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Continuous versus interrupted sutures for repair of episiotomy or second degree tears

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ABSTRACT

Background

Millions of women worldwide undergo perineal suturing after childbirth and the type of repair may have an impact on pain and healing. For more than 70 years, researchers have been suggesting that continuous non-locking suture techniques for repair of the vagina, perineal muscles and skin are associated with less perineal pain than traditional interrupted methods.

Objectives

To assess the effects of continuous versus interrupted absorbable sutures for repair of episiotomy and second degree perineal tears following childbirth.

Search strategy

We searched the Cochrane Pregnancy and Childbirth Group’s Trials Register (June 2007).

Selection criteria

Randomised trials comparing continuous versus interrupted sutures for repair of episiotomy and second-degree tears after vaginal delivery.

Data collection and analysis

Three review authors independently assessed trial quality. Two of the three authors independently extracted data and a third author checked them. We contacted study authors for additional information.

Main results

Seven studies, involving 3822 women at point of entry, from four countries, have been included. The trials were heterogeneous in respect of operator skill and training. Meta-analysis showed that continuous suture techniques compared with interrupted sutures for perineal closure (all layers or perineal skin only) are associated with less pain for up to 10 days postpartum (relative risk (RR) 0.70, 95% confidence interval 0.64 to 0.76). Subgroup analysis showed that there is a greater reduction in pain when continuous suturing techniques are used for all layers (RR 0.65, 95% CI 0.60 to 0.71). There was an overall reduction in analgesia use associated with the
continuous subcutaneous technique versus interrupted stitches for repair of perineal skin (RR 0.70, 95% CI 0.58 to 0.84). Subgroup analysis showed some evidence of reduction in dyspareunia experienced by participants in the groups that had continuous suturing for all layers (RR 0.83, 95% CI 0.70 to 0.98). There was also a reduction in suture removal in the continuous suturing groups versus interrupted (RR 0.54, 95% CI 0.45 to 0.65), but no significant differences were seen in the need for re-suturing of wounds or long-term pain.

**Authors’ conclusions**

The continuous suturing techniques for perineal closure, compared to interrupted methods, are associated with less short-term pain. Moreover, if the continuous technique is used for all layers (vagina, perineal muscles and skin) compared to perineal skin only, the reduction in pain is even greater.

**PLAIN LANGUAGE SUMMARY**

Continuous versus interrupted sutures for repair of episiotomy or second degree tears

Continuous stitching causes less pain than interrupted stitches when used for repairing the perineum after childbirth

When women give birth the perineum (the area between the vaginal opening and back passage) sometimes tears or it may be necessary to have an episiotomy (surgical cut) to increase the size of the outlet. Episiotomies and tears that involve the muscle layer (second degree) need to be stitched. In the UK alone, approximately 1,000 women per day will experience perineal stitches following vaginal birth and millions more worldwide. A midwife or doctor will stitch the episiotomy or second degree tear in three layers (vagina, perineal muscle and skin). Traditionally the vagina is stitched using a continuous locking stitch and the perineal muscles and skin are repaired using approximately three or four individual stitches, each needing to be knotted separately to prevent them from dislodging. Researchers have been suggesting for more than 70 years that the ‘continuous non-locking stitching method’ is better than ‘traditional interrupted methods’. This review looked at ‘continuous stitching methods’ compared with ‘traditional interrupted stitching methods’ and identified seven trials involving 3822 women. Results from the trials showed that stitching just underneath the skin (subcutaneous) was associated with less pain; however, when the ‘continuous stitching method’ is used for repair of all three layers, this is associated with even less pain. Other research is needed to assess perineal repair training programmes. In addition, research is needed to look at interventions that may reduce the incidence of perineal trauma during childbirth.

**BACKGROUND**

Prevalence and Morbidity

Perineal repair is one aspect of childbirth that affects literally millions of women throughout the world and can result in long-term maternal morbidity. In the United Kingdom approximately 85% (n = 637,500) of women will sustain some degree of perineal trauma during vaginal birth and of these, 60-70% will require stitches (McCandlish 1998; Sleep 1984). However, the rates of perineal trauma will vary considerably according to individual practices and policies of staff and institutions throughout the world. Perineal trauma may occur spontaneously during birth, or the midwife or obstetrician may need to make a surgical incision (episiotomy) to increase the diameter of the vaginal outlet to facilitate the baby’s birth. Spontaneous tears are defined as first degree (involving the perineal skin only), second degree (involving the perineal muscles and skin), third degree (injury to the anal sphincter complex - 3a = < 50% of the external anal sphincter torn; 3b = > 50% of the external anal sphincter torn; 3c = injury to the external and internal anal sphincter) and fourth degree (injury to the perineum involving the anal sphincter complex and anal epithelium) (Fernando 2006).

The majority of women experience some short-term discomfort or pain following perineal repair, and up to 20% will continue to have long-term problems such as superficial dyspareunia (painful...
Techniques of Perineal Repair

The technique of suturing perineal trauma following childbirth may have a significant effect on the extent and degree of morbidity experienced by women both in the short- and long-term. Perineal trauma is traditionally repaired in three stages. First a continuous 'locking' stitch is inserted to close the vaginal trauma, commencing at the apex of the wound and finishing at the level of the fourchette with a loop knot. It is traditional to use a 'locking' stitch to repair the vaginal trauma, as a continuous 'running' stitch may cause shortening of the vagina if it is pulled too tight, but no controlled studies have been carried out to investigate this theory. Next the deep and superficial muscles are re-approximated with three or four interrupted sutures and finally, the perineal skin is closed by inserting continuous subcutaneous or interrupted transcutaneous stitches. For more than 70 years, researchers have been suggesting that continuous non-locking suture techniques for repair of the vagina, perineal muscles and skin are far better than 'traditional' interrupted methods in terms of reduced postpartum pain and yet they have not been generally used (Christhilf 1962; Derlesfen 1980; Fleming 1990; Guilhem 1960; Isager-Sally 1986; Mandy 1951; Olah 1994; Rucker 1930; Rucker 1939).

Fleming 1990 published her experience of using a simple, non-locking, loose, continuous suturing technique with subcutaneous sutures to appose the skin. Women reported low levels of perineal pain after repair with the continuous technique compared to those repaired with more traditional interrupted suturing methods. The differences in pain between the two techniques may be due to increased suture tension caused by oedema in the perineal tissue. It is very easy to over tighten locked or interrupted stitches, which may restrict the distribution of tissue oedema and cause increased pain. With the continuous technique, the tension is transferred throughout the whole length of a single suture; also the skin sutures are inserted well below the skin surface, thus avoiding the nerve endings. Moreover, good cosmetic results were reported at six weeks following childbirth (Fleming 1987). However, Fleming's findings were based purely on an observational study and not a randomised controlled comparative trial. More recently, a large randomised controlled trial was carried out in the UK, which compared the continuous technique with the more traditional interrupted method of perineal repair, and similar findings were reported (Kettle 2002).

There is also evidence that if the perineal repair is carried out using an absorbable suture material, such as standard polyglactin 910 (Vicryl; Ethicon, Edinburgh, UK) or polyglycolic acid (Dexon; Davis and Geck, Gosport, UK) compared to catgut, short-term perineal pain is reduced; however, there is an increased risk of suture removal up to three months postpartum (Kettle 1999). More recent research has reported that the use of a more rapidly absorbed form of polyglactin 910 suture material (Vicryl Rapide; Ethicon) is associated with a significant reduction in suture removal when compared to standard absorbable suture materials (Kettle 2002).

Aim of the Review

The aim of this review is to examine the available research and to establish if there is any clear scientific evidence that the technique used for perineal repair, following childbirth, has any relation to the amount of pain and superficial dyspareunia experienced by women in the postpartum period.

This systematic review includes seven randomised clinical trials and represents a substantial update of the previous Cochrane review.

OBJECTIVES

To assess the effects of continuous versus interrupted suturing methods (using absorbable suture materials) on the incidence of short- and long-term postpartum maternal morbidity experienced by women following repair of episiotomy or second-degree perineal tears after vaginal birth. The evidence collated in this review will enable purchasers, providers and consumers of health care to choose the most appropriate technique of perineal repair in terms of both health gain and cost.

The main outcomes of interest are: short- and long-term pain; amount of analgesia used; time of resumption of pain-free inter-
METHODS

Criteria for considering studies for this review

Types of studies
We have included all identified, relevant randomised controlled trials, which compare continuous versus interrupted sutures for perineal closure (all layers or skin only), using absorbable suture materials, in this review. We have assessed all of the trials included according to the method of treatment allocation, randomisation, blinding of outcome assessment and handling of exclusions.

Types of participants
All primiparous and multiparous women who have sustained an episiotomy or second-degree perineal tear and require stitching following a spontaneous or instrumental vaginal delivery.

