Meta-analysis of techniques for closure of midline abdominal incisions

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Authors' objectives
To determine the optimal method of fascial closure that would prevent incisional hernia and other complications.

Searching
MEDLINE and EMBASE were searched from 1966 to 2000. The search terms were provided and no language restrictions were reported.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) with a least 100 participants and a minimum of 1-year follow up data were eligible for inclusion. The follow-up of the included studies ranged from 1 to 3 years.

Specific interventions included in the review
Studies examining different suturing material and/or suture techniques for fascial closure were eligible for inclusion. Three types of suture material were examined by the included studies: rapidly absorbable, slowly absorbable, and non-absorbable. Two studies examined more than one type of suture material. The resorption rate is 180 days for slowly absorbable sutures, and ranges from 15 to 90 days for rapidly absorbable sutures. The types of suture technique examined by the included studies were continuous, interrupted, and layered closure. Some studies examined additional variations in these techniques: interrupted 'figure of eight', interrupted 'far and near' or 'near-far-near', interrupted 'Smead-Jones', continuous double loop closure, and continuous running suture. Two studies examined the use of more suture material, in terms of a different suture length to wound length ratio.

Participants included in the review
Patients who had undergone a midline surgical incision were eligible for inclusion. Studies that included participants younger than 15 years of age were excluded.

Outcomes assessed in the review
The primary outcome of interest was post-operative incisional hernia. The secondary outcomes included wound dehiscence, wound infection, prolonged, wound pain and suture sinus formation.

How were decisions on the relevance of primary studies made?
Two reviewers independently assessed the studies for relevancy and resolved any disagreements by discussion and consensus.

Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
Two reviewers independently extracted the data and resolved any disagreements by discussion and consensus.

Methods of synthesis
How were the studies combined?
The studies were pooled using the Mantel-Haenszel fixed-effect model.

For the analysis of type of suture material, the studies were categorised into the three groups: rapidly absorbing, slowly

absorbing and non-absorbing. Some studies varied both the suture material and suture technique within a single trial. In such circumstances, separate meta-analyses were performed within groups of trials that made the same comparison.

How were differences between studies investigated?
Statistical heterogeneity was investigated using the chi-squared test. The studies were only pooled in the absence of statistical heterogeneity.

**Results of the review**
Fifteen studies (6,566 patients) were included in the review.

Continuous closure using rapidly absorbable versus non-absorbable sutures (1 RCT, n=751): rapidly absorbable sutures resulted in significantly more incisional hernias ($P=0.001$) than non-absorbable suture, but less suture sinuses ($P<0.001$) and prolonged wound pain ($P=0.003$). There was no statistically-significant difference between the two suture types for any other outcome measure.

Continuous closure using slowly absorbable versus non-absorbable sutures (5 RCTs, n=2,669): non-absorbable sutures resulted in significantly more wound pain ($P<0.005$) and suture sinuses ($P<0.02$) than slowly absorbable sutures. There was no statistically-significant difference between the two suture types for the incidence of hernias, wound dehiscence, or wound infection.

Continuous closure using rapidly versus slowly absorbable sutures (1 RCT, n=749): rapidly absorbable sutures resulted in significantly more hernias ($P<0.009$) than slowly absorbable sutures. There was no statistically-significant difference between the two suture types for any other outcome measure.

Interrupted closure using rapidly absorbable versus non-absorbable sutures (1 RCT, n=161): there were significantly more suture sinuses ($P<0.05$) with non-absorbable than rapidly absorbable sutures. There was no statistically-significant difference between the two suture types for the incidence of hernias, wound dehiscence, or wound infection.

Interrupted versus continuous closure using rapidly absorbable sutures (1 RCT, n=744): there was no statistically-significant difference between the groups for any of the outcome measures.

Interrupted rapidly absorbable versus continuous non-absorbable (2 RCTs, n=1,210): the continuous non-absorbable suture method resulted in more suture sinuses ($P=0.001$) and wound pain ($P<0.001$) than the interrupted rapidly absorbable suture method. There was no statistically-significant difference between the groups for any other outcome measure.

Interrupted rapidly absorbable versus continuous slowly absorbable (4 RCTs, n=1,992): there was no statistically-significant difference between the groups for any of the outcome measures.

Interrupted non-absorbable versus continuous rapidly absorbable (1 RCT, n=105): there was no statistically-significant difference between the groups for the incidence of hernias, wound dehiscence, or wound infection.

Continuous versus interrupted (any suture type): the pooled analysis did not show any significant difference between the two techniques for incisional hernias (odds ratio 0.9, 95% confidence interval: 0.6, 1.2, $P=0.40$), or the incidence of wound dehiscence or wound infection (no results presented).

Analysis of the suture length to wound length ratio (3 RCTs): two studies reported that an increased suture length to wound length ratio of 4:1 or even 6:1 resulted in a significant decrease in the incidence of incisional hernia.

**Authors’ conclusions**
To reduce the incidence of incisional hernia without increasing wound pain or suture sinus frequency, slowly absorbable continuous sutures appear to be the optimal method of fascial closure.
CRD commentary
The review included a clear objective as well as predefined inclusion or exclusion criteria. Only two electronic databases were searched and no attempt was made to look for unpublished studies. This means that some important information may have been missed and publication bias cannot be ruled out. The study selection and data extraction processes were carried out in duplicate, which helps to reduce errors and reviewer bias. The validity of the included studies was not assessed; it was therefore not possible to gauge whether the studies were well conducted.

Relevant details of the primary studies were presented in tabular format, including the proportion of events in each group. However, the authors did not report the results of the meta-analyses, other than P-values (except for the comparison of continuous versus interrupted techniques). They also did not report the findings of any tests for statistical heterogeneity, nor discuss clinical diversity between the studies within the different analyses groups. Thus, it is not possible to assess the reliability of the pooled results.

Implications of the review for practice and research
Practice: The authors stated that the ideal suture technique to reduce incisional hernia rate appears to be mass closure, with an adequate suture length (suture length to wound length ratio of at least 4:1); the suture material should be slowly absorbable.

Research: The authors did not state any implications for further research.

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