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RESEARCH ARTICLE

Efficacy and safety of erector spinae plane block for postoperative analgesia after surgery: An Umbrella review protocol

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Abstract

Background: Poorly managed postoperative pain after thoraco-abdominal surgery has several consequences in the postoperative period. The postoperative pain after thoraco-abdominal surgery has been managed with systemic opioids and different regional anesthesia techniques. The opioid-based analgesics and landmark techniques have undesirable consequences; regional analgesia technique with ultrasound requires resources and expertise, while erector spinae plane block is a new technique with minimal side effects and is easy to administer. However, the quality of evidence on its efficacy is still uncertain and needs further investigation.

Objective: This systematic review aimed to provide the quality of evidence on the efficacy and safety of erector spinae block after surgery.

Method: A comprehensive search was conducted in PubMed/Medline, Cochrane, Science Direct, CINHAL, and LILACS without date and language restrictions. All randomized trials comparing the efficacy of wound infiltration for postoperative pain management after cesarean section were included while observational studies and reviews were excluded. The data was extracted with two independent authors in a customized format. The methodological quality of the included studies was evaluated using a Measurement Tool to assess systematic Reviews (AMSTAR). The overall quality of the evidence was determined by GRADEpro software. The systematic review was conducted in line with the preferred Reporting Items of systematic review and meta-analysis (PRISMA).

Discussion: The incidence of postoperative pain after thoraco-abdominal surgery is very high, which has a severe impact on the patient, family, healthcare providers, and healthcare delivery. This systematic review aimed to provide quality evidence on the efficacy and safety of landmark and ultrasound-assisted erector spinae plane block technique for postoperative pain management after surgery.

Keywords: Analgesia, Erector spinae, Paravertebral, Postoperative

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1 Introduction

1.1 Description of the condition

Postoperative pain is considered a form of acute pain due to surgical trauma with an inflammatory reaction and contributed by sensitization of dorsal horn neurons. It is a combined constellation of several unpleasant sensory, emotional, and mental experiences precipitated by surgical trauma and associated with autonomic, endocrine-metabolic, physiological, and behavioral responses [1].

Predictors of postoperative pain can be categorized as preoperative, intraoperative, and postoperative factors. Several potential preoperative factors for postoperative pain have been reported, like pre-existing pain, anxiety, younger age, and female gender [2-8]. Identifying those at increased risk and treating their postoperative pain adequately facilitates early ambulation and enhances recovery may eventually reduce postoperative mortality and morbidity [9-11].

Postoperative factors, including the severity of postoperative pain, patient on radiotherapy/ chemotherapy, and psychological vulnerability have been shown to predict postoperative pain [2,12].

Evidence showed that the prevalence of postoperative pain in patients undergoing major surgery ranges from 17%-82% and 75% of those who reported describing their pain as moderate to severe during the immediate postoperative period [13-18].

Moderate to severe post discharge pain was experienced in 25–65% of these patients depending on the type of surgical intervention, leading to dissatisfaction with overall care [14,19-21]. Most of poorly managed acute postoperative pain transforms into chronic pain. Based on literature persistent postoperative pain occurs in 10%-60% patients after common surgical procedure. Traditionally, treatment of postoperative pain is based mainly on opioids with the result that are not quite satisfactory, however, advancement multimodal analgesia and enhanced recovery after surgery protocol lead to adjuvant modalities for postoperative management [14,19-21].

Postoperative pain may lead to a wide range of postoperative complications, like an increased risk of thrombo-embolic events, respiratory impairment, anxiety, sleep disturbance, prolonged hospital stay, chronic pain, impaired physical functioning, recovery, and quality of life after surgery, which increases a burden to the patient, health care providers, and community and increases healthcare-related costs [10,14,22-25]. In addition, inadequately treated postoperative pain might have significant physiological and psychological consequences, which may affect the quality of life along with a severe impact on organ dysfunction and increase postoperative mortality and morbidity [14,20,22,23,26].

1.2 Description of the intervention

The postoperative pain during or after thoracoabdominal surgery has been managed by systemic analgesic opioids for years; nevertheless, there is a wide range of adverse effects. Recent peer-reviewed published literature showed that regional blocks, including paravertebral, intercostal, pectoral, epidural, and erector spinae plane blocks, are gaining popularity [27-37]. However, epidural anesthesia requires resources and technical expertise, while landmark techniques are ineffective and also associated with complications. The Erector Spinae Plane Block is a relatively new technique of regional anesthesia where local anesthetic (LA) injection is performed into the fascial plane situated between the transverse process of the vertebra and the erector spinae muscles, and it is considered a relatively safe and easy technique to perform compared to other regional techniques [28,38].

1.3 How the intervention might work

The regional nerve block is considered an essential component of multimodal analgesia.