Types of interventions
All randomised controlled comparisons of continuous versus interrupted sutures for perineal closure (all layers or skin only) following vaginal delivery using absorbable suture material. Trials that compared continuous suturing techniques using absorbable sutures versus interrupted transcutaneous techniques that used non-absorbable sutures for perineal skin closure were excluded to avoid the confounding effect of suture material.

Types of outcome measures
The main focus is on outcome measures relating to short- and long-term postpartum morbidity. The main outcome measures include: short-term pain; analgesia use; removal of suture material; resuturing; long-term pain; failure to resume pain-free intercourse; superficial dyspareunia. Consumer views regarding what outcomes they would expect from this review were sought from local focus groups, members of the National Childbirth Trust and other postnatal support groups. The main outcomes of interest from the consumers’ point of view were short- and long-term pain, removal of suture material and the resumption of pain-free intercourse.

Search methods for identification of studies

Electronic searches
We searched the Cochrane Pregnancy and Childbirth Group’s Trials Register by contacting the Trials Search Co-ordinator (June 2007). The Cochrane Pregnancy and Childbirth Group’s Trials Register is maintained by the Trials Search Co-ordinator and contains trials identified from:
1. quarterly searches of the Cochrane Central Register of Controlled Trials (CENTRAL);
2. monthly searches of MEDLINE;
3. handsearches of 30 journals and the proceedings of major conferences;
4. weekly current awareness search of a further 36 journals plus monthly BioMed Central email alerts.
Details of the search strategies for CENTRAL and MEDLINE, the list of handsearched journals and conference proceedings, and the list of journals reviewed via the current awareness service can be found in the ‘Search strategies for identification of studies’ section within the editorial information about the Cochrane Pregnancy and Childbirth Group.
Trials identified through the searching activities described above are given a code (or codes) depending on the topic. The codes are linked to review topics. The Trials Search Co-ordinator searches the register for each review using these codes rather than keywords. We did not apply any language restrictions.

Data collection and analysis

Selection of studies
Three review authors (Christine Kettle (CK), Robert K Hills (RKH) and Khaled MK Ismail (KMKI)) independently assessed and selected the trials for inclusion in this review. It was not possible to assess the relevance of the trials blinded because we knew the authors’ names, institution, journal of publication and results when we applied the inclusion criteria. We resolved all disagreements by discussion.

Assessment of methodological quality of included studies
We assessed the validity of each study using the criteria outlined in the Cochrane Handbook for Systematic Reviews of Interventions (Higgins 2005). Methods used for generation of the randomisation sequence were described for each trial. We independently assessed the methodological quality of each individual trial and collected details of method of treatment con-
cealment, attrition bias, performance bias and whether 'intention-to-treat analysis' was performed.

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

(2) Attrition bias (loss of participants, eg withdrawals, dropouts, protocol deviations)
We assessed completeness to follow up using the following criteria:
(A) less than 5% loss of participants;
(B) 5% to 9.9% loss of participants;
(C) 10% to 19.9% loss of participants;
(D) more than 20% loss of participants.

(3) Performance bias (blinding of participants, researchers and outcome assessment)
We assessed blinding using the following criteria (please note that treatment could not be blinded in the trials included in this review):
(A) blinding of participants (yes/no/unclear);
(B) blinding of caregiver (yes/no/unclear);
(C) blinding of outcome assessment (yes/no/unclear).

Data extraction and management
All data were extracted and entered onto a bespoke form independently by all three review authors (CK, RKH and KMKI).
Two review authors (CK and KMKI) entered data into the Review Manager software (RevMan 2003); the third review author (RKH) extracted results independently and checked the accuracy of entered data.

Measures of treatment effect
We undertook statistical analysis using the Review Manager software (RevMan 2003) for calculation of the treatment effect as represented relative risk, proportional and absolute risk reductions. We performed fixed-effects (assumption free) meta-analysis using relative risk for combining data in the absence of significant heterogeneity.

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

Available case analysis
We analysed data on all participants with available data in the group to which they were allocated, regardless of whether or not they received the allocated intervention.

Assessment of heterogeneity
We applied tests of heterogeneity between trials, when appropriate, using the I² statistic. If we identified high levels of heterogeneity among the trials, (exceeding 50%), we explored it by prespecified subgroup analysis and performed a sensitivity analysis.

Subgroup analyses
We conducted subgroup analyses classifying whole trials by interaction tests as described by Deeks 2001. We undertook the following subgroup analyses:
(a) whether the continuous group used continuous suture techniques for all layers or perineal skin only.

RESULTS

Description of studies
See: Characteristics of included studies; Characteristics of excluded studies.
We have included seven studies, involving 3822 women at point of entry, from four countries.

All seven trials in this review compared continuous sutures techniques with interrupted methods for perineal closure (all layers or skin only). In the seven 'interrupted suture' comparison groups, the perineal muscle and skin were closed with interrupted stitches; whereas, in the 'continuous suture' groups, two of the included trials used interrupted sutures to repair the perineal muscles prior to continuous subcutaneous closure of the perineal skin (Banninger 1978; Mahomed 1989). In comparison, the other five trials used a continuous suturing technique to close the vagina and perineal muscles prior to subcutaneous skin closure (Croce 1997; Detlefsen 1980; Isager-Sally 1986; Kettle 2002; Morano 2006) (see ‘Characteristics of included studies’ for details).
Three of the trials used polyglycolic acid (Dexon) suture material throughout for repair of the vagina, perineal muscles and skin in
each group included in the review (Banninger 1978; Detlefsen 1980; Isager-Sally 1986). The Mahomed 1989 trial had a balanced factorial design and the participants in each group were repaired with chromic catgut (approximately 50%) and polyglycolic acid (Dexon) suture material (approximately 50%). Similarly, the Kettle 2002 trial used a factorial 2 x 2 design and participants were allocated Vicryl Rapide (50%) or Standard Vicryl suture material (50%) in each group. The Morano 2006 trial used Vicryl Rapide suture material for perineal repair in both comparison groups, whereas the Croce 1997 trial used catgut suture material in both groups. All seven trials used absorbable suture material; however, there were some variations among type of material, gauge and needle size used. In addition, there was some clinical heterogeneity between trials in respect of skill and training of the operator (see 'Characteristics of included studies' for details).

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

Risk of bias in included studies

The methodological qualities of the seven trials included in this systematic review were found to be inconsistent. Three trials (Kettle 2002; Mahomed 1989; Morano 2006) were rated 'A' because they had a high level of quality and three of the assessed criteria were met. As previously stated, it was not possible to blind outcome assessment due to obvious differences in suturing techniques for perineal skin closure (interrupted transcutaneous compared to continuous subcutaneous). The Isager-Sally 1986 trial was rated as 'B', as two of the criteria were met, and the other three trials (Banninger 1978; Croce 1997; Detlefsen 1980) were rated as 'C', as only one of the criteria was met.

Treatment was allocated by ‘randomisation’ in six of the trials; however, the method used was described only by Kettle 2002, Mahomed 1989 and Morano 2006. The Banninger 1978 trial used a quasi-random method of treatment allocation by ‘alternating sequence’, which carries a greater risk of introducing selection bias. The Isager-Sally 1986, Kettle 2002, Mahomed 1989 and Morano 2006 trials reported the use of sealed, opaque envelopes for ‘randomised’ concealed treatment allocation to reduce the risk of selection bias at point of entry into the study.

The Isager-Sally 1986 trial randomised a total 600 women to the two groups that were included in the meta-analysis; however approximately 11% (n = 70 women) were excluded from the study soon after entry. The authors reported that it was not possible to provide follow up for these women, as most of them were transferred with their babies to a paediatric department in another unit or they chose to leave hospital before the fifth day after delivery. These women were also excluded from the three-month follow up. The analysis of data in the Mahomed 1989 and Kettle 2002 trials were reported to be by “intention to treat”. Analysis in the Banninger 1978, Croce 1997, Detlefsen 1980 and Morano 2006 trials appear to be by ‘intention to treat’, as all participants randomised into the treatment groups were included. The Kettle 2002, Mahomed 1989, and Morano 2006 trials reported losses to follow up; no such losses were reported in the Banninger 1978, Croce 1997 and Detlefsen 1980 trials. Twenty-two randomisation envelopes were unaccounted for in the Mahomed 1989 trial and one in the Kettle 2002 trial.

All of the seven trials made provision for long-term follow up; only 33% of participants returned for follow up at three months in the Banninger 1978 trial; a total of 90% of participants returned for follow-up examination at two months in the Detlefsen 1980 trial; 86% of those participants who were initially randomised to the Isager-Sally 1986 trial responded to the three month questionnaire (Isager-Sally 1986); 85% of participants responded at three months in the Mahomed 1989 trial; 100% of participants responded at three months in the Croce 1997 trial; 91% of participants responded at three months in the Morano 2006 trial and 96.7% in the Kettle 2002 trial.

