------|----------------------|
| All outcomes                                              |              |                      |

| Selective reporting (reporting bias)                     | Low risk     | None.                |
|----------------------------------------------------------|--------------|----------------------|
| All outcomes                                              |              |                      |

| Random sequence generation (selection bias)              | Unclear risk | Not stated.           |
|----------------------------------------------------------|--------------|----------------------|
| All outcomes                                              |              |                      |

| Other bias                                               | Low risk     | None.                |
|----------------------------------------------------------|--------------|----------------------|
| All outcomes                                              |              |                      |

Shahin 2009

Methods
Prospective randomised trial.

Participants
Women at term, who consented to caesarean section and in the trial

Interventions
170 randomised to have the parietal peritoneum closed and 170 were left unclosed. Visceral peritoneum was closed in all women. 325 women were analysed

Outcomes
Postoperative abdominal pain, epigastric pain and wound pain

Notes

Risk of bias

| Bias                                               | Authors’ judgement | Support for judgement |
|----------------------------------------------------|--------------------|-----------------------|
| Allocation concealment (selection bias)            | Low risk           | Sealed opaque envelopes. |

| Blinding of participants and personnel (performance bias) All outcomes | Unclear risk | Lack of information. |
|----------------------------------------------------------------------|--------------|----------------------|
| All outcomes                                                          |              |                      |

| Blinding of outcome assessment (detection bias) All outcomes | Unclear risk | Lack of information. |
|-------------------------------------------------------------|--------------|----------------------|
| All outcomes                                               |              |                      |

| Incomplete outcome data (attrition bias) All outcomes       | High risk    | Outcomes were incomplete. 15 women were not analysed. |
|-------------------------------------------------------------|--------------|------------------------------------------------------|
Shahin 2009  (Continued)

| Bias                              | Authors’ judgement | Support for judgement          |
|-----------------------------------|--------------------|--------------------------------|
| Selective reporting (reporting bias) | Low risk           | None.                          |
| Random sequence generation (selection bias) | Low risk          | Computer-generated random sequence. |
| Other bias                        | Low risk           | None.                          |

Shahin 2010

Methods
Randomised trial.

Participants
Women for caesarean section.

Interventions
Closure of parietal peritoneum versus non-closure.

Outcomes
Postoperative urinary symptoms assessed up to 6 months.

Notes

Risk of bias

| Bias                              | Authors’ judgement | Support for judgement          |
|-----------------------------------|--------------------|--------------------------------|
| Allocation concealment (selection bias) | Low risk           | Opaque envelopes.              |
| Blinding of participants and personnel (performance bias) All outcomes | Unclear risk       | Lack of information.           |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk           | Assessor of outcome not aware of allocation. |
| Incomplete outcome data (attrition bias) All outcomes | Low risk           | 285 women in the non-closure versus 290. All studied women were assessed for outcome |
| Selective reporting (reporting bias) | Low risk           | No evidence of selective reporting. |
| Random sequence generation (selection bias) | Low risk           | Computer based.               |
| Other bias                        | Unclear risk       | None noted.                   |
### 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            | None.                                                         |

#### Risk of bias

| Bias                                      | Authors’ judgement | Support for judgement |
|-------------------------------------------|--------------------|-----------------------|
| Allocation concealment (selection bias)   | Unclear risk       | Unclear.              |
| Blinding of participants and personnel (performance bias) All outcomes | Unclear risk | Lack of information. |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Blinding of assessor. |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | None. |
| Selective reporting (reporting bias)      | Low risk           | None.                 |
| Random sequence generation (selection bias) | Unclear risk | Not stated. |
| Other bias                                | Low risk           | None.                 |

### 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, anaesthesia time, length of hospital stay, morphine consumption and visual analogue pain scores |
| Notes            |                                                               |
Risk of bias

| Bias                              | Authors' judgement | Support for judgement |
|-----------------------------------|--------------------|-----------------------|
| Allocation concealment (selection bias) | Unclear risk       | Unclear.              |
| Blinding of participants and personnel (performance bias) All outcomes | Unclear risk       | Lack of information.  |
| Blinding of outcome assessment (detection bias) All outcomes | Unclear risk       | Lack of information.  |
| Incomplete outcome data (attrition bias) All outcomes | Low risk           | None.                 |
| Selective reporting (reporting bias) | Low risk           | None.                 |
| Random sequence generation (selection bias) | Unclear risk       | Method of randomisation, unknown. |
| Other bias                        | Low risk           | None.                 |

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

Risk of bias

| Bias                              | Authors' judgement | Support for judgement |
|-----------------------------------|--------------------|-----------------------|
| Allocation concealment (selection bias) | High risk          | Inadequate.           |
| Blinding of participants and personnel (performance bias) All outcomes | Unclear risk       | Lack of information.  |
### Blinding of outcome assessment (detection bias)

| Bias                        | Risk    | Support for judgement |
|-----------------------------|---------|------------------------|
| All outcomes                | Low risk| Assessor blinded.      |

### Incomplete outcome data (attrition bias)

| Bias                        | Risk    | Support for judgement |
|-----------------------------|---------|------------------------|
| All outcomes                | Low risk| None.                  |

### Selective reporting (reporting bias)

| Bias                        | Risk    | Support for judgement |
|-----------------------------|---------|------------------------|
| All outcomes                | Low risk| None.                  |

### Random sequence generation (selection bias)

| Bias                        | Risk    | Support for judgement |
|-----------------------------|---------|------------------------|
| Unclear risk                | Yes.    |                        |

### Other bias

| Bias                        | Risk    | Support for judgement |
|-----------------------------|---------|------------------------|
| Low risk                    | None.   |                        |

### 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**

None.

### Risk of bias

| Bias                        | Authors' judgement | Support for judgement   |
|-----------------------------|--------------------|-------------------------|
| Allocation concealment (selection bias) | Unclear risk       | Not known.               |
| Blinding of participants and personnel (performance bias) | Unclear risk       | Lack of information.    |
| All outcomes                |                     |                         |
| Blinding of outcome assessment (detection bias) | Low risk           | To assessor.             |
| All outcomes                |                     |                         |
| Incomplete outcome data (attrition bias) | Low risk           | Outcome was complete.    |
| All outcomes                |                     |                         |
| Selective reporting (reporting bias) | Low risk           | None.                   |
| Random sequence generation (selection bias) | Unclear risk       | Not clear.               |
**Characteristics of excluded studies** [ordered by study ID]

| 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 effect in alternating order; no adequate randomisation and lack of data |
| 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 |
| Chaudri 2009         | This is a poster presentation that has no outcome data.                                |
| 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 |
| Study (Year) | Exclusion Reason | Study Details |
|-------------|-----------------|--------------|
| 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, laparotomy 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. |
#### 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 2 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.

#### Juszczak 2011
This paper brings into focus the feasibility of carrying out a randomised trial in a developing country. It does not address any of the outcomes

#### Khadem 2008
No details of data in this poster presentation.

#### Khadem 2009
It is a postal presentation the details of outcome data sought but in vain. However, non-closure of peritoneum conferred improved outcomes like infectious morbidity and duration of surgery

#### Lange 1993
Study was pseudo-randomised and data were incomplete. This study showed that uterine involution was earlier in the non-closure group

#### 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 versus 65% in the closure group)

#### Rengerink 2011
This study compared the 2 methods of skin closure - skin staples or sutures. It also assessed the need or otherwise of subcutaneous fat layer. It did not looked at peritoneal closure

#### 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 2 different operating techniques by 2 groups of surgeons, using different techniques of uterine and peritoneal closure. There was significant reduction in febrile morbidity and adhesions in repeat sections when the peritoneum was not closed, without differences in haematocrit or haemoglobin changes. Although analysis of the 2 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.

Svigos 1990  Data sought but in vain.

Ugur 2010  A very important long-time outcome of adhesions formation in this trial but no data were supplied for analysis. This is an abstract of a congress presentation.

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 2 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.

