Paravertebral blocks for anaesthesia and analgesia: a systematic review

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CRD summary
This review assessed the efficacy and safety of thoracic and lumbar paravertebral blocks (PVB) for anaesthesia and analgesia. The authors concluded that paravertebral block was at least as safe and effective as general anaesthesia and alternative analgesia techniques. This was a generally well-conducted review of heterogeneous studies. The conclusions are likely to be reliable.

Authors' objectives
To assess the efficacy and safety of thoracic and lumbar paravertebral blocks (PVB) for surgical anaesthesia compared to: general anaesthesia or other regional anaesthetic techniques; and regional blocks or analgesic drugs for postoperative analgesia.

Searching
MEDLINE, EMBASE, The Cochrane Library, Science Citation Index, Current Contents, US Clinical Trials Database, Centre for Reviews and Dissemination (DARE and NHS EED), NHS HTA, National Research Register, US National Institute of Health and Meta Register of Controlled Trials databases were searched from inception to December 2004. Search terms were reported. References of all retrieved publications were checked. Studies reported in languages other than English were initially eligible for inclusion, but were liable to subsequent exclusion if findings were similar to those of well-designed studies published in English.

Study selection
Studies of thoracic or lumbar paravertebral blocks performed primarily for anaesthesia or analgesia in patients aged at least 18 years were eligible for inclusion in the review. Lumbar blocks lower than L2 were excluded from the review, as were studies of intrathoracic placement or paravertebral blocks in the cervical region. Acceptable comparators included general anaesthesia or any alternative method of analgesia. Studies were required to report one of a range of efficacy (including surgical anaesthesia and pain scores) or safety (including mortality, bleeding and pneumothorax) outcomes. Randomised controlled trials (RCTs), non-randomised prospective or retrospective studies, case series and case reports were eligible for inclusion.

A wide range of indications were examined in the included studies, including breast surgery, herniorrhaphy, cardiovascular surgery, cholecystectomy, hepatectomy, labour and post-traumatic pain. The following comparators were used: general anaesthesia or field block and (for analgesia) thoracic epidural block; no additional intraoperative analgesia; morphine; intrapleural local anaesthetic; nerve block or bolus paravertebral block.

Two reviewers independently selected the studies for the review; differences were resolved through discussion.

Assessment of study quality
The authors assessed the following criteria for RCTs: randomisation; allocation concealment; use of intention-to-treat (ITT) analysis; blinding; use of power calculations; and loss to follow-up. Non-randomised comparative studies were assessed on method of patient recruitment, comparability of baseline characteristics, blinding, sample size and loss to follow-up. Case series and reports were not formally assessed for validity, although aspects of validity were discussed in the text. The authors did not state how many reviewers performed the validity assessment.

Data extraction
Data were extracted by one reviewer using pre-specified data extraction tables. Data extrapolation was performed in some instances. For RCTs, relative risks (RRs) with 95% confidence intervals (CIs) were calculated.

Methods of synthesis
The studies were primarily combined in a narrative synthesis, but limited meta-analysis of RCTs was undertaken to
calculate pooled RRs where at least two trials were available with data on the same comparison. Studies were grouped by whether anaesthesia or analgesia was the indication, and then for each outcome by type of surgical or other intervention and by study design. Differences between studies were discussed in detail in the narrative synthesis.

Results of the review
Fifty-seven (n = 2,071) studies were included in the review: 15 RCTs (n = 647); six comparative studies (n = 640); 20 case series (n = 766); and 16 case reports (n = 18). The studies were generally considered to be of average quality. Most studies reported no losses to follow-up, but power calculations and intention-to-treat analyses were not reported in most studies. Nineteen studies (n=989; six RCTs, n = 306) were of anaesthesia and 38 studies (n=1,082; nine RCTs, n=341) were of analgesia.

Anaesthesia:
Five of the six RCTs examined anaesthesia for breast surgery and one assessed herniorrhaphy.

Safety: Two RCTs assessed perioperative mortality and reported no deaths. Five RCTs assessed postoperative nausea and vomiting; the pooled relative risk showed significantly lower incidence in the paravertebral block groups (relative risk 0.25, 95% CI: 0.13 to 0.50; three RCTs). Results were also reported for a wide range of other safety outcomes, including: pleural puncture; pneumothorax; epidural spread; blood loss; urinary retention; local anaesthetic toxicity; bradycardia and hypotension; and other complications. None of these displayed a significant difference between groups reported by an RCT.