Effects of interventions

We have included seven studies, involving 3822 women at point of entry, from four countries.

Short-term pain - up to day 10 postpartum

Six trials presented data in a suitable format for inclusion in this analysis (Banninger 1978; Croce 1997; Isager-Sally 1986; Kettle 2002; Mahomed 1989; Morano 2006). The trials used a variety of categorical scales to measure the pain experienced by women, and data from these were combined and included in the meta-analysis as dichotomous outcomes (pain or no pain). All six trials showed lower rates of pain in the experimental groups that used continuous suture techniques for perineal closure (all layers or skin only). Meta-analysis indicates the risk of experiencing short-term pain are less when continuous suture techniques are used for perineal closure versus interrupted sutures (RR 0.70, 95% CI 0.64 to 0.76). However, only the Isager-Sally 1986, Kettle 2002 and Morano 2006 trials actually demonstrated any statistical significance between the two groups (RR 0.73, 95% confidence interval (CI) 0.63 to 0.81; RR 0.60, 95% CI 0.52 to 0.69 and RR 0.54 95% CI 0.39 to 0.74 respectively). Subgroup analysis show that there is a greater reduction in pain associated with continuous suturing for all layers (Croce 1997; Isager-Sally 1986; Kettle 2002; Morano 2006) (RR 0.65, 95% CI 0.60 to 0.71) versus continuous subcutaneous for closure of perineal skin only (Banninger 1978; Mahomed 1989) (RR 0.89, 95% CI 0.73 to 1.07).

Analgesia use - up to day 10 postpartum

Four of the included trials (Banninger 1978; Kettle 2002; Mahomed 1989; Morano 2006) presented data regarding analgesia use in the immediate postpartum period which showed an...
overall reduction in analgesia use in association with the continuous techniques for perineal closure versus interrupted stitches (all layers or skin only) (RR 0.70, 95% CI 0.58 to 0.84). There was no significant heterogeneity between the results of the different trials, nor when results were stratified by suturing method.

Resuturing of wound - reported up to three months after delivery

Data regarding the incidence of resuturing in the two intervention groups was provided by four trials. The Mahomed 1989 trial reported three cases requiring resuturing in each comparison group; the Banninger 1978 and Morano 2006 trials reported none in either group and the Kettle 2002 trial reported three cases in the treatment group and one case in the control group. Meta-analysis shows that there is no difference in risk of resuturing between groups; however with only 10 cases reported the numbers are too small to draw reliable conclusions.

Long-term pain - reported up to three months after delivery

Only two trials presented data in a suitable format for inclusion in this analysis (Kettle 2002; Mahomed 1989). The Mahomed 1989 trial reported a non-significant increase in long-term pain in the (experimental) group allocated to continuous subcutaneous sutures for perineal skin closure group compared to the interrupted transcutaneous (control) group, (RR 1.10, 95% CI 0.77 to 1.57), whereas the Kettle 2002 trial reported a decrease in long-term pain in the continuous (experimental) group (RR 0.73, 95% CI 0.54 to 0.97). However, overall the meta-analysis showed that there was no significant difference in long-term pain between the experimental and control groups (RR 0.86, 95% CI 0.69 to 1.07).

Dyspareunia - reported up to three months after delivery

Six trials provided data for inclusion in this analysis (Croce 1997; Detlefsen 1980; Isager-Sally 1986; Kettle 2002; Mahomed 1989; Morano 2006). The Detlefsen 1980 and Isager-Sally 1986 trials reported lower rates of dyspareunia in the continuous suturing (all layers) experimental groups; however, only the Detlefsen 1980 trial showed a statistically significant difference. In contrast, the Mahomed 1989 trial found a higher incidence of reported dyspareunia in the experimental group (continuous subcutaneous for closure of perineal skin only), which may have been due to the fact that more women in the experimental group had resumed intercourse by three months. Overall, the meta-analysis did not demonstrate any statistically significant reduction in dyspareunia experienced by participants in the continuous technique groups (all layers or skin only), (RR 0.93, 95% CI 0.81 to 1.06), although the presence of the highly significant heterogeneity between the Detlefsen 1980 trial and the other trials makes any form of summary measure difficult to interpret.

Failure to resume pain-free intercourse - up to three months after delivery

Two trials (Kettle 2002; Mahomed 1989) presented data for inclusion in this analysis. Overall, there was no significant difference in failure to resume pain-free intercourse between the two groups, with no evidence of heterogeneity of treatment effect (RR 1.07 95% CI 0.93 to 1.24).

Removal of suture material - up to three months after delivery

Three trials (Kettle 2002; Mahomed 1989; Morano 2006) provided data for inclusion in the analysis. The Morano 2006 trial reported no events of suture removal in either group, whereas the Kettle 2002 and Mahomed 1989 trials reported the removal of suture material to be less frequent in the continuous perineal closure groups (RR 0.54, 95% CI 0.45 to 0.65).

Discussion

The meta-analysis of data provides evidence that continuous techniques for perineal closure (all layers or skin only) cause less pain in the immediate postpartum period compared to interrupted stitching methods. However, there is significant between-trial heterogeneity (P = 0.02) which may be a result of clinical heterogeneity in terms of input in perineal repair training and different suturing techniques used (see table of 'Characteristics of included studies' for details).

To investigate the heterogeneity of results between the different trials, in line with the philosophy of Greenland 1987, we considered the possible sources of heterogeneity. In particular, we looked at the heterogeneity of treatment effects stratified by continuous suturing for all layers versus continuous subcutaneous for closure of perineal skin only. Five of the included trials (Croce 1997; Detlefsen 1980; Isager-Sally 1986; Kettle 2002; Morano 2006) used a non-locking continuous suturing technique to repair the vagina and perineal muscles with a continuous subcutaneous stitch inserted to close the skin in the experimental group; four trials (Croce 1997; Detlefsen 1980; Isager-Sally 1986; Kettle 2002) used a locking suture for the vagina, and interrupted sutures to repair perineal muscle and skin in the control group and the Morano 2006 trial used a non-locking suture for repair of the vaginal epithelium, three or four interrupted stitches to repair the deep and superficial perineal muscles and interrupted transcutaneous stitches inserted to close the skin. The other two trials by Mahomed 1989 and Banninger 1978 used a locking continuous stitch and interrupted stitches to
repair the vagina respectively; interrupted stitches for the muscle layer and continuous subcutaneous stitches versus interrupted for skin closure.

The rationale for performing continuous suturing indicates that any benefit would be larger in those trials which use continuous suturing throughout for all layers, therefore this was investigated by performing stratified subgroup analysis. It can be seen that once the different types of suturing were taken into account (continuous suturing for all layers versus continuous subcutaneous for closure of perineal skin only) the between-trial heterogeneity of results were non-significant, with the exception of dyspareunia, where most of the heterogeneity was contributed by the Detlefsen 1980 trial. This may possibly relate to the very high incidence of dyspareunia (66.7%) reported in the control group in the Detlefsen 1980 trial compared with the much lower rates in the control groups of the other five trials (average 20.8%) (Croce 1997; Isager-Sally 1986; Kettle 2002; Mahomed 1989; Morano 2006).

The Mahomed 1989 trial reported that the subcutaneous method of perineal skin closure was less practiced and unpopular with some operators and there was some crossover of treatment allocation (96 women in the subcutaneous group had interrupted transcutaneous stitches inserted). In the Kettle 2002 trial adherence to treatment allocation was very high. Perhaps the better results produced by the Isager-Sally 1986 trial were due to the continuous technique being introduced several months prior to the trial starting, thus ensuring that all members of staff were familiar with the new technique of perineal repair. In the Kettle 2002 trial, midwives received standardised training in both techniques (interrupted and continuous) prior to the study commencing. However, due to rotation of midwives from the delivery suite and delay in starting the study, many of the participating midwives were not familiar with the continuous technique and were trained during the early part of the recruitment phase. During the first phase of the Kettle 2002 trial, senior midwives were more likely to undertake the continuous suturing. This imbalance was considered in a subsequent association analysis; however, there was no evidence of significant heterogeneity between groups.

Meta-analysis also showed that the continuous techniques were associated with a reduction in the need for suture removal up to three months following childbirth. One could argue that this finding may be due to the fact that continuous subcutaneous stitches are less accessible than interrupted transcutaneous stitches. Nevertheless, this finding is important, as most women find the experience of having sutures removed from perineal wounds very distressing.

Authors’ Conclusions

Implications for practice

The evidence produced by this review shows that continuous suturing techniques for perineal closure is associated with less short-term pain. However, if the continuous technique is used for all layers (vagina, perineal muscles and skin), the benefit in terms of reducing pain is even greater. For every five women who were sutured using the continuous suturing technique (for all layers), there will be one less complaining of pain up to day 10 postpartum compared to the interrupted method groups.