**Characteristics of studies awaiting assessment  [ordered by study ID]**

**Mocanasu 2005**

| Methods | Randomised trial. |
|---------|------------------|
| Participants | 80 pregnant women undergoing caesarean section. |
| Interventions | Closure of peritoneum versus non-closure. |
| Outcomes | Short-term outcomes. |
| Notes | Awaiting full data from Romanian translator. |
### Characteristics of ongoing studies  *ordered by study ID*

**Nokiani 2010**

| Trial name or title |  |
|---------------------|--|
| **Methods**         | Randomised trial. |
| **Participants**    | Women for caesarean section. |
| **Interventions**   | Peritoneum repaired versus not repaired. |
| **Outcomes**        | Postoperative pain, ileus, analgesic requirement. |
| **Starting date**   | 2010. |
| **Contact information** |  |
| **Notes**           | May be published in Arabic. |
## Comparison 1. Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

| Outcome or subgroup title                        | No. of studies | No. of participants | Statistical method                  | Effect size       |
|------------------------------------------------|----------------|---------------------|-------------------------------------|-------------------|
| 1 Postoperative adhesions                       | 4              | 282                 | Risk Ratio (M-H, Fixed, 95% CI)     | 0.99 [0.76, 1.29] |
| 2 Wound infection                               | 13             | 15430               | Risk Ratio (M-H, Fixed, 95% CI)     | 0.96 [0.86, 1.07] |
| 3 Uterine dehiscence                            | 1              | 100                 | Risk Ratio (M-H, Fixed, 95% CI)     | 0.14 [0.01, 2.70] |
| 4 Numbers of narcotic analgesics required       | 7              | 1657                | Mean Difference (IV, Random, 95% CI)| -0.18 [-0.39, 0.02]|
| 5 Additional analgesia after 24-48 hours         | 1              | 9675                | Risk Ratio (M-H, Fixed, 95% CI)     | 0.94 [0.79, 1.12] |
| 6 Infectious morbidity                          | 11             | 14985               | Risk Ratio (M-H, Random, 95% CI)    | 0.92 [0.72, 1.16] |
| 7 Endometritis                                  | 5              | 10538               | Risk Ratio (M-H, Fixed, 95% CI)     | 1.07 [0.78, 1.46] |
| 8 Operating time (minutes)                      | 16             | 15480               | Mean Difference (IV, Random, 95% CI)| -5.81 [-7.68, -3.93]|
| 9 Postoperative days in hospital                | 13             | 14906               | Mean Difference (IV, Random, 95% CI)| -0.26 [-0.47, -0.05]|
| 10 Chronic pelvic pain                          | 1              | 112                 | Risk Ratio (M-H, Fixed, 95% CI)     | 0.49 [0.25, 0.98] |
| 11 Pain at 6 weeks postpartum                   | 1              | 9465                | Risk Ratio (M-H, Fixed, 95% CI)     | 1.04 [0.80, 1.36] |
| 12 Secondary infertility                        | 1              | 144                 | Risk Ratio (M-H, Fixed, 95% CI)     | 0.89 [0.23, 3.44] |
| 13 Blood transfusion > 1 unit (not prespecified outcome) | 1 | 9675 | Risk Ratio (M-H, Fixed, 95% CI) | 0.98 [0.69, 1.39] |
| 14 Maternal death (not prespecified outcome)    | 1              | 9675                | Risk Ratio (M-H, Fixed, 95% CI)     | 1.49 [0.25, 8.92] |
| 15 Intervention for postpartum haemorrhage (not prespecified outcome) | 1 | 9675 | Risk Ratio (M-H, Fixed, 95% CI) | 0.99 [0.72, 1.38] |
| 16 Readmission to hospital within 6 weeks (not prespecified outcome) | 1 | 9465 | Risk Ratio (M-H, Fixed, 95% CI) | 1.00 [0.67, 1.49] |

## Comparison 2. Non-closure of visceral peritoneum only versus closure of both peritoneal layers

| Outcome or subgroup title                        | No. of studies | No. of participants | Statistical method                  | Effect size       |
|------------------------------------------------|----------------|---------------------|-------------------------------------|-------------------|
| 1 Adhesion formation                            | 2              | 157                 | Risk Ratio (M-H, Fixed, 95% CI)     | 2.49 [1.49, 4.16] |
| 2 Wound infection                               | 2              | 789                 | Risk Ratio (M-H, Fixed, 95% CI)     | 0.36 [0.14, 0.89] |
| 3 Postoperative fever                            | 3              | 889                 | Risk Ratio (M-H, Random, 95% CI)    | 0.60 [0.29, 1.27] |
| 4 Endometritis                                  | 1              | 240                 | Risk Ratio (M-H, Fixed, 95% CI)     | 3.0 [0.12, 72.91] |
| 5 Operating time (minutes)                      | 1              | 544                 | Mean Difference (IV, Fixed, 95% CI) | -6.30 [-9.22, -3.38]|
| 6 Postoperative days in hospital                | 1              | 549                 | Mean Difference (IV, Fixed, 95% CI) | -0.70 [-0.98, -0.42]|

Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes (Review)  
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### Comparison 3. Non-closure of parietal peritoneum only versus closure of both peritoneal layers

| Outcome or subgroup title                                      | No. of studies | No. of participants | Statistical method                           | Effect size               |
|----------------------------------------------------------------|---------------|---------------------|----------------------------------------------|---------------------------|
| 1 Wound infection                                             | 1             | 248                 | Risk Ratio (M-H, Fixed, 95% CI)               | 0.95 [0.14, 6.66]         |
| 2 Postoperative pain                                          | 1             | 325                 | Risk Ratio (M-H, Fixed, 95% CI)               | 0.45 [0.31, 0.66]         |
| 3 Postoperative fever                                         | 1             | 40                  | Risk Ratio (M-H, Fixed, 95% CI)               | 0.18 [0.01, 3.56]         |
| 4 Endometritis                                                | 1             | 248                 | Risk Ratio (M-H, Fixed, 95% CI)               | 0.88 [0.53, 1.46]         |
| 5 Operating time (minutes)                                   | 1             | 248                 | Mean Difference (IV, Fixed, 95% CI)           | -5.10 [-8.71, -1.49]      |
| 6 Postoperative days in hospital                              | 2             | 288                 | Mean Difference (IV, Random, 95% CI)          | -0.15 [-1.20, 0.91]       |
| 7 Mobilisation time in hours (not prespecified outcome)      | 1             | 110                 | Mean Difference (IV, Fixed, 95% CI)           | -1.89 [-3.18, -0.60]      |
| 8 Time to oral intake in hours (not prespecified outcome)    | 1             | 110                 | Mean Difference (IV, Fixed, 95% CI)           | -2.31 [-3.76, -0.86]      |
| 9 Drop in haemoglobin g/dL (not prespecified outcome)        | 1             | 110                 | Mean Difference (IV, Fixed, 95% CI)           | 0.28 [-0.03, 0.59]        |
| 10 Blood loss (not prespecified outcome)                     | 1             | 110                 | Mean Difference (IV, Fixed, 95% CI)           | 56.97 [-28.08, 142.02]    |
| 11 Time to flatus (not prespecified outcome)                 | 1             | 110                 | Mean Difference (IV, Fixed, 95% CI)           | -0.04 [-1.99, 1.91]       |
| 12 Wound pain, day 1 (visual analogue score)                 | 1             | 325                 | Mean Difference (IV, Fixed, 95% CI)           | -1.60 [-1.97, -1.23]      |
| 13 Persistent abdominal pain after 8 months (numerical rating scale) | 1             | 325                 | Mean Difference (IV, Fixed, 95% CI)           | -1.10 [-1.39, -0.81]      |

### Comparison 4. Non closure versus closure of visceral peritoneum when parietal peritoneum is closed

| Outcome or subgroup title                                      | No. of studies | No. of participants | Statistical method                           | Effect size               |
|----------------------------------------------------------------|---------------|---------------------|----------------------------------------------|---------------------------|
| 1 Urinary frequency at 8 weeks                                | 1             | 582                 | Risk Ratio (M-H, Fixed, 95% CI)               | 0.24 [0.13, 0.45]         |
| 2 Urgency of urination                                        | 1             | 582                 | Risk Ratio (M-H, Fixed, 95% CI)               | 0.30 [0.18, 0.51]         |
| 3 Stress incontinence                                         | 1             | 582                 | Risk Ratio (M-H, Fixed, 95% CI)               | 0.45 [0.21, 0.96]         |
**Analysis 1.1. Comparison 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 1 Postoperative adhesions.**