Ultrasound-guided erector spinae plane block is a novel technique that injects local anesthetics into the fascial space between the transverse process and erector spines, blocking the branches of the thoracic and abdominal spinal nerves. The exact mechanism of erector spinae nerve block is uncertain, but the most probable primary mechanism is a direct effect of local anesthetic via physical spread and diffusion to neural structures in the fascial plane deep to the erector spinae muscles and adjacent tissue compartments.

The cadaveric injection and computerized tomographic scan studies showed that the local anesthetics spread in a cephalocaudal direction within a facial plane deep to the erector spinae muscle in the paraspinal region potentially spreads towards paravertebral space through the inter-transverse tissue [39,40].

Why is it important to do this review

The prevalence of postoperative pain after thoraco-abdominal surgery is very high, which is a great challenge for healthcare workers. An inadequately managed postoperative management after thoracic surgery has several consequences, including pulmonary infection, deep venous thrombosis, paralytic ileus, postpartum depression, delayed wound healing, and increased in-hospital length of stay, chronic pain, and increased health care cost.

Many postoperative pain management modalities have been practiced during or after thoracoabdominal surgery in recent years. However, systemic opioid-based analgesics and landmark intercostal and paravertebral techniques have several complications; the epidural regional analgesia technique requires resources and expertise, while erector spinae is a new technique with minimal side effects and is easy to administer.

Currently, erector spinae has been compared with other regional anesthesia techniques for postoperative pain management after thoracoabdominal surgery. However, the quality of the available evidence on the efficacy and safety of this technique is uncertain.

This umbrella review will provide quality evidence and recommendations on the efficacy and safety profile of erector spinae plane block to prevent undesirable adverse effects of opioids and other landmark techniques, particularly for the resource-limited environment. Besides, the output of this umbrella review is expected to contribute to the successful accomplishment of sustainable development goals (SDGs) Article 3.2.2 [41].

2 Objective and Research Questions

2.1 Objective of the Study

The objective of this umbrella review is to summarize the evidence from a systematic review and meta-analysis regarding the efficacy and safety of erector spinae plane block for postoperative analgesia.

2.2 Research Questions

This umbrella review is intended to address the following questions.

- Do we have strong evidence on the efficacy and safety of erector spinae plane block after surgery?
- Can we recommend an erector spinae plane block for all thoracoabdominal and spine surgeries?
- What are the most commonly reported complications associated with erector spinae block?

3 Methods

3.1 Protocol and registration

The systematic review and meta-analysis will be conducted based on the Preferred Reporting Items for Systematic and Meta-analysis (PRISMA) [42]. This Systematic Review and Meta-Analysis protocol was registered in Prospero (CRD42021270711) on August 5, 2021.

3.2 Eligibility criteria

3.2.1 Types of studies

All systematic reviews and meta-analyses comparing the efficacy and safety of erector spinae plane block with epidural anesthesia, paravertebral block, intercostal block, pectoral nerve block, systemic analgesics, and placebo for postoperative pain management after thoracoabdominal and spin surgery were included. However, randomized controlled trials, observational studies, and clinical reviews were excluded.

3.2.2 Types of participants

All studies comparing erector spinae plane block against any of the regional anesthesia techniques for pain management during or after thoracoabdominal and spine surgery were included, and the rest were excluded. These inclusion and exclusion criteria were as per the definition of each primary included study.

3.2.3 Types of intervention

The treatment group was patients allocated to landmark or ultrasound-guided erector spinae plane blocks, which were as per the included studies, while the patients assigned to comparator defined by each included study were considered as controlled groups.

3.2.4 Outcome measures

The primary outcomes of this umbrella review were postoperative pain severity, first analgesic request, total analgesic request, and patient satisfaction, while postoperative nausea and vomiting, sedation, and mortality were secondary outcomes.

3.3 Search strategy

The search strategy was intended to explore all available published and unpublished systematic reviews and meta-analyses among thoracoabdominal surgeries comparing erector spinae plane block with paravertebral block, intercostal block, epidural block, systemic analgesics, and placebo for postoperative pain management without language and date restrictions. A comprehensive initial search was employed in Cochrane Library, CINHAL, PubMed/Medline, Science Direct, and Latin American and Caribbean Health Sciences Literature (LILACS) followed by an analysis of the text words contained in Title/Abstract and indexed terms.

A second search was undertaken by combining free text words and indexed terms with Boolean operators. The third search was conducted with the reference lists of all identified reports and articles for additional studies. Finally, additional and grey literature search was conducted on Google Scholar. The duplicates were removed using the EndNote reference manager. Then, the rest were evaluated for inclusion in the systematic review based on the eligibility criteria. The results of the search strategy were summarized with a prisma flow chart [43].

