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Efficacy and Safety of Different Anesthesia Methods for Percutaneous Endoscopic Interlaminar Lumbar Discectomy: A Network Meta-Analysis

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ADMINISTRATIVE INFORMATION

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Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 2 December 2024 and was last updated on 2 December 2024.

INTRODUCTION

Review question / Objective To evaluate and compare the efficacy and safety of general anesthesia (GA), epidural anesthesia (EA), and local anesthesia (LA) in percutaneous endoscopic interlaminar discectomy (PEID) through a network meta-analysis.

Condition being studied With the increasing prevalence of lumbar disc herniation due to occupational factors and aging populations, percutaneous endoscopic interlaminar discectomy (PEID) has become a preferred minimally invasive technique for its reduced tissue damage and quick recovery. However, there is insufficient evidence comparing the effects of general anesthesia (GA), epidural anesthesia (EA), and local anesthesia (LA) on the efficacy and safety of PEID. This study aims to evaluate the efficacy and safety of these three anesthesia methods using a network meta-analysis to provide evidence-based recommendations for clinical practice.Percutaneous Endoscopic Interlaminar Discectomy (PEID) is a minimally invasive surgical technique for treating Lumbar Disc Herniation (LDH), particularly effective for the L5/S1 segment due to its wide interlaminar space and favorable anatomical structure. Currently, there is a lack of evidence-based research comparing the application and outcomes of three anesthesia methods—general anesthesia (GA), epidural anesthesia (EA), and local anesthesia (LA)—in PEID procedures. This study aims to evaluate the efficacy and safety of these anesthesia methods through a network meta-analysis, providing evidence-based guidance for clinical decision-making.

METHODS

Participant or population Adults undergoing PEID.

Intervention General anesthesia (GA), epidural anesthesia (EA), and local anesthesia (LA).

Comparator No specific comparator; the study directly compares GA, EA, and LA within the same context of PEID for LDH.

Study designs to be included Randomized controlled trials (RCTs), non-randomized controlled trials (nRCTs), and retrospective studies.

Eligibility criteria Inclusion Criteria:
①Study Types: Randomized controlled trials (RCTs), non-randomized controlled trials (nRCTs), and retrospective studies.
②Study Subjects: Adult patients undergoing percutaneous endoscopic interlaminar discectomy (PEID) without a history of lumbar fusion surgery.
Exclusion Criteria:
①Reviews, meta-analyses, conference abstracts, animal studies, or case reports.
②Duplicate publications based on the same clinical study.
③Studies with incomplete data or inaccessible full text.
④Studies involving multiple interventions where the effect of anesthesia methods cannot be independently assessed.

Information sources The study will retrieve data from eight Chinese and English databases, including CNKI (China National Knowledge Infrastructure), VIP, Wanfang, SinoMed, PubMed, Embase, Cochrane Library, and Web of Science. The search will cover studies published up to July 19, 2024. Both subject terms and free-text keywords will be used to ensure a comprehensive search.The English search strategy (PubMed) includes:(((Endoscopy[Mesh Terms]) AND ((Diskectomy[Mesh Terms]) AND (interlaminar[Title/Abstract])) OR (PEID[Title/Abstract])) AND (Anesthesia[Mesh Terms])).Additional manual screening of reference lists from included studies will also be conducted to identify any relevant studies.

Main outcome(s) ①Surgical duration.
②VAS score differences: Changes in Visual Analog Scale (VAS) scores between preoperative and final follow-up assessments.
③ODI score differences: Changes in Oswestry Disability Index (ODI) scores between preoperative and final follow-up assessments.
④Anesthesia satisfaction rate: Proportion of patients willing to undergo the same anesthesia method again.
⑤Incidence of dural or nerve root injury.
⑥Incidence of postoperative sensory impairment (POD).
⑦Failure or recurrence rate: Proportion of unresolved or recurrent symptoms postoperatively.
1.Surgical duration.

Quality assessment / Risk of bias analysis Study Screening:
Duplicate studies were removed using Endnote software.
Titles and abstracts irrelevant to the study were excluded.
Full texts were reviewed for final inclusion.
Data Extraction:
Two independent researchers extracted data, with disagreements resolved by a third reviewer.
Extracted data included:
Study information (title, first author, journal, etc.).
Baseline characteristics and interventions.
Key bias evaluation factors.
Outcomes and related data (texts, tables, and figures).
Quality Assessment:
Tools used based on study type:
RCTs: Modified Jadad scale.
nRCTs: MINORS criteria.
Retrospective studies: NOS scale.
Reviewer blinding to authors, institutions, and journal information was conducted to minimize subjective bias.
Data Reliability: Ensured all data sources were clear and reliable.

Strategy of data synthesis Two investigators will independently screen the literature and extract the data, with any disagreements resolved by consultation with a third party. The screening process will utilize EndNote software to eliminate duplicate documents, exclude titles and abstracts unrelated to the study, and finalize the included studies through full-text review. Extracted data will include:① basic study information (title, first author, published journal, etc.); baseline characteristics and interventions of ② study subjects; key evaluation factors for the risk of ③ bias; ④ outcome measures and related data (text, tables and charts). ① basic study information (title, first author, published journal, etc.); baseline characteristics and interventions of ② study subjects; key evaluation factors for the risk of ③ bias; ④ outcome measures and related data (text, tables and charts).All data sources will be verified for clarity and reliability. Quality assessment tools will be selected based on study type: the Modified Jadad scale for RCTs, MINORS criteria for non-RCTs, and the NOS scale for retrospective studies. To minimize subjective bias, information about

authors, institutions, and journals will be anonymized during the evaluation process.

Subgroup analysis A frequentist network meta-analysis will be conducted using StataMP 17 software to construct network relationships and perform statistical analyses. Dichotomous variables will be calculated as hazard ratios (risk ratios, RR), and continuous variables will be calculated as mean differences (MD), with all effect sizes expressed as 95% confidence intervals (95% CI). The effects of different anesthesia methods will be evaluated and ranked using cumulative ranking probability curves (SUCRA), presented in percentage form. Inconsistency and convergence tests will be performed, with $P > 0.05$ indicating good result agreement. Funnel plots will also be generated to assess publication bias in the included studies.

Sensitivity analysis Use sensitivity analysis to verify the reliability of the combined effect quantity.

Country(ies) involved China.

Keywords General anesthesia; Epidural anesthesia; Local anesthesia; Lumbar disc herniation; Percutaneous endoscopic interlaminar discectomy; PEID; Meta-analysis.

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