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Quadratus lumborum block versus caudal block in paediatric surgeries: a protocol for systematic review and meta-analysis

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ABSTRACT

Introduction Emerging studies have compared the analgesic effects of quadratus lumborum block versus caudal block in paediatric surgeries, but the results remain controversial. This protocol of a systematic review and meta-analysis aims to determine whether quadratus lumborum block is better than caudal block for postoperative analgesia in paediatric surgeries.

Methods and analysis PubMed, EMBASE, the Cochrane Library and Web of Science will be systematically searched from inception to 30 May 2025. The language will be restricted to English. Randomised controlled trials that compared the efficacy and safety of quadratus lumborum block and caudal block in paediatric patients will be included. The duration of analgesia, defined as the time to first analgesic request, will be the primary outcome. The secondary outcomes will include total opioid consumption over the first 24 hours postoperatively, pain scores at rest and during movement, and the incidence of side effects. RevMan V.5.4 software will be used for the statistical analysis. The Grading of Recommendations Assessment, Development and Evaluation approach will be applied to assess the evidence quality.

Ethics and dissemination Ethical approval is not applicable. The results will be publicly published when completed.

PROSPERO registration number CRD42025637094

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Subgroup analysis and meta-regression will be applied to explore the source of heterogeneity.
⇒ Sensitivity analysis will be performed to assess the reliability of pooled results.
⇒ The Grading of Recommendations Assessment, Development and Evaluation approach will be used to assess the quality of the evidence.
⇒ There might be substantial clinical heterogeneity among the included studies.
⇒ Publication bias might exist in this study.

INTRODUCTION

Postoperative pain is one of the most undesirable problems in paediatric patients after abdominal surgery.[1] Peripheral nerve blocks are effective in controlling postoperative pain and are recommended as an important component for multimodal analgesia after abdominal surgeries.[2 3] Caudal block is widely used for postoperative analgesia in paediatric patients undergoing lower abdominal surgeries.[4 5] With the guidance of ultrasound, caudal block can be easily performed with high safety profiles.[6 7] However, a single injection of local anaesthetics for caudal block provides a limited duration of analgesia.[8] In recent years, several new types of peripheral nerve blocks have emerged to manage postoperative pain in paediatric patients. Quadratus lumborum block, first proposed in 2007, is gaining popularity for pain relief in various paediatric surgeries, such as open orchiopexy,[9] inguinal hernia repair[10] and open renal surgery.[11] An increasing number of studies have compared the efficacy and safety of ultrasound-guided caudal block versus quadratus lumborum block for postoperative pain in paediatric patients after surgeries,[11–16] but the results have been inconsistent. One recent systematic review and meta-analysis compared the analgesic effects of quadratus lumborum block versus caudal block for paediatric patients undergoing surgeries involving the lower abdomen, inguinal region and urogenital system with a literature search time in August 2023.[17] This present study will provide a protocol for an updated systematic review and meta-analysis, which will perform the literature research to 30 May 2025 and include more paediatric studies involving all surgical types. Moreover, total opioid consumption over the first 24 hours postoperatively will be an important outcome in our study, which was not included in the previous systematic review.[17] Furthermore, we will conduct subgroup analysis to identify the preferred type of nerve block for specific conditions and use sensitivity analysis to explore the source of heterogeneity

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and test the reliability of the pooled results. Therefore, it is meaningful to conduct a systematic review and meta-analysis to synthesise the evidence and determine whether quadratus lumborum block is superior to caudal block in controlling postoperative pain in paediatric patients.

METHODS AND ANALYSIS

Study registration

We have registered this protocol in the International Prospective Register of Systematic Reviews (PROSPERO; CRD42025637094). This protocol was conducted according to the guidelines of the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) Protocols.

Search strategy

Four major databases, namely, PubMed, the Cochrane Library, EMBASE and Web of Science, will be systematically searched from their inception to 30 May 2025. The planned start date and completion date will be 30 May 2025 and 30 December 2025, respectively. English language restriction will be applied. The search keywords will include "quadratus lumborum block", "caudal block" and "randomized controlled trial". Randomised controlled trials (RCTs) that compared the efficacy and safety of quadratus lumborum block and caudal block in paediatric patients will be identified. The search strategy for all databases is shown in online supplemental file 1.

