Authors' objectives
To compare post-operative complications after vertical and transverse laparotomy incisions.

Searching
MEDLINE, the Cochrane Library and EMBASE were searched for publications in the English language, using combinations of the following terms: 'abdominal', 'incisions', 'horizontal', 'transverse', 'vertical', 'midline', 'laparotomy' and 'complications'. All RCTs published in English were identified. The references of identified studies were also reviewed.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) that assessed abdominal incision and post-operative complications were eligible for inclusion. In addition, retrospective controlled studies were eligible for the outcomes of burst abdomen and incisional hernia.

Specific interventions included in the review
Vertical and transverse laparotomy incisions. Studies that compared transverse and vertical abdominal incisions were eligible for inclusion. Vertical incisions included right paramedian and midline. Transverse incisions included subcostal and oblique subcostal.

Participants included in the review
Patients undergoing open abdominal surgery were eligible. Patients undergoing the following types of surgery were included: open cholecystectomy; laparotomy for trauma; jejunoileal bypass for morbid obesity; and aortoiliac surgery.

Outcomes assessed in the review
Studies that assessed post-operative complications were eligible for inclusion. The actual complications assessed included early complications (postoperative pain, pulmonary complications, burst abdomen, wound infection, and hospital stay) and late complications (incisional hernia). Post-operative pain was assessed using the number of doses of analgesia (or the total analgesic dose) required by the patients in the first 24 to 48 post-operative hours. The follow-up period for incisional hernia ranged from the early post-operative period to 72 months.

How were decisions on the relevance of primary studies made?
The authors do not state how the papers were selected for the review, or how many of the reviewers performed the selection.

Assessment of study quality
The authors report that validity was assessed using predefined criteria, but no details were provided of the criteria used. Study quality was assessed independently and in duplicate, and any disagreements were resolved by consensus.

Data extraction
The data were assessed independently and in duplicate, and any disagreements were resolved by consensus.

The tabulated data included the following: author; type of operation; incision type; and results.

Methods of synthesis
How were the studies combined?
The authors stated that the pooled relative risk and 95% confidence interval (CI) were calculated for the dichotomous outcomes of burst abdomen and incisional hernia using a fixed-effect model. However, pooled odds ratios (ORs) and 95% CIs were reported in the review. Data on other outcomes (post-operative pulmonary complications, pain, and duration of operation) were combined in the narrative.

How were differences between studies investigated?
The studies were grouped according to the outcome measured. For post-operative analgesia, differences in the drug, dose and regimen were tabulated. For pulmonary complications, differences in the type of complications or impairment recorded in each trial were tabulated. Meta-analysis graphs showed the ORs and 95% CIs for burst abdomen and incisional hernia, whilst the associated tables reported the design (RCT or retrospective) of the included studies. No formal investigation of heterogeneity was reported, although the authors stated that it was not possible to pool the data due to differences in the study design and reporting.

Results of the review
Eighteen studies were included. There were 11 RCTs with over 1,025 patients, and 7 retrospective studies with over 10,923 patients.

Post-operative pain (4 studies, 339 patients).
Three of the four studies found that the transverse incision resulted in significantly less post-operative pain (analgesic use) than the vertical incision; one study showed no difference.

Pulmonary complications (9 studies, 1,025 patients).
Seven of the nine studies found that the transverse incision resulted in significantly fewer pulmonary complications than the vertical incision; two studies showed no difference.

Operating times (5 studies, 1,310 patients).
Several studies showed that transverse laparotomy may take between 6 and 15 minutes longer than a vertical laparotomy.

Burst abdomen (3 studies including 1 RCT and 2 retrospective studies, 8,845 patients in total). The vertical incision was associated with a significantly higher rate of burst abdomen than the transverse incision. The OR was 2.86 (95% CI: 1.72, 4.73, p=0.0001). Burst abdomens occurred in 1.13% of vertical incisions and in 0.34% of transverse incisions (p=0.001).

Incisional hernia (6 studies including 3 prospective and 3 retrospective studies, 1,436 patients in total).
The vertical incision was associated with a significantly higher rate of late incisional hernia than the transverse incision. The OR was 1.68 (95% CI: 1.10, 2.57, p=0.02).

Length of hospital stay (1 prospective study, 129 patients).
Use of a midline incision was associated with a significantly longer hospital stay than a transverse incision (p<0.01).

Authors’ conclusions
Transverse incisions in abdominal surgery offered considerable advantages in the post-operative period when compared with vertical incisions. The early post-operative period was associated with fewer complications (pain, burst abdomen, and pulmonary morbidity). In addition, the incidence of late incisional hernia was lower after transverse incisions for laparotomy.
CRD commentary
The aims were stated, and the inclusion criteria were defined in terms of the study design, participants, intervention and outcome. Several relevant literature sources were searched, but restricting eligible studies to those published in the English language may have resulted in the omission of other relevant studies. In addition, the lack of an attempt to locate unpublished material raises the possibility of publication bias. The methods used to select the studies for inclusion in the review were not reported. Study quality was reported as being assessed using predefined criteria, but the criteria used were not specified; however, some potential sources of bias in the individual studies were commented upon.

The methods used to assess validity and to extract the data were described, and some relevant data were tabulated. The data were pooled in meta-analyses regardless of study design, and no comment was made on the heterogeneity or otherwise of the studies combined in meta-analyses. Where differences existed among studies in the narrative syntheses, potential causes of heterogeneity were mentioned only briefly and the results were not discussed in relation to the quality of the individual studies.

The evidence presented appears to support the authors' conclusions, although the strength of this evidence would be increased by reporting results in relation to the quality of the studies.

Implications of the review for practice and research
Practice: The authors state that the transverse incision should be strongly considered, particularly in high-risk patients such as the obese and those with chronic obstructive lung disease. They went on to state that the midline incision is still the incision of choice in conditions requiring rapid entry into the peritoneal cavity, or when the pre-operative diagnosis is unsure, as it can easily be extended.

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

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