The PubMed/Medline database was searched, as thoracic surgery OR breast surgery OR breast cancer OR thoracotomy OR cholecystectomy OR upper abdominal surgery OR abdominal surgery OR spine surgery AND erector spinae OR epidural OR paravertebral OR Intercostal OR pectoral nerve OR systemic analgesics OR placebo AND postoperative pain OR analgesia OR analgesic consumption OR morphine consumption OR opioid consumption OR pain score OR VAS score AND complication OR pneumothorax OR Toxicity OR cardiac arrest OR mortality OR death AND systematic review OR meta-analysis.

Data extraction

The data from each systematic review and meta-analysis was extracted by two independent reviewers to describe included studies and grade the overall quality of evidence of each systemic review and meta-analysis. The disagreement between the two reviewers was resolved by the

third reviewer. The data extracted included author, year of publication, number of RCTs included, number of participants, methodological quality, outcome of interest, total events in intervention, and comparator and effect sizes (Odds Ratio, Relative Risk, Mean difference, and 95% confidence interval). The overall quality of evidence was graded with online GRADEpro GDT software. The umbrella review was presented as per the Preferred Reporting Items for Systemic Reviews and Meta-Analysis (PRISMA) [44].

3.4 Methodological Quality Assessment

The methodological quality of each included systematic review was evaluated with the AMSTAR tool (Assessing the Methodological quality of systematic reviews) by two independent authors [45]. Each positive finding was allocated 1 point, and the sums of the points were used to assign a final score to each systematic review. Disagreements between the first two reviewers were adjudicated and resolved by a third reviewer. The included systematic reviews were classified according to the AMSTAR scores: high quality 8-11, moderate quality 4-7, and low quality 0-3 score values. The AMSTAR tool (Assessing the Methodological quality of systemic reviews).

3.4.1 Grading the quality of evidence

The overall quality of evidence for the studied outcome will be evaluated using the GRADE system (Grading of Recommendations, Assessment, Development, and Evaluation) [46,47]. The system incorporates study quality (risk of bias), inconsistency (comparison of effect estimates across studies), indirectness (applicability of the population, intervention, comparator and outcomes to the clinical decision), imprecision (certainty of confidence interval) and high probability of publication bias.

The overall quality of evidence will be categorized as follows by evaluating and combing the above five parameters for maternal and neonatal outcomes.

- Effective interventions: indicated that the review found high-quality evidence of effectiveness for an intervention.
- Possibly effective interventions: indicated that the review found moderate-quality evidence of effectiveness for an intervention, but more evidence is needed.
- Ineffective interventions: indicated that the review found high-quality evidence of lack of effectiveness (or harm) for an intervention.
- Probably ineffective interventions: indicated that the review found moderate-quality evidence suggesting a lack of effectiveness (or harm) for an intervention, but more evidence is needed.
- No conclusions possible: indicated that the review found low or very low-quality evidence, or insufficient evidence to comment on the effectiveness or safety of an intervention.

4 Discussion

This systematic review is planned to investigate the efficacy and safety of erector spinae plane blocks for postoperative pain management after thoracoabdominal surgeries.

Evidence from various peer-reviewed published literature showed that systemic opioid-based analgesics, neuraxial analgesia, paravertebral block, intercostal nerve block, and pectoral nerve block provide better postoperative pain relief after thoracic and chest wall surgeries [48-58]. However, systemic opioid-based analgesics are associated with several postoperative adverse events, including nausea, vomiting, respiratory depression, opioid addiction, and other gastrointestinal complications [57,59]; neuraxial and thoracoabdominal field block require resources and expertise and are also associated with complications including pneumothorax, hypotension, high spinal, bradycardia, nerve damage, and local anesthetics toxicity [60,61].

On the other hand, erector spinae plane block is a new technique that is safe and simple to administer despite discrepancies in effectiveness and superiority [33,34,36,38,40,62-66].

Published literature showed that the incidence of postoperative acute as well as chronic pain is very high after surgery, which has a tremendous impact on postoperative patient outcomes, family, healthcare providers, and healthcare delivery [3,7,8,10,12,14,23,67,68].

It is a basic human right to provide postoperative pain management to every patient, which is feasible for everyone in terms of resources, technique, cost, and adverse events profile [69,70].

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Ethical Concern

Not applicable.

Consent for Publication - Not applicable.

Availability of Data and Materials

Data and material can be available where appropriate.

Competing Interests

The authors declare that there are no competing interests.

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Author's Detail

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Author's Contributions

SA and GM conceived the idea design of the project.

SA, HM, BJ, and AA were involved in searching strategy, data extraction, quality assessment, analysis, and manuscript preparation. All authors read and approved the manuscript.

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