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

Outcome: 1 Postoperative adhesions

| Study or subgroup | Peritoneal non closure | Peritoneal closure | Risk Ratio M-H,Fixed,95% CI | Weight | Risk Ratio M-H,Fixed,95% CI |
|-------------------|------------------------|--------------------|----------------------------|--------|----------------------------|
| Ghahiry 2012      | 26/52                  | 30/60              | 1.00 [ 0.69, 1.45 ]          | 46.2%  |                           |
| Irion 1996        | 8/14                   | 6/14               | 1.33 [ 0.63, 2.84 ]          | 10.0%  |                           |
| Kapustian 2012    | 20/50                  | 23/47              | 0.82 [ 0.52, 1.28 ]          | 39.4%  |                           |
| Weerawetwat 2004  | 4/20                   | 3/25               | 1.67 [ 0.42, 6.60 ]          | 4.4%   |                           |

Total (95% CI) 136 146 100.0% 0.99 [ 0.76, 1.29 ]

Total events: 58 (Peritoneal non closure), 62 (Peritoneal closure)

Heterogeneity: Chi² = 1.85, df = 3 (P = 0.60); I² = 0.0%

Test for overall effect: Z = 0.07 (P = 0.95)

Test for subgroup differences: Not applicable
Analysis 1.2. Comparison 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 2 Wound infection.

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

Outcome: 2 Wound infection

| Study or subgroup | Peritoneal non closure | Peritoneal closure | Risk Ratio M-H Fixed,95% CI | Weight | Risk Ratio M-H Fixed,95% CI |
|-------------------|------------------------|-------------------|----------------------------|--------|----------------------------|
| Anteby 2009       | 29/256                 | 35/277            | 5.3 %                      | 0.90   | [0.56, 1.42]               |
| CAESAR 2010       | 200/1499               | 182/1496          | 28.5 %                     | 1.10   | [0.91, 1.32]               |
| CORONIS 2013      | 310/4851               | 330/4824          | 51.8 %                     | 0.93   | [0.80, 1.09]               |
| Galaal 2000       | 4/30                   | 7/30              | 1.1 %                      | 0.57   | [0.19, 1.75]               |
| Gerner 2006       | 14/187                 | 20/192            | 3.1 %                      | 0.72   | [0.37, 1.38]               |
| Ghongdemath 2011  | 5/100                  | 7/100             | 1.1 %                      | 0.71   | [0.23, 2.18]               |
| Grundsell 1998    | 4/179                  | 7/182             | 1.1 %                      | 0.58   | [0.17, 1.95]               |
| Huchon 2005       | 3/63                   | 1/75              | 0.1 %                      | 3.57   | [0.38, 33.49]              |
| Hull 1991         | 3/54                   | 5/59              | 0.7 %                      | 0.66   | [0.16, 2.61]               |
| Kapustian 2012    | 29/256                 | 35/277            | 5.3 %                      | 0.90   | [0.56, 1.42]               |
| Malomo 2006       | 4/27                   | 3/27              | 0.5 %                      | 1.33   | [0.33, 5.40]               |
| Sood 2004         | 2/71                   | 5/78              | 0.7 %                      | 0.44   | [0.09, 2.19]               |
| Weerawetwat 2004  | 4/120                  | 4/120             | 0.6 %                      | 1.00   | [0.26, 3.91]               |

Total (95% CI) 7693 | 7737 | 100.0 % | 0.96 [0.86, 1.07] |

Total events: 611 (Peritoneal non closure), 641 (Peritoneal closure)

Heterogeneity: Chi² = 7.48, df = 12 (P = 0.82); I² = 0.0%

Test for overall effect: Z = 0.76 (P = 0.45)

Test for subgroup differences: Not applicable
### Analysis 1.3. Comparison 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 3 Uterine dehiscence.

**Review:** Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

**Comparison:** 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

**Outcome:** 3 Uterine dehiscence

| Study or subgroup | Peritoneal non closure | Peritoneal closure | Risk Ratio M-H,Fixed 95% CI | Weight % | Risk Ratio M-H,Fixed 95% CI |
|-------------------|------------------------|--------------------|-----------------------------|----------|-----------------------------|
| Ghahiry 2012      | 0/50                   | 3/50               |                             | 100.0 %  | 0.14 [0.01, 2.70]           |

**Total (95% CI)**

| Total events: 0 (Peritoneal non closure), 3 (Peritoneal closure) |
|------------------------------------------------------------------|
| Heterogeneity: not applicable                                    |
| Test for overall effect: $Z = 1.30$ ($P = 0.19$)                 |
| Test for subgroup differences: Not applicable                    |

| 0.01  | 0.1  | 1    | 10   | 100  |
|-------|------|------|------|------|
| Peritoneal non closure | Peritoneal closure |
Analysis 1.4. Comparison 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 4 Numbers of narcotic analgesics required.

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

Outcome: 4 Numbers of narcotic analgesics required

Study or subgroup | Peritoneal non closure | Peritoneal closure | Mean Difference | Weight | Mean Difference |
|------------------|------------------------|--------------------|----------------|--------|----------------|
| Antebay 2009     | 256 1.09 (1.2)         | 277 1.05 (1)       | 0.04 [-0.15, 0.23] | 19.0 % |
| Gemer 2006       | 187 1.4 (1)            | 192 1.3 (1)        | 0.10 [-0.10, 0.30] | 18.5 % |
| Hull 1991        | 54 8.6 (4.9)           | 59 11.1 (6.3)      | -2.50 [-4.57, -0.43] | 0.9 % |
| Irion 1996       | 137 2.5 (1.8)          | 143 2.7 (1.7)      | -0.20 [-0.61, 0.21] | 11.9 % |
| Komoto 2005      | 53 2 (0.9)             | 70 2.4 (1.1)       | -0.40 [-0.75, -0.05] | 13.5 % |
| Sood 2004        | 71 3.3 (0.4)           | 78 3.4 (0.5)       | -0.10 [-0.24, 0.04] | 20.3 % |
| Tuner 2003       | 40 1.25 (0.59)         | 40 1.8 (0.68)      | -0.55 [-0.83, -0.27] | 15.9 % |
| **Total (95% CI)** | **798**                 | **859**            | **-0.18 [-0.39, 0.02]** | **100.0 %** |

Heterogeneity: Tau² = 0.05; Chi² = 24.05, df = 6 (P = 0.00051); I² = 75%

Test for overall effect: Z = 1.75 (P = 0.081)

Test for subgroup differences: Not applicable
### Analysis 1.5. Comparison 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 5 Additional analgesia after 24-48 hours.

**Review:** Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

**Comparison:** 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

**Outcome:** 5 Additional analgesia after 24-48 hours

| Study or subgroup | Peritoneal non closure | Peritoneal closure | Risk Ratio M-H,Fixed,95% CI | Weight | Risk Ratio M-H,Fixed,95% CI |
|-------------------|------------------------|--------------------|-----------------------------|--------|-----------------------------|
| CORONIS 2013      | 236/4851               | 250/4824           | 100.0 %                     | 0.94 [ 0.79, 1.12 ] |
| **Total (95% CI)** | **4851**               | **4824**           |                             | 100.0 % | **0.94 [ 0.79, 1.12 ]** |

Total events: 236 (Peritoneal non closure), 250 (Peritoneal closure)

Heterogeneity: not applicable

Test for overall effect: Z = 0.71 (P = 0.47)

Test for subgroup differences: Not applicable
### Analysis 1.6. Comparison 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 6 Infectious morbidity.