Inclusion and exclusion criteria

The inclusion criteria will be as follows: (1) Population: paediatrics who underwent surgeries; (2) Intervention: quadratus lumborum block; (3) Comparator: caudal block; (4) Outcomes: primary outcome will be the duration of analgesia, defined as the time to first analgesic request. Secondary outcomes will include total opioid consumption over the first 24 hours postoperatively, pain scores at rest and during movement at 1 hour, 4 hours, 8 hours, 12 hours and 24 hours postoperatively, and the incidence of side effects, such as nausea and vomiting, urine retention, motor weakness, haematoma or respiratory depression; (5) Study design: RCTs. Studies that did not meet the above criteria will be excluded.

Study selection

According to the inclusion and exclusion criteria, two authors will independently identify potentially eligible studies by reviewing the titles and abstracts, followed by reading the full texts. Any disagreements will be settled by discussion. The study selection process will be performed according to the PRISMA flow chart.

Data extraction

Two authors will independently perform the data extraction. The study region, publication year, sample size, patient characteristics, type of surgery and anaesthesia, local anaesthetics and adjuvants, timing of nerve block, comparisons, outcomes, and postoperative analgesic use will be included.

Risk of bias assessment

Two authors will independently evaluate the risk of bias of each included study using the Cochrane Collaboration's tool based on six items: random sequence generation (selection bias), allocation concealment (selection bias), blinding of participants and personnel (performance bias), blinding of outcome assessment (detection bias), incomplete outcome data (attrition bias), and selective reporting (reporting bias). The estimated results will be ranked as 'unclear', 'low' or 'high'.

Statistical analysis

RevMan V.5.4 software (The Cochrane Collaboration, 2020) will be used for statistical analysis. Continuous data will be presented using mean differences with 95% CIs, while dichotomous data will be summarised by risk ratios with 95% CIs. Statistical heterogeneity will be reflected by the I^2 test results. A fixed-effect model will be used to synthesise data when the I^2 value <50%. However, a random effects model will be used when I^2>50%, and the source of heterogeneity will be explored using subgroup analysis and meta-regression. The outcomes, including duration of analgesia, total opioid consumption over the first 24 hours postoperatively and pain scores, will be subjected to sensitivity analysis if high heterogeneity (I^2>50%) exists. Sensitivity analysis will assess the reliability of the pooled results by excluding studies according to the methodological quality, sample size or variance. Sensitivity analysis will also examine the impact of different meta-analysis models. The results will be reliable when the pooled results remain consistent across different analyses. Otherwise, the results should be interpreted with caution. Publication bias will be evaluated by Egger's test with the funnel plots. Finally, the Grading of Recommendations Assessment, Development and Evaluation approach will be conducted to assess the quality of the evidence. P value <0.05 indicates a significant difference.

Patient and public Involvement

Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

Ethics and dissemination

Ethical approval is not applicable. The results will be publicly published when completed.

DISCUSSION

Effective postoperative analgesia is an important challenge after abdominal surgery, especially in paediatric patients. Quadratus lumborum block has been proposed in recent years and has been widely used for postoperative analgesia in paediatric patients undergoing various abdominal surgeries. Emerging studies have compared the efficacy and safety of quadratus lumborum block

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versus caudal block in paediatric patients, but the results remain inconsistent. This protocol of a systematic review and meta-analysis aims to determine whether quadratus lumborum block has better analgesic effects than caudal block in paediatric patients undergoing surgeries.

There might be substantial clinical heterogeneity among the included studies due to several conditions, such as the surgery type, the local anaesthetic type and volume and concentration, the age of the children, the approach of quadratus lumborum block and the timing of nerve block performance. Subgroup analysis and meta-regression will be applied to explore the source of heterogeneity and will identify the preferred type of nerve block for certain conditions. It should be noted that there might be a limited number of RCTs that compared the analgesic effects of quadratus lumborum block and caudal block in paediatric patients. This protocol will also provide a reference method for comparing the analgesic effects of quadratus lumborum block with those of other nerve block types in paediatric surgeries. In summary, this study will offer some guidance for choosing the nerve block type for paediatric surgeries.

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