The continuous technique is easily performed by the novice or inexperienced operator. In addition, it has economical advantages in that the continuous technique requires one packet of suture material per perineal repair compared to two or more packets for the interrupted method (Kettle 2002). Therefore, the non-locking continuous suturing technique is recommended for repair of vagina and perineal muscles with a continuous subcutaneous stitch to close the perineal skin.

Implications for research

The review has highlighted the following areas that are worthy of further evaluation.

- Future trials relating to perineal trauma need to address outcomes that are important to women, including sexual problems and pelvic floor muscle dysfunction in the immediate and long-term period following childbirth.
- Research into the impact of standardised training programmes for the identification, management and repair of perineal trauma on short- and long-term maternal morbidity.
- Clinical trials to investigate techniques for the prevention of perineal trauma.

Acknowledgements

The Pregnancy and Childbirth Group (Liverpool) for their assistance and support during the preparation of this systematic review. As part of the pre-publication editorial process, this review has been commented on by two peers (an editor and referee who are external to the editorial team), one or more members of the Pregnancy and Childbirth Group’s international panel of consumers and the Group’s Statistical Adviser.
Continuous versus interrupted sutures for repair of episiotomy or second degree tears (Review)

References to studies included in this review

Banninger 1978 {published data only}

Croce 1997 {published data only}

Detlefsen 1980 {published data only}

Isager-Sally 1986 {published data only}

Kettle 2002 {published data only}

Mahomed 1989 {published data only}

Morano 1997 {published data only}

Glazener 1995

Grant 1989
Grant AM. Repair of perineal trauma after childbirth. In: Chalmers I, Enkin M, Keirse MJNC editor(s). Effective care in

References to studies excluded from this review

Bendsen 1980 {published data only}

Buchan 1980 {published data only}

Doyle 1993 {published data only}

Hansen 1975 {published data only}

References to studies awaiting assessment

Uslu 1992 {published data only}

Additional references

Christhilf 1962

Deeks 2001

Fernando 2006

Fleming 1983

Fleming 1990

Glazener 1995

Glazener 1997

Grant 1989
Grant AM. Repair of perineal trauma after childbirth. In: Chalmers I, Enkin M, Keirse MJNC editor(s). Effective care in

Greenland 1987

Guilhem 1960

Higgins 2005

Kettle 1999

Klein 1994

MacArthur 1991

Mandy 1951

McCandlish 1998

Olah 1994

RevMan 2003

Rucker 1930

Rucker 1939

Sleep 1984

Sleep 1991

References to other published versions of this review
Johanson 1995

Kettle 1998

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

#### Banninger 1978

| Methods | Allocated by 'alternating sequence' - quasi (non)-randomised.  
|         | No information available regarding concealment of treatment allocation or whether analysis was by 'intention to treat'.  
|         | Outcome assessment - not blinded.  
|         | All participants entered into the trial were included in the analysis. |
| Participants | 160 women having an episiotomy without complications. This was a subgroup of the main trial.  
|         | Method of delivery - spontaneous vaginal with cephalic presentation.  
|         | Parity - primigravidae.  
|         | Mean age - group 1 = 25.2; group 2 = 24.8.  
|         | Operator - doctors. |
| Interventions | Method of repair - described as below.  
|         | Participants divided into 2 groups.  
|         | Group 1 (n = 80) - vagina, perineal muscle and skin sutured using the interrupted technique with Dexon 2/0 on a 60 mm round bodied needle.  
|         | Group 2 (n = 80) - vagina and perineal muscle sutured using the interrupted technique with polyglycolic acid (Dexon) 2/0 on a 60 mm round bodied needle. Perineal skin closed using a continuous intracutaneous (subcutaneous)technique with Dexon 3/0 on a 16 mm 3/8 circle atraumatic cutting needle. |
| Outcomes | Included in analysis:  
|         | Short-term pain - day 7.  
|         | Analgesia - day 7.  
|         | Resuturing - day 7.  
|         | Dyspareunia - at 3 months. |
| Notes | Setting - Switzerland.  
|         | Method of repair - described.  
|         | Training period - not described.  
|         | Exclusion criteria - described.  
|         | Only one-third of participants followed up at 3 months.  
|         | Observation of cosmetic results at 3 months - no data available.  
|         | Participant inclusion criteria described.  
|         | Does not state if trial had Research Ethics Committee approval. |

#### Risk of bias

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors' judgement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocation concealment?</td>
<td>No</td>
<td>C - Inadequate</td>
</tr>
</tbody>
</table>
### Croce 1997

**Methods**
- Allocated by 'randomisation' matched for age, socioeconomic status and parity.
- No information available regarding concealment of treatment allocation. Analyses apparently intention to treat (all 202 women contribute) but no discussion of whether 202 women originally randomised.
- Outcome assessment - not blinded.

**Participants**
- 202 women with selective episiotomy.
  - Mean age - group A: 29.5 years, group B: 27.7 years. Operator not stated.

**Interventions**
- Participants divided into 2 groups.
  - Group A (n = 100) - vaginal trauma sutured with a continuous (Guilmen-Pontonnier technique) with catgut.
  - Group B (n = 102) interrupted (Blair-Donatti technique) with catgut.

**Outcomes**
- Included in analysis:
  - Short-term pain - at 24 and 76 hours.
  - Long-term pain - at 1, 2 and 3 months postpartum.
  - Dyspareunia. Also, infection, haematoma and cosmetic results (not reported).

**Notes**
- Setting - single center (Codogno Civic Hospital, Italy).
- Method of repair - described.

### Risk of bias

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors' judgement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - Unclear</td>
</tr>
</tbody>
</table>

### Detlefsen 1980

**Methods**
- Allocated by 'randomisation' - method not described.
- No information available regarding concealment of treatment allocation or whether analysis was by 'intention to treat'.
- Outcome assessment - not blinded.

**Participants**
- 117 women with a medio-lateral episiotomy. This was a subgroup of the main trial.
  - Method of delivery - spontaneous vaginal with cephalic presentation.
  - Parity - primigravida and multigravida included.
  - Mean age - not specified between groups.
  - Operator - doctors and midwives.

**Interventions**
- Participants divided into 2 groups.
  - Group 1 (n = 65) - vaginal trauma sutured with a continuous locking stitch, perineal muscle and skin sutured using the interrupted technique with Dexon 1/0 on a T-125 needle.
  - Group 2 (n = 52) - vaginal trauma sutured with a continuous locking stitch, perineal muscle closed with a continuous non-locking (running) stitch and perineal skin closed using an intracutaneous (subcuticular) technique with Dexon 1/0 on a T-125 needle.
Detlefsen 1980  
(Continued)

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Included in analysis:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dyspareunia - at 2 months.</td>
</tr>
<tr>
<td></td>
<td>Not included in analysis due to data being presented in unsuitable format:</td>
</tr>
<tr>
<td></td>
<td>Short-term pain - day 5.</td>
</tr>
<tr>
<td></td>
<td>Analgesia - day 5.</td>
</tr>
</tbody>
</table>

| Notes | Setting - Denmark. |
|       | Method of repair - described. |
|       | Training period - midwives and doctors underwent training for 1 month in the new suturing technique used in Group 2. |
|       | All women delivered between 01/04/78 and 31/07/78 with an episiotomy were randomised into the trial. |
|       | Long-term follow up - 2 months and 6 months postpartum. |
|       | Does not state if trial had Research Ethics Committee approval. |

<table>
<thead>
<tr>
<th>Risk of bias</th>
<th>Item</th>
<th>Authors' judgement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - Unclear</td>
</tr>
</tbody>
</table>

Isager-Sally 1986

| Methods | Allocated randomly into treatment groups. |
|         | Concealed treatment allocation - sealed envelopes, (envelopes contained a number indicating the method to be used for repair). |
|         | Outcome assessment - not blinded due to obvious differences in suturing techniques. |
|         | Analysis for only those participants still in the hospital at 5th day (not 'intention to treat' - missing data possibly outcome dependent). |
|         | 70 participants excluded from analysis - reasons stated. |

| Participants | 530 women with medio-lateral episiotomy were analysed. This was a subgroup of the main trial. |
|             | Method of delivery - spontaneous or instrumental vaginal deliveries. |
|             | Parity - primigravidae and multiparae. |
|             | Mean age - group 1 = 27.5; group 2 = 27.1. |
|             | Operators - midwives and experienced obstetricians. |

| Interventions | Method of repair - described as below. |
|               | Participants divided into 2 groups. |
|               | Group 1 (n = 263) - vaginal trauma sutured with a continuous locking stitch, perineal muscle and skin sutured using the interrupted technique with polyglycolic acid (Dexon) suture material gauge 0 - needle size not specified. |
|               | Group 2 (n = 267) - vaginal trauma sutured with a continuous locking stitch, perineal muscle closed with a continuous non-locking (running) stitch and perineal skin closed using an intracutaneous (subcuticular) technique with polyglycolic acid (Dexon) suture material gauge 0 - needle size not specified. |

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Included in analysis:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Short-term pain - day 5.</td>
</tr>
<tr>
<td></td>
<td>Long-term pain - 3 months.</td>
</tr>
</tbody>
</table>
Notes
Setting - Herlev Hospital, Denmark.
Method of repair - method described.
Training period - introductory period of several months to make sure all members of staff were familiar
with the new suturing technique used in group 2.
Does not state if trial had Research Ethics Committee approval.
Response rate at 3 months - group 1 = 95%; group 2 = 99% (of those who responded at 5 days - numbers
randomised per arm not given).