**Review:** Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

**Comparison:** 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

**Outcome:** 6 Infectious morbidity

| Study or subgroup | Peritoneal non closure | Peritoneal closure | Risk Ratio M-H,Random, 95% CI | Weight | Risk Ratio M-H,Random, 95% CI |
|------------------|-----------------------|--------------------|--------------------------------|--------|-----------------------------|
| CAESAR 2010      | 262/1499              | 240/1496           | 19.8 % 1.09 [ 0.93, 1.28 ]   |        |                             |
| CORONIS 2013     | 84/4851               | 100/4824           | 16.5 % 0.84 [ 0.63, 1.11 ]   |        |                             |
| Galal 2000       | 7/30                  | 9/30               | 5.7 % 0.78 [ 0.33, 1.82 ]    |        |                             |
| Gern 2006        | 15/187                | 8/192              | 5.9 % 1.93 [ 0.84, 4.43 ]    |        |                             |
| Ghongdemath 2011 | 12/100                | 16/100             | 7.5 % 0.75 [ 0.37, 1.50 ]    |        |                             |
| Grundsell 1998   | 14/179                | 35/182             | 9.3 % 0.41 [ 0.23, 0.73 ]    |        |                             |
| Hull 1991        | 9/54                  | 8/59               | 5.4 % 1.23 [ 0.51, 2.96 ]    |        |                             |
| Irion 1996       | 11/137                | 12/143             | 6.4 % 0.96 [ 0.44, 2.10 ]    |        |                             |
| Kapustian 2012   | 18/256                | 14/277             | 7.8 % 1.39 [ 0.71, 2.74 ]    |        |                             |
| Sood 2004        | 7/71                  | 18/78              | 6.1 % 0.43 [ 0.19, 0.96 ]    |        |                             |
| Weerawetwat 2004 | 22/120                | 17/120             | 9.4 % 1.29 [ 0.72, 2.31 ]    |        |                             |

**Total (95% CI):** 7484 7501 100.0 % 0.92 [ 0.72, 1.16 ]

Total events: 461 (Peritoneal non closure), 477 (Peritoneal closure)

Heterogeneity: $\tau^2 = 0.07$, $\chi^2 = 21.16$, $df = 10$ ($P = 0.02$); $I^2 = 53$

Test for overall effect: $Z = 0.73$ ($P = 0.47$)

Test for subgroup differences: Not applicable
**Analysis 1.7. Comparison 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 7 Endometritis.**

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

Outcome: 7 Endometritis

| Study or subgroup | Peritoneal non closure | Peritoneal closure | Risk Ratio M-H,Fixed,95% CI | Weight | Risk Ratio M-H,Fixed,95% CI |
|-------------------|------------------------|--------------------|-----------------------------|--------|-----------------------------|
| CORONIS 2013      | 56/4851                | 53/4824            | 73.7 % 1.05 [ 0.72, 1.53 ]   |        |                             |
| Grundsell 1998    | 9/179                  | 9/182              | 12.4 % 1.02 [ 0.41, 2.50 ]   |        |                             |
| Hull 1991         | 6/54                   | 3/59               | 4.0 % 2.19 [ 0.57, 8.31 ]    |        |                             |
| Sood 2004         | 3/71                   | 7/78               | 9.3 % 0.47 [ 0.13, 1.75 ]    |        |                             |
| Weerawatwat 2004  | 2/120                  | 0/120              | 0.7 % 5.00 [ 0.24, 103.06 ]  |        |                             |
| **Total (95% CI)** | **5275**              | **5263**           | **100.0 %** 1.07 [ 0.78, 1.46 ] |        |                             |

Total events: 76 (Peritoneal non closure), 72 (Peritoneal closure)

Heterogeneity: Chi² = 3.61, df = 4 (P = 0.46); I² =0.0%

Test for overall effect: Z = 0.39 (P = 0.70)

Test for subgroup differences: Not applicable
**Analysis 1.8. Comparison 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 8 Operating time (minutes).**

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

Outcome: 8 Operating time (minutes)

| Study or subgroup | Peritoneal non closure | Peritoneal closure | Mean Difference | Weight | Mean Difference |
|-------------------|------------------------|--------------------|-----------------|--------|-----------------|
| Antebi 2009       | 256 40.8 (13.3)        | 277 42.8 (12.8)    | -2.00 [-4.22, 0.22] | 6.6 % |                  |
| CAESAR 2010       | 1499 36.1 (11.5)       | 1496 38.5 (12)     | -2.40 [-3.24, -1.56] | 7.1 % |                  |
| Channachakul 2002 | 30 51.6 (10.5)         | 30 55.3 (12.1)     | -3.70 [-9.43, 2.03] | 4.3 % |                  |
| CORONIS 2013      | 485 39.57 (15.58)      | 4824 40.88 (15.37) | -1.31 [-1.93, -0.69] | 7.2 % |                  |
| Galal 2000        | 30 53.56 (11.21)       | 30 61.9 (11.73)    | -8.34 [-14.15, -2.53] | 4.3 % |                  |
| Gerner 2006       | 187 41.6 (5.6)         | 192 42.4 (11.6)    | -0.80 [-2.63, 1.03] | 6.8 % |                  |
| Ghorpade 2011     | 100 32.02 (4.9)        | 100 43.24 (4.61)   | -11.22 [-12.54, -9.90] | 7.0 % |                  |
| Grundsell 1998    | 179 33.4 (6.2)         | 182 41.3 (6.9)     | -7.90 [-9.25, -6.55] | 7.0 % |                  |
| Hull 1991         | 54 50 (13.5)           | 59 57.9 (13.9)     | -7.90 [-12.95, -2.85] | 4.8 % |                  |
| Irlan 1996        | 137 47.3 (19.4)        | 143 53.2 (15.5)    | -5.90 [-10.02, -1.78] | 5.4 % |                  |
| Komato 2005       | 53 35.3 (5.9)          | 70 41.7 (6.9)      | -6.65 [-8.67, -4.13] | 6.6 % |                  |
| Malomo 2006       | 27 50.5 (4.5)          | 27 63.5 (6)        | -13.00 [-15.83, -10.17] | 6.2 % |                  |
| Rafique 2002      | 50 32.8 (6.8)          | 50 38.8 (7.6)      | -6.00 [-8.83, -3.17] | 6.2 % |                  |
| Sood 2004         | 71 30.9 (6.13)         | 78 38.4 (6.3)      | -7.50 [-9.50, -5.50] | 6.7 % |                  |
| Tuncer 2003       | 40 19.05 (3.13)        | 40 25.05 (4.94)    | -7.81 [-10.85, -4.79] | 6.8 % |                  |
| Zhang 2000        | 160 20.2 (4.8)         | 158 24.4 (5.6)     | -4.20 [-5.35, -3.05] | 7.1 % |                  |

Total (95% CI) 7724 7756 100.0 % -5.81 [-7.68, -3.93]

Heterogeneity: $\tau^2 = 1.263; \chi^2 = 315.79, df = 15 (P<0.00001); I^2 = 95$

Test for overall effect: $Z = 6.07 (P < 0.00001)$

Test for subgroup differences: Not applicable
# Analysis 1.9. Comparison 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 9 Postoperative days in hospital.