Efficacy: Four RCTs and eight other studies of breast surgery reported rates of effective block ranging from 80% to 100% (range in RCTs was 93.2% to 100%). One small RCT in herniorrhaphy found significantly higher rates of effective block in the paravertebral block group compared to the field block group (p<0.01). Eight studies, including two RCTs, reported rates of conversion to general anaesthesia. These ranged from 0 to 33% (range in RCTs was 0 to 13.3%). One RCT reported that 10% of paravertebral block patients required intraoperative re-block. Hospital stay was comparable between groups in one RCT and significantly shorter in the paravertebral block group in another. High levels of patient satisfaction were reported in two RCTs. This was significantly higher than in the general anaesthesia group in one RCT (p = 0.008). There was evidence that both operative (five RCTs) and postoperative (five RCTs) use of a range of analgesic medication was equivalent or lower in the paravertebral block groups than in the comparator groups.

Other efficacy outcomes reported were: number of dermatomes blocked, bilateral block, time to effective block, duration of surgery and duration of anaesthesia. In none of these was a significant difference between groups reported by an RCT.

Analgesia:
Of the nine RCTs, two assessed each of breast surgery, cardiovascular surgery and cholecystectomy and thoracotomy; one assessed herniorrhaphy.

Safety: Three RCTs assessed mortality and reported no deaths. No significant differences in postoperative nausea and vomiting were reported (four RCTs). One RCT recorded an incidence of vascular puncture of 8.7%. No RCTs reported incidences of pleural puncture or pneumothorax. One RCT reported significantly lower arterial blood pressure in the paravertebral block group compared to the thoracic epidural group (p<0.001); no other significant differences in blood pressure or heart rate were found (two RCTs). There was little or no RCT evidence of the following complications: epidural spread, urinary retention, local anaesthetic toxicity and other complications.

Efficacy: Rates of effective block in RCTs ranged from 80% to 92%. Two RCTs reported equivalent numbers of dermatomes blocked in paravertebral block and comparator groups. One RCT reported a lower rate of unintended bilateral block in the paravertebral block group (30% compared to 100% of epidural patients). Time to effective block did not differ between paravertebral block and thoracic epidural groups in one RCT.

Conflicting results for use of supplemental medication were found: one RCT reported significantly higher use in the paravertebral block group and one reported no differences, while four reported lower use in the paravertebral block
group. A similarly conflicting pattern was observed for reported postoperative pain. No significant differences were found for duration of surgery or duration of analgesia, or patient satisfaction.

**Cost information**
Two studies reported cost information. One reported a total cost of $2,938 for ambulatory breast surgery using paravertebral block, rising to $3,764 with an overnight stay. The second reported that overnight stay after paravertebral block cost an additional 222 Euros.

**Authors’ conclusions**
Paravertebral blocks at the level of the thoracic and lumbar vertebrae were at least as safe and effective as other regional anaesthetic techniques and general anaesthesia during surgery, and analgesic drugs and other regional blocks for postoperative analgesia.

**CRD commentary**
The review question and the inclusion criteria were clear. The authors searched a wide range of databases and other sources. However, the decision to exclude foreign language studies where a similar finding was reported by a well-designed English language study may have introduced language bias into the review. The authors reported using methods designed to reduce bias and error in the selection of studies for the review, but not in the extraction of data or the assessment of validity. The authors’ assessment of study validity used appropriate criteria. The decision to adopt a narrative synthesis with provision for limited meta-analysis was appropriate in view of the clinical and methodological heterogeneity between studies. The authors’ conclusions accurately reflected the evidence of the review, and are likely to be reliable despite study heterogeneity and lack of reporting of some aspects of the review.

**Implications of the review for practice and research**
**Practice:** The authors stated that anaesthetists wishing to use paravertebral block should undergo appropriate training and supervised instruction until competent, and that their performance should be subject to ongoing audit.

**Research:** The authors stated that additional high quality RCTs would strengthen the evidence base, while cost-effectiveness studies that considered the Australian healthcare context should also be considered.

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.