Risk of bias

<table>
<thead>
<tr>
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<th>Description</th>
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<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Yes</td>
<td>A - Adequate</td>
</tr>
</tbody>
</table>

Kettle 2002

Methods
Allocated randomly - random permuted blocks.
Concealed treatment allocation - serially numbered, sealed opaque envelopes, (envelopes contained 2
packets of masked suture material and instructions for method of repair on different coloured cards).
Acknowledged that fully blind assessment was not possible due to obvious differences in suture techniques.
Analysis by ‘intention to treat’.
Factorial - 2 x 2 design.

Participants
1542 women needing perineal repair following delivery, (second degree tears and episiotomies included).
Method of delivery - spontaneous vaginal deliveries.
Parity - primiparous and multiparous.
Mean age - continuous (group A) 27.2; interrupted (group B) 27.2.
Operators - midwives (n = 150) - 29 women sutured by doctor.

Interventions
Method of repair - described as below.
Participants divided into 2 groups.
Group A (n = 771) vaginal trauma, perineal muscle and skin repaired with a continuous non-locking
suture technique. 50% were repaired with undyed Vicryl Rapide 2/0 on a 35 mm tapercut needle and
50% were repaired with undyed standard Vicryl on a 35 mm tapercut needle.
Group B (n = 771) vaginal trauma repaired with a locking continuous stitch; perineal muscle and skin
sutured using the interrupted method. 50% were repaired with undyed Vicryl Rapide 2/0 on a 35 mm
tapercut needle and 50% were repaired with undyed standard Vicryl on a 35 mm tapercut needle.

Outcomes
Included in analysis:
Short-term pain - day 2 and 10.
Pain when walking, sitting, passing urine, opening bowels at 10 days.
Analgesia - day 10.
Long-term pain - 3 months and 12 months.
Dyspareunia - 3 and 12 months.
Removal of suture material at 3 months.
(Additional analyses in Kettle (2002).)
### Notes
- Setting - UK district general hospital.
- Method of repair - described.
- Training period - described.
- Concealed interim analysis after 400 women entered the trial.
- Ethics Committee Approval.
- One envelope unaccounted for.
- 96.7% response rate at 3 months and 90% at 12 months.

### Risk of bias

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<tr>
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<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Yes</td>
<td>A - Adequate</td>
</tr>
</tbody>
</table>

### Mahomed 1989

**Methods**
- Allocated randomly - random-number tables.
- Concealed treatment allocation - serially numbered, sealed opaque envelopes, (envelopes contained suture material and instructions for method of repair).
- Acknowledged that fully blind assessment was not possible due to obvious differences in suture materials and techniques.
- Analysis by 'intention to treat'.
- Modified factorial - 2 x 3 x 2 design.

**Participants**
- 1057 women needing perineal repair following delivery, (all tears and episiotomies included). This was a subgroup of the main trial.
- Method of delivery - spontaneous or instrumental vaginal deliveries.
- Parity - primigravidae and multiparae.
- Mean age - 26.0/25.9.
- Operators - midwives, senior house officers, registrars, consultants, medical students.

**Interventions**
- Method of repair - described as below.
- Participants divided into 2 groups.
  - Group 1 (n = 524) vaginal trauma repaired with a continuous stitch, perineal muscle and skin sutured using the interrupted technique. 50% were repaired with Dexon (plus) 2/0 on a multipurpose needle and 50% were repaired with chromic catgut on a 35 mm tapercut needle.
  - Group 2 (n = 533) vaginal trauma repaired with a continuous stitch, perineal muscle apposed with interrupted stitches and skin sutured using the continuous subcuticular technique. 50% were repaired with Dexon (plus) 2/0 on a multipurpose needle and 50% were repaired with chromic catgut on a 35 mm tapercut needle.

**Outcomes**
- Included in analysis:
  - Short-term pain - day 2 and 10.
  - Long-term pain - 3 months.
  - Analgesia - day 2 and 10.
  - Resuturing - up to 3 months.
  - Dyspareunia - 3 months.
  - Removal of suture material - 3 months.
Mahomed 1989  (Continued)

| Notes | Setting - Southmead Hospital, Bristol.  
Method of repair - method described.  
Subcuticular technique was unpopular with some operators.  
Training period - not described.  
No interim analysis.  
Ethics Committee Approval.  
22 envelopes were unaccounted for.  
Preset trial size had 80% chance of detecting significant clinical differences.  
85% response rate at 3 months. |

<table>
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<tr>
<th>Risk of bias</th>
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<tbody>
<tr>
<td><strong>Item</strong></td>
</tr>
<tr>
<td>Allocation concealment?</td>
</tr>
</tbody>
</table>

Morano 2006

| Methods | Allocated randomly - computer generated list of numbers  
Concealed treatment allocation - sealed and consecutively numbered opaque envelopes (instructions for method of repair written on cards within envelopes).  
Outcome assessment - stated to be double blinded (surgeon, woman and person assessing perineal pain were unaware of group assigned). It would be difficult to blind the assessment of wound healing due to obvious differences in suturing techniques.  
Analyses by 'intention to treat' |
| Participants | 214 women with a second-degree tear or episiotomy.  
Method of delivery - spontaneous vaginal deliveries after 37 weeks gestation.  
Parity - primiparous  
Mean age - continuous (group A): 28 years, interrupted (group B): 27 years.  
Operators - young medical doctors with supervision provided by an experienced doctor. |
| Interventions | Method of repair - as described below.  
Participants divided into 2 groups.  
Group A (n = 107) - vaginal trauma, perineal muscles and skin repaired with loose, continuous non-locking technique. Suture material rapidly absorbed polyglactin 910 (Vicryl Rapide) - gauge 0 for vagina, perineal muscles and skin. Needle size not specified.  
Group B (n = 107) - vaginal trauma repaired with a continuous non-locking stitch; perineal muscle and skin sutured with interrupted method. Suture material: rapidly absorbed polyglactin 910 (Vicryl Rapide) - gauge 0 for vagina, 1 for perineal muscles and 2/0 for skin. Needle size not specified. |
| Outcomes | Included in analysis:  
Short-term pain - at 48 hours and 10 days.  
Suture removal, wound dehiscence - at 10 days.  
Oral analgesia - at 48 hours.  
Dyspareunia - at 3 months. |
Setting - single center (University Hospital, Italy).
Method of repair - method described.
Training period - doctors had opportunity to practice two methods prior to commencement of study.
Local research ethics committee approval obtained.

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors’ judgement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Yes</td>
<td>A - Adequate</td>
</tr>
</tbody>
</table>

mm: millimetre

**Characteristics of excluded studies**  
*ordered by study ID*

<table>
<thead>
<tr>
<th>Study</th>
<th>Reason for exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bendsen 1980</td>
<td>This study was excluded from the meta-analysis due to non-absorbable and absorbable material being compared which may have had a confounding effect on the results.</td>
</tr>
<tr>
<td>Buchan 1980</td>
<td>This study was excluded from the meta-analysis due to non-absorbable and absorbable material being compared which may have had a confounding effect on the results.</td>
</tr>
<tr>
<td>Doyle 1993</td>
<td>This study was excluded from the meta-analysis due to non-absorbable and absorbable material being compared which may have had a confounding effect on the results.</td>
</tr>
<tr>
<td>Hansen 1975</td>
<td>This study was excluded from the meta-analysis due to non-absorbable and absorbable material being compared which may have had a confounding effect on the results.</td>
</tr>
<tr>
<td>Roberts 1993</td>
<td>This study was excluded from the meta-analysis due to non-absorbable and absorbable material being compared which may have had a confounding effect on the results.</td>
</tr>
</tbody>
</table>
### Comparison 1. Continuous versus interrupted sutures for repair of all layers or perineal skin only