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

Outcome: 9 Postoperative days in hospital

| Study or subgroup | Peritoneal non closure | Peritoneal closure | Mean Difference | Weight | Mean Difference |
|-------------------|------------------------|--------------------|----------------|--------|----------------|
| CAESAR 2010       | 1499 4.7 (2)           | 1496 4.8 (1.9)     | -0.10 [-0.24, 0.04] | 9.7 %  |
| Chanrachakul 2002 | 30 4.1 (0.4)           | 30 4.1 (0.3)       | 9.5 % 0.0 [-0.18, 0.18] |       |
| CORONIS 2013      | 4850 4.93 (2.61)       | 4822 4.91 (2.6)    | 9.9 % 0.02 [-0.08, 0.12] |       |
| Galaal 2000       | 30 5.5 (1.14)          | 30 6 (0.91)        | 6.2 % -0.50 [-1.02, 0.02] |       |
| Ghongdemath 2011  | 100 7.17 (0.75)        | 100 7.29 (1)       | 8.9 % -0.12 [-0.36, 0.12] |       |
| Grundsell 1998    | 179 5.3 (1)            | 182 6.4 (1)        | 9.2 % -1.10 [-1.31, -0.89] |       |
| Huchon 2005       | 75 5.56 (0)            | 63 5.84 (0)        | Not estimable |       |
| Hull 1991         | 54 4.02 (0.79)         | 59 4.25 (0.98)     | 8.2 % -0.23 [-0.56, 0.10] |       |
| Irion 1996        | 137 6.5 (1.9)          | 143 6.8 (2.2)      | 6.6 % -0.30 [-0.78, 0.18] |       |
| Moraes 1999       | 349 3.6 (2.33)         | 349 3.7 (2.25)     | 8.0 % -0.10 [-0.44, 0.24] |       |
| Rafique 2002      | 50 4.1 (1.2)           | 50 3.9 (1.1)       | 6.9 % 0.20 [-0.25, 0.65] |       |
| Sood 2004         | 71 6.1 (0.5)           | 78 6.5 (1)         | 8.9 % -0.40 [-0.65, -0.15] |       |
| Tunerc 2003       | 40 4.3 (0.9)           | 40 4.8 (0.7)       | 7.9 % -0.50 [-0.85, -0.15] |       |
| **Total (95% CI)** | **7464**              | **7442**           | **100.0 % -0.26 [-0.47, -0.05]** |       |

Heterogeneity: Tau² = 0.11; Chi² = 106.78, df = 11 (P<0.00001); I² = 90%

Test for overall effect: Z = 2.42 (P = 0.016)

Test for subgroup differences: Not applicable
### Analysis 1.10. Comparison 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 10 Chronic pelvic pain.

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

Outcome: 10 Chronic pelvic pain

| Study or subgroup | Peritoneal non closure | Peritoneal closure | Risk Ratio M-H,Fixed,95% CI | Weight | Risk Ratio M-H,Fixed,95% CI |
|-------------------|------------------------|--------------------|-----------------------------|--------|-----------------------------|
| Ghahiry 2012      | 9/52                   | 21/60              | 0.49 [0.25, 0.98]           | 100.0% |                             |
| **Total (95% CI)**| **52**                 | **60**             |                             | **100.0 %** | **0.49 [0.25, 0.98]**     |

Total events: 9 (Peritoneal non closure), 21 (Peritoneal closure)

Heterogeneity: not applicable

Test for overall effect: Z = 2.01 (P = 0.045)

Test for subgroup differences: Not applicable

### Analysis 1.11. Comparison 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 11 Pain at 6 weeks postpartum.

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

Outcome: 11 Pain at 6 weeks postpartum

| Study or subgroup | Peritoneal non closure | Peritoneal closure | Risk Ratio M-H,Fixed,95% CI | Weight | Risk Ratio M-H,Fixed,95% CI |
|-------------------|------------------------|--------------------|-----------------------------|--------|-----------------------------|
| CORONIS 2013      | 108/4744               | 103/4721           | 1.04 [0.80, 1.36]           | 100.0% |                             |
| **Total (95% CI)**| **4744**               | **4721**           |                             | **100.0 %** | **1.04 [0.80, 1.36]**     |

Total events: 108 (Peritoneal non closure), 103 (Peritoneal closure)

Heterogeneity: not applicable

Test for overall effect: Z = 0.31 (P = 0.75)

Test for subgroup differences: Not applicable
Analysis 1.12. Comparison 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 12 Secondary infertility.

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

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

Outcome: Secondary infertility

| Study or subgroup | Peritoneal non closure n/N | Peritoneal closure n/N | Risk Ratio M-H,Fixed 95% CI | Weight % | Risk Ratio M-H,Fixed 95% CI |
|-------------------|---------------------------|------------------------|-----------------------------|----------|-----------------------------|
| Irion 1996        | 4/76                      | 4/68                   |                             | 100.0 %  | 0.89 [ 0.23, 3.44 ]         |
| **Total (95% CI)**| **76**                    | **68**                 |                             | **100.0 %** | **0.89 [ 0.23, 3.44 ]**     |
| Total events:     | 4 (Peritoneal non closure), 4 (Peritoneal closure) | | | | |
| Heterogeneity:    | not applicable            | | | | |
| Test for overall effect: Z = 0.16 (P = 0.87) | | | | |
| Test for subgroup differences: Not applicable | | | | |

Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes (Review)
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Analysis 1.13. Comparison 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 13 Blood transfusion > 1 unit (not prespecified outcome).

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

Outcome: 13 Blood transfusion > 1 unit (not prespecified outcome)

| Study or subgroup | Peritoneal non closure n/N | Peritoneal closure n/N | Risk Ratio M-H,Fixed 95% CI | Weight | Risk Ratio M-H,Fixed 95% CI |
|------------------|---------------------------|-----------------------|-----------------------------|--------|-----------------------------|
| CORONIS 2013     | 62/4851                   | 63/4824               |                             | 100.0% | 0.98 [ 0.69, 1.39 ]         |
| **Total (95% CI)** | **4851**                 | **4824**              |                             | **100.0%** | **0.98 [ 0.69, 1.39 ]** |

Total events: 62 (Peritoneal non closure), 63 (Peritoneal closure)
Heterogeneity: not applicable
Test for overall effect: Z = 0.12 (P = 0.90)
Test for subgroup differences: Not applicable

Analysis 1.14. Comparison 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 14 Maternal death (not prespecified outcome).

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

Outcome: 14 Maternal death (not prespecified outcome)

| Study or subgroup | Peritoneal non closure n/N | Peritoneal closure n/N | Risk Ratio M-H,Fixed 95% CI | Weight | Risk Ratio M-H,Fixed 95% CI |
|------------------|---------------------------|-----------------------|-----------------------------|--------|-----------------------------|
| CORONIS 2013     | 3/4851                    | 2/4824                |                             | 100.0% | 1.49 [ 0.25, 8.92 ]         |
| **Total (95% CI)** | **4851**                 | **4824**              |                             | **100.0%** | **1.49 [ 0.25, 8.92 ]** |

Total events: 3 (Peritoneal non closure), 2 (Peritoneal closure)
Heterogeneity: not applicable
Test for overall effect: Z = 0.44 (P = 0.66)
Test for subgroup differences: Not applicable

Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes (Review)
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Analysis 1.15. Comparison 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 15 Intervention for postpartum haemorrhage (not prespecified outcome).

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

Outcome: 15 Intervention for postpartum haemorrhage (not prespecified outcome)

| Study or subgroup | Peritoneal non closure n/N | Peritoneal closure n/N | Risk Ratio M-H,Fixed 95% CI | Weight | Risk Ratio M-H,Fixed 95% CI |
|-------------------|---------------------------|------------------------|-----------------------------|--------|-----------------------------|
| CORONIS 2013      | 71/4851                   | 71/4824                | 100.0 %                     | 0.99 [0.72, 1.38] |
| Total (95% CI)    | 4851                      | 4824                   | 100.0 %                     | 0.99 [0.72, 1.38] |

Total events: 71 (Peritoneal non closure), 71 (Peritoneal closure)

Heterogeneity: not applicable

Test for overall effect: Z = 0.03 (P = 0.97)

Test for subgroup differences: Not applicable
Analysis 1.16. Comparison 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers, Outcome 16 Readmission to hospital within 6 weeks (not prespecified outcome).

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 1 Non-closure of both parietal and visceral peritoneum versus closure of both peritoneal layers

Outcome: 16 Readmission to hospital within 6 weeks (not prespecified outcome)

| Study or subgroup | Peritoneal non closure | Peritoneal closure | Risk Ratio M-H,Fixed,95% CI | Weight | Risk Ratio M-H,Fixed,95% CI |
|------------------|------------------------|--------------------|-----------------------------|--------|-----------------------------|
| CORONIS 2013     | 47/4744                | 47/4721            | 100.0 %                     | 1.00   | [ 0.67, 1.49 ]              |

Total (95% CI) 4744 4721 100.0 % 1.00 [ 0.67, 1.49 ]

Total events: 47 (Peritoneal non closure), 47 (Peritoneal closure)

Heterogeneity: not applicable

Test for overall effect: Z = 0.02 (P = 0.98)

Test for subgroup differences: Not applicable

Analysis 2.1. Comparison 2 Non-closure of visceral peritoneum only versus closure of both peritoneal layers, Outcome 1 Adhesion formation.

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 2 Non-closure of visceral peritoneum only versus closure of both peritoneal layers

Outcome: 1 Adhesion formation

| Study or subgroup | Visceral non-closure | Closure both peritone | Risk Ratio M-H,Fixed,95% CI | Weight | Risk Ratio M-H,Fixed,95% CI |
|-------------------|---------------------|----------------------|-----------------------------|--------|-----------------------------|
| Malvasi 2009      | 31/54               | 12/58                | 81.3 %                      | 2.77   | [ 1.59, 4.83 ]              |
| Weerawetwat 2004  | 3/20                | 3/25                 | 18.7 %                      | 1.25   | [ 0.28, 5.54 ]              |

Total (95% CI) 74 83 100.0 % 2.49 [ 1.49, 4.16 ]

Total events: 34 (Visceral non-closure), 15 (Closure both peritone)

Heterogeneity: Chi² = 0.97, df = 1 (P = 0.32); I² = 0.0%

Test for overall effect: Z = 3.47 (P = 0.00051)

Test for subgroup differences: Not applicable
### Analysis 2.2. Comparison 2 Non-closure of visceral peritoneum only versus closure of both peritoneal layers, Outcome 2 Wound infection.

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 2 Non-closure of visceral peritoneum only versus closure of both peritoneal layers

Outcome: 2 Wound infection

| Study or subgroup | Visceral non-closure | Closure both peritoneal layers | Risk Ratio 95% CI | Weight |
|-------------------|----------------------|-------------------------------|-------------------|--------|
| Nagele 1996       | 5/262                | 14/287                        | 0.39 [0.14, 1.07] | 77.0 % |
| Weerawetwat 2004  | 1/120                | 4/120                         | 0.25 [0.03, 2.20] | 23.0 % |
| **Total (95% CI)** | **382**              | **407**                       | **0.36 [0.14, 0.89]** | 100.0 % |

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

Heterogeneity: Chi² = 0.13, df = 1 (P = 0.71); I² = 0.0%

Test for overall effect: Z = 2.20 (P = 0.027)

Test for subgroup differences: Not applicable
### Analysis 2.3. Comparison 2 Non-closure of visceral peritoneum only versus closure of both peritoneal layers, Outcome 3 Postoperative fever.

**Review:** Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

**Comparison:** 2 Non-closure of visceral peritoneum only versus closure of both peritoneal layers

**Outcome:** 3 Postoperative fever

| Study or subgroup | Visceral non-closure | Closure both Periton | Risk Ratio M-H,Random,95% CI | Weight | Risk Ratio M-H,Random,95% CI |
|------------------|---------------------|----------------------|-----------------------------|--------|-----------------------------|
|                  | n/N                 | n/N                  |                             |        |                             |
| Nagele 1996      | 22/262              | 45/287               | 43.3 %                      | 0.54   | [0.33, 0.87]                |
| Saha 2001        | 2/50                | 10/50                | 17.4 %                      | 0.20   | [0.05, 0.87]                |
| Weerawetwat 2004 | 19/120              | 17/120               | 39.3 %                      | 1.12   | [0.61, 2.04]                |
| **Total (95% CI)** | **432**             | **457**              | **100.0 %**                 | **0.60** | **[0.29, 1.27]**           |

Total events: 43 (Visceral non-closure), 72 (Closure both Periton)

Heterogeneity: Tau² = 0.28; Chi² = 6.26, df = 2 (P = 0.04); I² = 68%

Test for overall effect: Z = 1.33 (P = 0.18)

Test for subgroup differences: Not applicable

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### Analysis 2.4. Comparison 2 Non-closure of visceral peritoneum only versus closure of both peritoneal layers, Outcome 4 Endometritis.

**Review:** Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

**Comparison:** 2 Non-closure of visceral peritoneum only versus closure of both peritoneal layers

**Outcome:** 4 Endometritis

| Study or subgroup | Visceral non-closure | Closure both Periton | Risk Ratio M-H,Fixed,95% CI | Weight | Risk Ratio M-H,Fixed,95% CI |
|------------------|---------------------|----------------------|-----------------------------|--------|-----------------------------|
|                  | n/N                 | n/N                  |                             |        |                             |
| 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)

Heterogeneity: not applicable

Test for overall effect: Z = 0.67 (P = 0.50)

Test for subgroup differences: Not applicable

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Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes (Review)  
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Analysis 2.5. Comparison 2 Non-closure of visceral peritoneum only versus closure of both peritoneal layers, Outcome 5 Operating time (minutes).

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 2 Non-closure of visceral peritoneum only versus closure of both peritoneal layers

Outcome: 5 Operating time (minutes)

| Study or subgroup  | Visceral non-closure | Closure both peritoneal layers | Mean Difference | Weight  | Mean Difference |
|-------------------|----------------------|-------------------------------|----------------|---------|----------------|
|                   | N  | Mean(SD) | N  | Mean(SD) | IV/Fixed 95% CI | IV/Fixed 95% CI |
| Nagele 1996       | 262 | 50.6 (16.8) | 282 | 56.9 (17.9) | -6.30 [-9.22, -3.38] | 100.0 % |
| Total (95% CI)    | 262 | 50.6 (16.8) | 282 | 56.9 (17.9) | -6.30 [-9.22, -3.38] | 100.0 % |

Heterogeneity: not applicable

Test for overall effect: Z = 4.23 (P = 0.000023)

Test for subgroup differences: Not applicable
Analysis 2.6. Comparison 2 Non-closure of visceral peritoneum only versus closure of both peritoneal layers, Outcome 6 Postoperative days in hospital.

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 2 Non-closure of visceral peritoneum only versus closure of both peritoneal layers

Outcome: 6 Postoperative days in hospital

| Study or subgroup | Visceral non-closure | Closure both peritoneal layers | Mean Difference | Weight | Mean Difference |
|-------------------|----------------------|-------------------------------|----------------|--------|----------------|
|                   | N Mean(SD)           | N Mean(SD)                    | IV,Fixed,95% CI|        | IV,Fixed,95% CI|
| Nagele 1996       | 262 7.2 (1.6)        | 287 7.9 (1.8)                 |                | 100.0% | -0.70 [-0.98, -0.42] |
| Total (95% CI)    | 262                  | 287                           | 100.0%         | -0.70  | [-0.98, -0.42]   |

Heterogeneity: not applicable

Test for overall effect: Z = 4.82 (P < 0.00001)

Test for subgroup differences: Not applicable

Analysis 3.1. Comparison 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers, Outcome 1 Wound infection.

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers

Outcome: 1 Wound infection

| Study or subgroup | Parietal non-closure | Closure both peritoneal layers | Risk Ratio | Weight | Risk Ratio |
|-------------------|----------------------|-------------------------------|------------|--------|------------|
|                   | n/N                  | n/N M-H,Fixed,95% CI          | M-H,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 peritoneal layers)

Heterogeneity: not applicable

Test for overall effect: Z = 0.05 (P = 0.96)

Test for subgroup differences: Not applicable
### Analysis 3.2. Comparison 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers, Outcome 2 Postoperative pain.

**Review:** Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

**Comparison:** 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers

**Outcome:** 2 Postoperative pain

| Study or subgroup | Parietal non-closure | Closure both peritoneal | Risk Ratio M-H,Fixed,95% CI | Weight | Risk Ratio M-H,Fixed,95% CI |
|-------------------|----------------------|-------------------------|----------------------------|--------|-----------------------------|
| Shahin 2009       | 30/164               | 65/161                  | 0.45 [0.31, 0.66]           | 100.0% | 0.45 [0.31, 0.66]           |
| **Total (95% CI)**| **164**              | **161**                 |                            | **100.0%** | **0.45 [0.31, 0.66]**     |

Total events: 30 (Parietal non-closure), 65 (Closure both peritoneal)

Heterogeneity: not applicable

Test for overall effect: Z = 4.15 (P = 0.000033)

Test for subgroup differences: Not applicable

### Analysis 3.3. Comparison 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers, Outcome 3 Postoperative fever.

**Review:** Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

**Comparison:** 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers

**Outcome:** 3 Postoperative fever

| Study or subgroup | Parietal non-closure | Closure both peritoneal | Risk Ratio M-H,Fixed,95% CI | Weight | Risk Ratio M-H,Fixed,95% CI |
|-------------------|----------------------|-------------------------|----------------------------|--------|-----------------------------|
| Hojberg 1998      | 0/21                 | 2/19                    | 0.18 [0.01, 3.56]           | 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 peritoneal)

Heterogeneity: not applicable

Test for overall effect: Z = 1.12 (P = 0.26)

Test for subgroup differences: Not applicable
Analysis 3.4. Comparison 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers, Outcome 4 Endometritis.