<table>
<thead>
<tr>
<th>Outcome or subgroup title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Short-term pain - up to day 10</td>
<td>6</td>
<td>3527</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.70 [0.64, 0.76]</td>
</tr>
<tr>
<td>2 Analgesia - up to day 10</td>
<td>4</td>
<td>2821</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.70 [0.58, 0.84]</td>
</tr>
<tr>
<td>3 Resuturing - up to 3 months</td>
<td>4</td>
<td>2812</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>1.47 [0.42, 5.19]</td>
</tr>
<tr>
<td>4 Long-term pain - up to 3 months postpartum</td>
<td>2</td>
<td>2408</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.86 [0.69, 1.07]</td>
</tr>
<tr>
<td>5 Dyspareunia - up to 3 months postpartum</td>
<td>6</td>
<td>2974</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.93 [0.81, 1.06]</td>
</tr>
<tr>
<td>6 Failure to resume pain-free intercourse - 3 months postpartum</td>
<td>2</td>
<td>2305</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>1.07 [0.93, 1.24]</td>
</tr>
<tr>
<td>7 Removal of suture material - up to 3 months postpartum</td>
<td>3</td>
<td>2650</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.54 [0.45, 0.65]</td>
</tr>
</tbody>
</table>

### Comparison 2. Subgroup analysis: continuous versus interrupted (all layers)

<table>
<thead>
<tr>
<th>Outcome or subgroup title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Short-term pain - up to day 10</td>
<td>4</td>
<td>2459</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.65 [0.60, 0.71]</td>
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<tr>
<td>2 Analgesia - up to day 10</td>
<td>2</td>
<td>1753</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.63 [0.51, 0.78]</td>
</tr>
<tr>
<td>3 Dyspareunia - up to 3 months postpartum</td>
<td>5</td>
<td>2149</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.83 [0.70, 0.98]</td>
</tr>
</tbody>
</table>

### Comparison 3. Subgroup analysis: continuous versus interrupted (skin only)

<table>
<thead>
<tr>
<th>Outcome or subgroup title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Short-term pain - up to day 10</td>
<td>2</td>
<td>1068</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.89 [0.73, 1.07]</td>
</tr>
<tr>
<td>2 Analgesia - up to day 10</td>
<td>2</td>
<td>1068</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.88 [0.63, 1.22]</td>
</tr>
<tr>
<td>3 Dyspareunia - up to 3 months postpartum</td>
<td>1</td>
<td>825</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>1.17 [0.92, 1.48]</td>
</tr>
</tbody>
</table>
**Analysis 1.1.** **Comparison 1** Continuous versus interrupted sutures for repair of all layers or perineal skin only, **Outcome 1** Short-term pain - up to day 10.

Review: Continuous versus interrupted sutures for repair of episiotomy or second degree tears

Comparison: Continuous versus interrupted sutures for repair of all layers or perineal skin only

Outcome: Short-term pain - up to day 10

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Treatment</th>
<th>Control</th>
<th>Risk Ratio</th>
<th>Weight</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>M-H,Fixed,95% CI</td>
<td></td>
<td>M-H,Fixed,95% CI</td>
</tr>
<tr>
<td>Kettle 2002</td>
<td>204/770</td>
<td>338/769</td>
<td>41.4 %</td>
<td>0.60 [ 0.52, 0.69 ]</td>
<td></td>
</tr>
<tr>
<td>Isager-Sally 1986</td>
<td>156/262</td>
<td>214/261</td>
<td>26.3 %</td>
<td>0.73 [ 0.65, 0.81 ]</td>
<td></td>
</tr>
<tr>
<td>Mahomed 1989</td>
<td>129/447</td>
<td>150/461</td>
<td>18.1 %</td>
<td>0.89 [ 0.73, 1.08 ]</td>
<td></td>
</tr>
<tr>
<td>Croce 1997</td>
<td>40/100</td>
<td>50/102</td>
<td>6.1 %</td>
<td>0.82 [ 0.60, 1.11 ]</td>
<td></td>
</tr>
<tr>
<td>Banninger 1978</td>
<td>7/80</td>
<td>8/80</td>
<td>1.0 %</td>
<td>0.88 [ 0.33, 2.30 ]</td>
<td></td>
</tr>
<tr>
<td>Morano 2006</td>
<td>32/99</td>
<td>58/96</td>
<td>7.2 %</td>
<td>0.54 [ 0.39, 0.74 ]</td>
<td></td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>1758</strong></td>
<td><strong>1769</strong></td>
<td><strong>100.0 %</strong></td>
<td><strong>0.70 [ 0.64, 0.76 ]</strong></td>
<td></td>
</tr>
</tbody>
</table>

Total events: Treatment, 568; Control, 818

Heterogeneity: Chi² = 14.00, df = 5 (P = 0.02); I² = 64%

Test for overall effect: Z = 8.77 (P < 0.00001)

---

Continuous versus interrupted sutures for repair of episiotomy or second degree tears (Review)

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Analysis 1.2. Comparison 1 Continuous versus interrupted sutures for repair of all layers or perineal skin only, Outcome 2 Analgesia - up to day 10.

Review: Continuous versus interrupted sutures for repair of episiotomy or second degree tears

Comparison: 1 Continuous versus interrupted sutures for repair of all layers or perineal skin only

Outcome: 2 Analgesia - up to day 10

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Treatment</th>
<th>Control</th>
<th>Risk Ratio</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>M-H,Fixed,95% CI</td>
<td></td>
</tr>
<tr>
<td>Kettle 2002</td>
<td>66/770</td>
<td>104/769</td>
<td>46.0 %</td>
<td>0.63 [ 0.47, 0.85 ]</td>
</tr>
<tr>
<td>Mahomed 1989</td>
<td>33/447</td>
<td>41/461</td>
<td>17.8 %</td>
<td>0.83 [ 0.53, 1.29 ]</td>
</tr>
<tr>
<td>Banninger 1978</td>
<td>23/80</td>
<td>24/80</td>
<td>10.6 %</td>
<td>0.96 [ 0.59, 1.55 ]</td>
</tr>
<tr>
<td>Morano 2006</td>
<td>36/107</td>
<td>58/107</td>
<td>25.6 %</td>
<td>0.62 [ 0.45, 0.85 ]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>1404</td>
<td>1417</td>
<td>100.0 %</td>
<td>0.70 [ 0.58, 0.84 ]</td>
</tr>
</tbody>
</table>

Total events: 158 (Treatment), 227 (Control)
Heterogeneity: Chi² = 3.21, df = 3 (P = 0.36); I² = 7%
Test for overall effect: Z = 3.85 (P = 0.00012)

Analysis 1.3. Comparison 1 Continuous versus interrupted sutures for repair of all layers or perineal skin only, Outcome 3 Resuturing - up to 3 months.

Review: Continuous versus interrupted sutures for repair of episiotomy or second degree tears

Comparison: 1 Continuous versus interrupted sutures for repair of all layers or perineal skin only

Outcome: 3 Resuturing - up to 3 months

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Treatment</th>
<th>Control</th>
<th>Risk Ratio</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>M-H,Fixed,95% CI</td>
<td>M-H,Fixed,95% CI</td>
</tr>
<tr>
<td>Kettle 2002</td>
<td>3/770</td>
<td>1/771</td>
<td>3.00 [ 0.31, 28.81 ]</td>
<td></td>
</tr>
<tr>
<td>Mahomed 1989</td>
<td>3/465</td>
<td>3/451</td>
<td>0.97 [ 0.20, 4.78 ]</td>
<td></td>
</tr>
<tr>
<td>Banninger 1978</td>
<td>0/80</td>
<td>0/80</td>
<td>0.0 [ 0.0, 0.0 ]</td>
<td></td>
</tr>
<tr>
<td>Morano 2006</td>
<td>0/99</td>
<td>0/96</td>
<td>0.0 [ 0.0, 0.0 ]</td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>1414</td>
<td>1398</td>
<td>1.47 [ 0.42, 5.19 ]</td>
<td></td>
</tr>
</tbody>
</table>

Total events: 6 (Treatment), 4 (Control)
Heterogeneity: Chi² = 0.65, df = 1 (P = 0.42); I² = 0%
Test for overall effect: Z = 0.60 (P = 0.55)
### Analysis 1.4. Comparison 1 Continuous versus interrupted sutures for repair of all layers or perineal skin only, Outcome 4 Long-term pain - up to 3 months postpartum.

**Review:** Continuous versus interrupted sutures for repair of episiotomy or second degree tears  
**Comparison:** 1 Continuous versus interrupted sutures for repair of all layers or perineal skin only  
**Outcome:** 4 Long-term pain - up to 3 months postpartum

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Treatment</th>
<th>Control</th>
<th>Risk Ratio</th>
<th>Weight</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>M-H,Fixed,95% CI</td>
<td>M-H,Fixed,95% CI</td>
<td></td>
</tr>
<tr>
<td>Kettle 2002</td>
<td>70/751</td>
<td>95/741</td>
<td>0.73 [ 0.54, 0.97 ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mahomed 1989</td>
<td>58/465</td>
<td>51/451</td>
<td>1.10 [ 0.77, 1.57 ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>1216</strong></td>
<td><strong>1192</strong></td>
<td><strong>100.0 %</strong></td>
<td><strong>0.86 [ 0.69, 1.07 ]</strong></td>
<td></td>
</tr>
</tbody>
</table>

Total events: 128 (Treatment), 146 (Control)  
Heterogeneity: Chi² = 3.18, df = 1 (P = 0.07); I² = 69%  
Test for overall effect: Z = 1.33 (P = 0.18)
Analysis 1.5. Comparison 1 Continuous versus interrupted sutures for repair of all layers or perineal skin only, Outcome 5 Dyspareunia - up to 3 months postpartum.