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers

Outcome: 4 Endometritis

| Study or subgroup | Parietal non-closure | Closure both peritoneal layers | Risk Ratio M-H,Fixed,95% CI | Weight | Risk Ratio M-H,Fixed,95% CI |
|-------------------|----------------------|--------------------------------|-----------------------------|--------|-----------------------------|
| Pietrantoni 1991  | 23/127               | 25/121                         | 0.88 [0.53, 1.46]           | 100.0% | 0.88 [0.53, 1.46]           |

Total (95% CI) 127 121

Total events: 23 (Parietal non-closure), 25 (Closure both peritoneal layers)

Heterogeneity: not applicable

Test for overall effect: Z = 0.51 (P = 0.61)

Test for subgroup differences: Not applicable
Analysis 3.5. Comparison 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers, Outcome 5 Operating time (minutes).

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers

Outcome: 5 Operating time (minutes)

| Study or subgroup | Parietal non-closure | Closure both peritoneal layers | Mean Difference | Weight | Mean Difference |
|-------------------|----------------------|--------------------------------|----------------|--------|----------------|
|                   | N Mean(SD)           | N Mean(SD)                     |                |        |                |
| Pietrantoni 1991  | 127 48.1 (13.52)     | 121 53.2 (15.4)                | -5.10 [-8.71, -1.49] | 100.0 % |                |
| Total (95% CI)    | 127                  | 121                            | 100.0 % -5.10 [-8.71, -1.49] |

Heterogeneity: not applicable

Test for overall effect: Z = 2.77 (P = 0.0057)

Test for subgroup differences: Not applicable

Analysis 3.6. Comparison 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers, Outcome 6 Postoperative days in hospital.

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers

Outcome: 6 Postoperative days in hospital

| Study or subgroup | Parietal non-closure | Closure both peritoneal layers | Mean Difference | Weight | Mean Difference |
|-------------------|----------------------|--------------------------------|----------------|--------|----------------|
|                   | N Mean(SD)           | N Mean(SD)                     |                |        |                |
| Hojberg 1998      | 21 6.3 (1.37)        | 19 7.1 (1.74)                  | -0.80 [-1.78, 0.18] | 40.6 % |                |
| Pietrantoni 1991  | 127 4.8 (1.13)       | 121 4.5 (1.1)                  | 0.30 [0.02, 0.58] | 59.4 % |                |
| Total (95% CI)    | 148                  | 140                            | 100.0 % -0.15 [-1.20, 0.91] |

Heterogeneity: Tau² = 0.47; Chi² = 4.50, df = 1 (P = 0.03); I² = 78%

Test for overall effect: Z = 0.27 (P = 0.79)

Test for subgroup differences: Not applicable
### Analysis 3.7. Comparison 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers, Outcome 7 Mobilisation time in hours (not prespecified outcome).

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers

Outcome: 7 Mobilisation time in hours (not prespecified outcome)

| Study or subgroup | Parietal non-closure | Closure | Mean Difference | Weight | Mean Difference |
|-------------------|----------------------|---------|----------------|--------|----------------|
|                   | N Mean(SD)           | N Mean(SD) | IV/Fixed,95% CI |        | IV/Fixed,95% CI |
| Altinbas 2013     | 55 9.36 (3.24)       | 55 11.25 (3.65) | 100.0 % -1.89 [ -3.18, -0.60 ] |
| Total (95% CI)    | 55                   | 55       | 100.0 % -1.89 [ -3.18, -0.60 ] |

Heterogeneity: not applicable

Test for overall effect: Z = 2.87 (P = 0.0041)

Test for subgroup differences: Not applicable
Analysis 3.8. Comparison 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers, Outcome 8 Time to oral intake in hours (not prespecified outcome).

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers

Outcome: 8 Time to oral intake in hours (not prespecified outcome)

| Study or subgroup | Parietal non-closure | Parietal closure | Mean Difference | Weight | Mean Difference |
|------------------|----------------------|-----------------|----------------|--------|----------------|
|                  | N  Mean(SD)          | N  Mean(SD)     | IV,Fixed,95% CI |        | IV,Fixed,95% CI |
| Altinbas 2013    | 55  9.45 (3.27)      | 55  11.76 (4.41) |                 | 100.0 % | -2.31 [-3.76, -0.86] |
| Total (95% CI)   | 55                   | 55              |                 | 100.0 % | -2.31 [-3.76, -0.86] |

Heterogeneity: not applicable

Test for overall effect: Z = 3.12 (P = 0.0018)

Test for subgroup differences: Not applicable

Analysis 3.9. Comparison 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers, Outcome 9 Drop in haemoglobin g/dL (not prespecified outcome).

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers

Outcome: 9 Drop in haemoglobin g/dL (not prespecified outcome)

| Study or subgroup | Parietal non-closure | Parietal closure | Mean Difference | Weight | Mean Difference |
|------------------|----------------------|-----------------|----------------|--------|----------------|
|                  | N  Mean(SD)          | N  Mean(SD)     | IV,Fixed,95% CI |        | IV,Fixed,95% CI |
| Altinbas 2013    | 55  1.41 (0.82)      | 55  1.13 (0.86)  |                 | 100.0 % | 0.28 [-0.03, 0.59] |
| Total (95% CI)   | 55                   | 55              |                 | 100.0 % | 0.28 [-0.03, 0.59] |

Heterogeneity: not applicable

Test for overall effect: Z = 1.75 (P = 0.081)

Test for subgroup differences: Not applicable
**Analysis 3.10. Comparison 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers, Outcome 10 Blood loss (not prespecified outcome).**

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers

Outcome: 10 Blood loss (not prespecified outcome)

| Study or subgroup | Parietal non-closure | Parietal closure | Mean Difference | Weight | Mean Difference |
|-------------------|----------------------|-----------------|----------------|--------|----------------|
|                    | N        | Mean(SD)[mL]   | IV,Fixed,95% CI |        | IV,Fixed,95% CI |
| Altinbas 2013      | 55      | 544.87 (237.64) | -28.08, 142.02 | 100.0% | 56.97 |
| Total (95% CI)     | 55      | 55             | 56.97 [ -28.08, 142.02 ] | 100.0% | 56.97 |

Heterogeneity: not applicable

Test for overall effect: Z = 1.31 (P = 0.19)

Test for subgroup differences: Not applicable

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**Analysis 3.11. Comparison 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers, Outcome 11 Time to flatus (not prespecified outcome).**

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers

Outcome: 11 Time to flatus (not prespecified outcome)

| Study or subgroup | Parietal non-closure | Parietal closure | Mean Difference | Weight | Mean Difference |
|-------------------|----------------------|-----------------|----------------|--------|----------------|
|                    | N        | Mean(SD)        | IV,Fixed,95% CI |        | IV,Fixed,95% CI |
| Altinbas 2013      | 55      | 18.21 (4.23)    | -1.99, 1.91 | 100.0% | -0.04 |
| Total (95% CI)     | 55      | 55             | -0.04 [ -1.99, 1.91 ] | 100.0% | -0.04 |

Heterogeneity: not applicable

Test for overall effect: Z = 0.04 (P = 0.97)

Test for subgroup differences: Not applicable

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_Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes (Review)_

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Analysis 3.12. Comparison 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers, Outcome 12 Wound pain, day 1 (visual analogue score).