Review: Continuous versus interrupted sutures for repair of episiotomy or second degree tears

Comparison: 1 Continuous versus interrupted sutures for repair of all layers or perineal skin only

Outcome: 5 Dyspareunia - up to 3 months postpartum

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Treatment</th>
<th>Control</th>
<th>Risk Ratio</th>
<th>Weight</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>M-H,Fixed,95% CI</td>
<td></td>
<td>M-H,Fixed,95% CI</td>
</tr>
<tr>
<td>Kettle 2002</td>
<td>98/581</td>
<td>102/593</td>
<td>0.98 [ 0.76, 1.26 ]</td>
<td>30.4 %</td>
<td></td>
</tr>
<tr>
<td>Isager-Sally 1986</td>
<td>45/265</td>
<td>58/250</td>
<td>0.73 [ 0.52, 1.04 ]</td>
<td>18.0 %</td>
<td></td>
</tr>
<tr>
<td>Mahomed 1989</td>
<td>116/424</td>
<td>94/401</td>
<td>1.17 [ 0.92, 1.48 ]</td>
<td>29.1 %</td>
<td></td>
</tr>
<tr>
<td>Croce 1997</td>
<td>24/100</td>
<td>25/102</td>
<td>0.98 [ 0.60, 1.59 ]</td>
<td>7.5 %</td>
<td></td>
</tr>
<tr>
<td>Detlefsen 1980</td>
<td>11/45</td>
<td>32/48</td>
<td>0.37 [ 0.21, 0.64 ]</td>
<td>9.3 %</td>
<td></td>
</tr>
<tr>
<td>Morano 2006</td>
<td>18/87</td>
<td>18/78</td>
<td>0.90 [ 0.50, 1.60 ]</td>
<td>5.7 %</td>
<td></td>
</tr>
</tbody>
</table>

Total (95% CI) 1502 1472 100.0 % 0.93 [ 0.81, 1.06 ]

Total events: 312 (Treatment), 329 (Control)
Heterogeneity: Chi^2 = 16.57, df = 5 (P = 0.01); I^2 = 70%
Test for overall effect: Z = 1.07 (P = 0.28)

Analysis 1.6. Comparison 1 Continuous versus interrupted sutures for repair of all layers or perineal skin only, Outcome 6 Failure to resume pain-free intercourse - 3 months postpartum.

Review: Continuous versus interrupted sutures for repair of episiotomy or second degree tears

Comparison: 1 Continuous versus interrupted sutures for repair of all layers or perineal skin only

Outcome: 6 Failure to resume pain-free intercourse - 3 months postpartum

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Treatment</th>
<th>Control</th>
<th>Risk Ratio</th>
<th>Weight</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>M-H,Fixed,95% CI</td>
<td></td>
<td>M-H,Fixed,95% CI</td>
</tr>
<tr>
<td>Kettle 2002</td>
<td>136/700</td>
<td>123/689</td>
<td>1.09 [ 0.87, 1.36 ]</td>
<td>45.9 %</td>
<td></td>
</tr>
<tr>
<td>Mahomed 1989</td>
<td>157/465</td>
<td>144/451</td>
<td>1.06 [ 0.88, 1.27 ]</td>
<td>54.1 %</td>
<td></td>
</tr>
</tbody>
</table>

Total (95% CI) 1165 1140 100.0 % 1.07 [ 0.93, 1.24 ]

Total events: 293 (Treatment), 267 (Control)
Heterogeneity: Chi^2 = 0.04, df = 1 (P = 0.84); I^2 = 0.0%
Test for overall effect: Z = 0.95 (P = 0.34)
Analysis 1.7. Comparison 1 Continuous versus interrupted sutures for repair of all layers or perineal skin only, Outcome 7 Removal of suture material - up to 3 months postpartum.

Review: Continuous versus interrupted sutures for repair of episiotomy or second degree tears

Comparison: 1 Continuous versus interrupted sutures for repair of all layers or perineal skin only

Outcome: 7 Removal of suture material - up to 3 months postpartum

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Treatment n/N</th>
<th>Control n/N</th>
<th>Risk Ratio M-H,Fixed 95% CI</th>
<th>Risk Ratio M-H,Fixed 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kettle 2002</td>
<td>24/770</td>
<td>96/769</td>
<td>0.25 [ 0.16, 0.39 ]</td>
<td></td>
</tr>
<tr>
<td>Mahomed 1989</td>
<td>121/465</td>
<td>166/451</td>
<td>0.71 [ 0.58, 0.86 ]</td>
<td></td>
</tr>
<tr>
<td>Morano 2006</td>
<td>0/99</td>
<td>0/96</td>
<td>0.0 [ 0.0, 0.0 ]</td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>1334</td>
<td>1316</td>
<td>0.54 [ 0.45, 0.65 ]</td>
<td></td>
</tr>
</tbody>
</table>

Total events: 145 (Treatment), 262 (Control)

Heterogeneity: $\chi^2 = 19.30, df = 1 (P = 0.00001); I^2 = 95$

Test for overall effect: $Z = 6.76 (P < 0.00001)$
Analysis 2.1. Comparison 2 Subgroup analysis: continuous versus interrupted (all layers), Outcome 1 Short-term pain - up to day 10.

Review: Continuous versus interrupted sutures for repair of episiotomy or second degree tears

Comparison: 2 Subgroup analysis: continuous versus interrupted (all layers)

Outcome: 1 Short-term pain - up to day 10

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Treatment n/N</th>
<th>Control n/N</th>
<th>Risk Ratio M-H,Fixed,95% CI</th>
<th>Weight</th>
<th>Risk Ratio M-H,Fixed,95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kettle 2002</td>
<td>204/770</td>
<td>338/769</td>
<td>51.2% 0.60 [0.52, 0.69]</td>
<td>51.2%</td>
<td>0.60 [0.52, 0.69]</td>
</tr>
<tr>
<td>Isager-Sally 1986</td>
<td>156/262</td>
<td>214/261</td>
<td>32.4% 0.73 [0.65, 0.81]</td>
<td>32.4%</td>
<td>0.73 [0.65, 0.81]</td>
</tr>
<tr>
<td>Croce 1997</td>
<td>40/100</td>
<td>50/102</td>
<td>7.5% 0.82 [0.60, 1.11]</td>
<td>7.5%</td>
<td>0.82 [0.60, 1.11]</td>
</tr>
<tr>
<td>Morano 2006</td>
<td>32/99</td>
<td>58/96</td>
<td>8.9% 0.54 [0.39, 0.74]</td>
<td>8.9%</td>
<td>0.54 [0.39, 0.74]</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>1231</strong></td>
<td><strong>1228</strong></td>
<td><strong>100.0% 0.65 [0.60, 0.71]</strong></td>
<td>100.0%</td>
<td>0.65 [0.60, 0.71]</td>
</tr>
</tbody>
</table>

Heterogeneity: Chi² = 7.91, df = 3 (P = 0.05); I² = 62%
Test for overall effect: Z = 9.46 (P < 0.00001)

Analysis 2.2. Comparison 2 Subgroup analysis: continuous versus interrupted (all layers), Outcome 2 Analgesia - up to day 10.

Review: Continuous versus interrupted sutures for repair of episiotomy or second degree tears

Comparison: 2 Subgroup analysis: continuous versus interrupted (all layers)

Outcome: 2 Analgesia - up to day 10

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Treatment n/N</th>
<th>Control n/N</th>
<th>Risk Ratio M-H,Fixed,95% CI</th>
<th>Weight</th>
<th>Risk Ratio M-H,Fixed,95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kettle 2002</td>
<td>66/770</td>
<td>104/769</td>
<td>64.2% 0.63 [0.47, 0.85]</td>
<td>64.2%</td>
<td>0.63 [0.47, 0.85]</td>
</tr>
<tr>
<td>Morano 2006</td>
<td>36/107</td>
<td>58/107</td>
<td>35.8% 0.62 [0.45, 0.85]</td>
<td>35.8%</td>
<td>0.62 [0.45, 0.85]</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>877</strong></td>
<td><strong>876</strong></td>
<td><strong>100.0% 0.63 [0.51, 0.78]</strong></td>
<td>100.0%</td>
<td>0.63 [0.51, 0.78]</td>
</tr>
</tbody>
</table>

Heterogeneity: Chi² = 0.01, df = 1 (P = 0.92); I² = 0.0%
Test for overall effect: Z = 4.14 (P = 0.000035)
## Analysis 2.3. Comparison 2 Subgroup analysis: continuous versus interrupted (all layers), Outcome 3 Dyspareunia - up to 3 months postpartum.

Review: Continuous versus interrupted sutures for repair of episiotomy or second degree tears
Comparison: 2 Subgroup analysis: continuous versus interrupted (all layers)
Outcome: 3 Dyspareunia - up to 3 months postpartum

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Treatment</th>
<th>Control</th>
<th>Risk Ratio</th>
<th>Weight</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>M-H (Fixed, 95% CI)</td>
<td></td>
<td>M-H (Fixed, 95% CI)</td>
</tr>
<tr>
<td>Kettle 2002</td>
<td>98/581</td>
<td>102/593</td>
<td>42.9 %</td>
<td>0.98</td>
<td>[0.76, 1.26]</td>
</tr>
<tr>
<td>Isager-Sally 1986</td>
<td>45/265</td>
<td>58/250</td>
<td>25.4 %</td>
<td>0.73</td>
<td>[0.52, 1.04]</td>
</tr>
<tr>
<td>Croce 1997</td>
<td>24/100</td>
<td>25/102</td>
<td>10.5 %</td>
<td>0.98</td>
<td>[0.60, 1.59]</td>
</tr>
<tr>
<td>Detlefsen 1980</td>
<td>11/45</td>
<td>32/48</td>
<td>13.2 %</td>
<td>0.37</td>
<td>[0.21, 0.64]</td>
</tr>
<tr>
<td>Morano 2006</td>
<td>18/87</td>
<td>18/78</td>
<td>8.1 %</td>
<td>0.90</td>
<td>[0.50, 1.60]</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td>1078</td>
<td>1071</td>
<td>100.0 %</td>
<td>0.83</td>
<td>[0.70, 0.98]</td>
</tr>
</tbody>
</table>

Total events: 196 (Treatment), 235 (Control)
Heterogeneity: $\chi^2 = 11.12$, df = 4 ($P = 0.03$); $I^2 = 64\%$
Test for overall effect: $Z = 2.16$ ($P = 0.030$)

### Analysis 3.1. Comparison 3 Subgroup analysis: continuous versus interrupted (skin only), Outcome 1 Short-term pain - up to day 10.

Review: Continuous versus interrupted sutures for repair of episiotomy or second degree tears
Comparison: 3 Subgroup analysis: continuous versus interrupted (skin only)
Outcome: 1 Short-term pain - up to day 10

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Treatment</th>
<th>Control</th>
<th>Risk Ratio</th>
<th>Weight</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>M-H (Fixed, 95% CI)</td>
<td></td>
<td>M-H (Fixed, 95% CI)</td>
</tr>
<tr>
<td>Mahomed 1989</td>
<td>129/447</td>
<td>150/461</td>
<td>94.9 %</td>
<td>0.89</td>
<td>[0.73, 1.08]</td>
</tr>
<tr>
<td>Banninger 1978</td>
<td>7/80</td>
<td>8/80</td>
<td>5.1 %</td>
<td>0.88</td>
<td>[0.33, 2.30]</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td>527</td>
<td>541</td>
<td>100.0 %</td>
<td>0.89</td>
<td>[0.73, 1.07]</td>
</tr>
</tbody>
</table>

Total events: 136 (Treatment), 158 (Control)
Heterogeneity: $\chi^2 = 0.00$, df = 1 ($P = 0.98$); $I^2 = 0.0\%$
Test for overall effect: $Z = 1.23$ ($P = 0.22$)
Analysis 3.2. Comparison 3 Subgroup analysis: continuous versus interrupted (skin only), Outcome 2 Analgesia - up to day 10.

Review: Continuous versus interrupted sutures for repair of episiotomy or second degree tears

Comparison: 3 Subgroup analysis: continuous versus interrupted (skin only)

Outcome: 2 Analgesia - up to day 10

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Treatment n/N</th>
<th>Control n/N</th>
<th>Risk Ratio M-H,Fixed,95% CI</th>
<th>Weight %</th>
<th>Risk Ratio M-H,Fixed,95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mahomed 1989</td>
<td>33/447</td>
<td>41/461</td>
<td></td>
<td>62.7 %</td>
<td>0.83 [ 0.53, 1.29 ]</td>
</tr>
<tr>
<td>Banninger 1978</td>
<td>23/80</td>
<td>24/80</td>
<td></td>
<td>37.3 %</td>
<td>0.96 [ 0.59, 1.55 ]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>527</td>
<td>541</td>
<td></td>
<td>100.0 %</td>
<td>0.88 [ 0.63, 1.22 ]</td>
</tr>
</tbody>
</table>

Total events: 56 (Treatment), 65 (Control)
Heterogeneity: Chi² = 0.19, df = 1 (P = 0.66); I² =0.0%
Test for overall effect: Z = 0.78 (P = 0.44)

Analysis 3.3. Comparison 3 Subgroup analysis: continuous versus interrupted (skin only), Outcome 3 Dyspareunia - up to 3 months postpartum.

Review: Continuous versus interrupted sutures for repair of episiotomy or second degree tears

Comparison: 3 Subgroup analysis: continuous versus interrupted (skin only)

Outcome: 3 Dyspareunia - up to 3 months postpartum

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Treatment n/N</th>
<th>Control n/N</th>
<th>Risk Ratio M-H,Fixed,95% CI</th>
<th>Weight %</th>
<th>Risk Ratio M-H,Fixed,95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mahomed 1989</td>
<td>116/424</td>
<td>94/401</td>
<td></td>
<td>100.0 %</td>
<td>1.17 [ 0.92, 1.48 ]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>424</td>
<td>401</td>
<td></td>
<td>100.0 %</td>
<td>1.17 [ 0.92, 1.48 ]</td>
</tr>
</tbody>
</table>

Total events: 116 (Treatment), 94 (Control)
Heterogeneity: not applicable
Test for overall effect: Z = 1.29 (P = 0.20)
WHAT'S NEW

Last assessed as up-to-date: 11 July 2007.

1 September 2008      Amended      Converted to new review format.

HISTORY

Protocol first published: Issue 1, 1997
Review first published: Issue 1, 1998

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 July 2007</td>
<td>New citation required and conclusions have changed</td>
<td>Meta-analysis indicates that the subcutaneous suturing technique for perineal skin closure is associated with less short-term pain, however a subgroup analysis showed that if the continuous technique is used for all layers (vagina, perineal muscles and skin) the reduction in pain is more significant.</td>
</tr>
<tr>
<td>30 June 2007</td>
<td>New search has been performed</td>
<td>Search updated. Two new studies were added to the included studies and four were added to the excluded studies. Changes to the text have been made to reflect new data.</td>
</tr>
</tbody>
</table>

CONTRIBUTIONS OF AUTHORS

This update is based on the previous Cochrane review ‘Continuous versus interrupted sutures for perineal repair’ by Christine Kettle (CK) and Richard B Johanson.

CK co-ordinated the update. All three review authors (CK, Robert K Hills (RKH) and Khaled MK Ismail (KMKI)) critically appraised all papers for quality and eligibility independently. CK, KMKI and RKH independently extracted the data and CK and KMKI entered them onto the Review Manager software. RKH checked all entered data for accuracy. RKH provided statistical advice relating to subgroup analysis to investigate heterogeneity between studies. CK and KMKI drafted the updated review and RKH checked the final document for accuracy, including data interpretation prior to submission.

KMKI and Dr V Dhingra (research fellow/SPR obstetrics and gynaecology) independently assessed one of the included studies (Kettle 2002) for quality and extracted the data onto bespoke proforma due to possible conflict of interest by the two other review authors (CK and RKH).
DECLARATIONS OF INTEREST

Christine Kettle (CK) was the recipient of a fellowship from the Iolanthe Midwifery Research Trust 1996, which provided funding to enable her to carry out a randomised controlled trial of perineal repair following childbirth (Kettle 2002). The Iolanthe Midwifery Research Trust and Ethicon Ltd, UK (manufacturers of suture material) provided funding for employment of a part-time data management clerk for that trial.

CK and Khaled MK Ismail run perineal repair workshops both nationally and internationally and have developed an episiotomy and second-degree tear training model with Limbs & Things, UK.

Robert K Hills has no known conflict of interest.

INDEX TERMS

Medical Subject Headings (MeSH)
* Delivery, Obstetric; *Episiotomy; *Suture Techniques; Obstetric Labor Complications [surgery]; Perineum [*injuries; surgery]

MeSH check words
Female; Humans; Pregnancy