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes
Comparison: 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers
Outcome: 12 Wound pain, day 1 (visual analogue score)

| Study or subgroup | nonclosure | closure | Mean Difference | Weight | Mean Difference |
|-------------------|------------|---------|----------------|--------|----------------|
| Shahin 2009       | 164        | 161     | -1.60 [-1.97, -1.23] | 100.0 % | -1.60 [-1.97, -1.23] |
| Total (95% CI)    | 164        | 161     | 100.0 %        | 100.0 % | -1.60 [-1.97, -1.23] |
| Heterogeneity: not applicable |
| Test for overall effect: Z = 8.46 (P < 0.00001) |
| Test for subgroup differences: Not applicable |

Analysis 3.13. Comparison 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers, Outcome 13 Persistent abdominal pain after 8 months (numerical rating scale).

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes
Comparison: 3 Non-closure of parietal peritoneum only versus closure of both peritoneal layers
Outcome: 13 Persistent abdominal pain after 8 months (numerical rating scale)

| Study or subgroup | nonclosure | closure | Mean Difference | Weight | Mean Difference |
|-------------------|------------|---------|----------------|--------|----------------|
| Shahin 2009       | 164        | 161     | -1.10 [-1.39, -0.81] | 100.0 % | -1.10 [-1.39, -0.81] |
| Total (95% CI)    | 164        | 161     | 100.0 %        | 100.0 % | -1.10 [-1.39, -0.81] |
| Heterogeneity: not applicable |
| Test for overall effect: Z = 7.53 (P < 0.00001) |
| Test for subgroup differences: Not applicable |
### Analysis 4.1. Comparison 4 Non closure versus closure of visceral peritoneum when parietal peritoneum is closed, Outcome 1 Urinary frequency at 8 weeks.

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 4 Non closure versus closure of visceral peritoneum when parietal peritoneum is closed

Outcome: 1 Urinary frequency at 8 weeks

| Study or subgroup | non-closure of visceral | Closure of visceral | Risk Ratio | Weight |
|-------------------|-------------------------|---------------------|------------|--------|
| Shahin 2010       | 11/285                  | 48/297              | 0.24 [0.13, 0.45] | 100.0 % |
| **Total (95% CI)**| **285**                 | **297**             | **0.24 [0.13, 0.45]** | **100.0 %** |

Total events: 11 (non-closure of visceral), 48 (Closure of visceral)
Heterogeneity: not applicable
Test for overall effect: Z = 4.42 (P < 0.00001)
Test for subgroup differences: Not applicable

### Analysis 4.2. Comparison 4 Non closure versus closure of visceral peritoneum when parietal peritoneum is closed, Outcome 2 Urgency of urination.

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 4 Non closure versus closure of visceral peritoneum when parietal peritoneum is closed

Outcome: 2 Urgency of urination

| Study or subgroup | non-closure of visceral | Closure of visceral | Risk Ratio | Weight |
|-------------------|-------------------------|---------------------|------------|--------|
| Shahin 2010       | 16/285                  | 56/297              | 0.30 [0.18, 0.51] | 100.0 % |
| **Total (95% CI)**| **285**                 | **297**             | **0.30 [0.18, 0.51]** | **100.0 %** |

Total events: 16 (non-closure of visceral), 56 (Closure of visceral)
Heterogeneity: not applicable
Test for overall effect: Z = 4.47 (P < 0.00001)
Test for subgroup differences: Not applicable
Analysis 4.3. Comparison 4 Non closure versus closure of visceral peritoneum when parietal peritoneum is closed, Outcome 3 Stress incontinence.

Review: Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes

Comparison: 4 Non closure versus closure of visceral peritoneum when parietal peritoneum is closed

Outcome: 3 Stress incontinence

| Study or subgroup | non-closure of visceral n/N | Closure of visceral n/N | Risk Ratio M-H,Fixed,95% CI | Weight | Risk Ratio M-H,Fixed,95% CI |
|-------------------|-----------------------------|-------------------------|-----------------------------|--------|-----------------------------|
| Shahin 2010       | 9/285                       | 21/297                  |                             | 100.0 %| 0.45 [0.21, 0.96]           |
| Total (95% CI)    | 285                         | 297                     |                             | 100.0 %| 0.45 [0.21, 0.96]           |

Total events: 9 (non-closure of visceral), 21 (Closure of visceral)
Heterogeneity: not applicable
Test for overall effect: Z = 2.07 (P = 0.039)
Test for subgroup differences: Not applicable

F E E D B A C K

Wein, 19 February 2008

Summary
This review has been interpreted by the Royal College of Obstetricians and Gynaecologists in the UK as saying that non-closure of both layers of peritoneum is better than closure. However, there are no RCTs comparing closure with non-closure of the parietal peritoneum alone when the visceral peritoneum is not closed in either arm. Cohort studies and at least one RCT have suggested that non-closure of the parietal peritoneum is associated with more adhesions at the next caesarean section. This should be acknowledged in the conclusions and recommendations of this review.

Reply
The data on adhesions formation involved a few women assessed in two trials where visceral peritoneum was not closed. The numbers involved appears to be too small to advice on practice. However the finding is noted for future update as we have more data to base an informed advice.
WHAT’S NEW

Last assessed as up-to-date: 1 November 2013.

| Date               | Event                                         | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 November 2013    | New citation required and conclusions have changed | Fifteen new trials were incorporated (Altinbas 2013; Anteby 2009; CAESAR 2010; CORONIS 2013; Geman 2006; Ghahiry 2012; Ghongdemath 2011; Huchon 2005; Kapustian 2012; Komoto 2005; Malomo 2006; Malvasi 2009; Moraes 1999; Shahin 2009; Shahin 2010), which resulted to changes in the short- and long-term outcomes. There is now no reduction in analgesic dose or post-operative fever for women who received non-closure of visceral and parietal peritoneum when compared with closure of both layers. There was an increase in postoperative adhesion formation in women who received non-closure of visceral peritoneum only when compared with closure of both peritoneal layers. |
| 1 November 2013    | New search has been performed                  | Search updated. Methods updated.                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

HISTORY

Protocol first published: Issue 1, 1995

Review first published: Issue 1, 1995

| Date               | Event                  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2 December 2009    | Amended                | Search updated. Fourteen new reports added to Studies awaiting classification.                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 25 June 2008       | Feedback has been incorporated | Feedback from Peter Wein added.                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 23 June 2008       | Amended                | Converted to new review format.                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 1 December 2006    | New search has been performed | 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 |
1 July 2003  New citation required and conclusions have changed  Substantive amendment

**CONTRIBUTIONS OF AUTHORS**

Anthony Bamigboye wrote the initial protocol, which was checked by Justus Hofmeyr. The first version of the review and the 2003 and 2014 updates were prepared by Anthony Bamigboye and Justus Hofmeyr. Anthony Bamigboye is the guarantor of the review.

**DECLARATIONS OF INTEREST**

None known.

**SOURCES OF SUPPORT**

**Internal sources**

- Effective Care Research Unit, University of the Witwatersrand/Fort Hare, East London Hospital Complex, South Africa.

**External sources**

- HRP-UNDP/UNFPA/WHO/World Bank Special Programme in Human Reproduction, Geneva, Switzerland.

**DIFFERENCES BETWEEN PROTOCOL AND REVIEW**

Additional outcomes not specified in the protocol were reported, and identified as such in the text.

- Blood transfusion > 1 unit.
- Maternal death.
- Intervention for postpartum haemorrhage.
- Readmission to hospital within six weeks.
- Mobilisation time in hours.
- Time to oral intake in hours.
- Drop in haemoglobin g/dL.
- Blood loss mL.
- Time to flatus.
INDEX TERMS

Medical Subject Headings (MeSH)
*Abdominal Wound Closure Techniques; Cesarean Section [*methods]; Length of Stay [statistics & numerical data]; Operative Time; Peritoneal Diseases [etiology]; Peritoneum [*surgery]; Randomized Controlled Trials as Topic; Suture Techniques; Tissue Adhesions [etiology]

MeSH check words
Female; Humans; Pregnancy