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INPLASY

Ultrasound-Guided Costoclavicular versus Conventional Infraclavicular Brachial Plexus Block for Upper-Limb Surgery: An Updated Systematic Review and Meta-Analysis of Randomized Controlled Trials

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ADMINISTRATIVE INFORMATION

Support - No support.

Review stage at the time of initial registration - Data analysis.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY2026110042

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 11 November 2026 and was last updated on 11 November 2026.

INTRODUCTION

Review question / Objective To evaluate whether the ultrasound-guided costoclavicular approach (CC), compared with conventional ultrasound-guided infraclavicular approaches, improves block performance efficiency, sensory and motor block onset, anesthetic effectiveness, and procedural safety in adults undergoing upper-limb surgery.

Condition being studied Upper-limb surgical conditions requiring brachial plexus block, with particular attention to differences in block performance time, sensory and motor block characteristics, surgical readiness, block failure, and procedure-related complications between ultrasound-guided infraclavicular approaches.

METHODS

Participant or population Adults undergoing upper-limb surgery with ultrasound-guided infraclavicular brachial plexus block, including procedures involving the elbow, forearm, wrist, or hand.

Intervention Ultrasound-guided costoclavicular brachial plexus block (CC), targeting the brachial plexus cords within the costoclavicular space.

Comparator Conventional ultrasound-guided infraclavicular brachial plexus block, including the lateral sagittal, paracoracoid, or coracoid approach. Local anesthetic regimens and other perioperative treatments should be comparable between groups.

Study designs to be included Randomized controlled trials.

Eligibility criteria Inclusion criteria:
(1) Randomized controlled trials (RCTs) involving adults undergoing upper-limb surgery.
(2) Direct comparison of ultrasound-guided costoclavicular and conventional ultrasound-guided infraclavicular brachial plexus blocks.

(3) Conventional approaches including lateral sagittal, paracoracoid, or coracoid techniques.
(4) Comparable local anesthetic regimens and perioperative management between groups, allowing the effects of the different approaches to be evaluated independently.
For multi-arm trials, only the relevant intervention and comparison groups will be included.
Exclusion criteria:
(1) Nonrandomized studies and studies involving pediatric patients.
(2) Studies comparing CC with interscalene, supraclavicular, axillary, or other approaches outside the predefined comparison.
(3) Studies comparing only different needle directions, injection techniques, or local anesthetic regimens within the CC approach.
(4) Studies primarily investigating continuous catheter-based nerve blocks.
Duplicate publications or multiple reports of the same trial will be consolidated into a single study to avoid double-counting participants. Outcomes with data that cannot be reliably verified will be excluded from quantitative synthesis.

Information sources Two reviewers will independently search PubMed, Embase, Cochrane Library, Web of Science, China Biology Medicine (CBM), China National Knowledge Infrastructure (CNKI), Wanfang Data, and VIP Database from database inception.

Main outcome(s) Outcomes will be assessed across four domains: procedural efficiency, block onset characteristics, anesthetic effectiveness, and safety.
Procedural efficiency will be evaluated by the time required to perform the block, taking into account differences in whether ultrasound scanning and needle manipulation are included in the reported duration.
Block onset characteristics will include the time needed to achieve a predefined level of sensory blockade based on cold perception, as well as sensory onset times for the median and musculocutaneous nerves. Motor block development will be assessed separately for the median, musculocutaneous, and ulnar nerves. Additional time-related endpoints will include the interval required to reach a specified combined sensory–motor blockade criterion and the time until patients meet the conditions for surgery.
Anesthetic effectiveness will be assessed through the frequency of block failure and the proportions of patients achieving predefined composite sensory–motor block criteria at 20 and 30 minutes. These two assessment points will be analyzed independently. Block failure will follow the definitions provided in individual trials, including inadequate anesthesia necessitating supplementary nerve blockade, additional local anesthetic administration, intraoperative rescue analgesia, or conversion to general anesthesia. Routine sedation and postoperative pain management will not be regarded as block failure.
Safety outcomes will comprise accidental vascular puncture, paresthesia occurring during the block procedure, and Horner syndrome. Each adverse event will be assessed independently.

Quality assessment / Risk of bias analysis The Cochrane Risk of Bias 2 (RoB 2) tool will be independently applied by two reviewers.

Strategy of data synthesis Review Manager 5.4 will be used for meta-analysis. Continuous outcomes will be pooled using the inverse-variance method to calculate mean differences (MDs), while binary outcomes will be analyzed using the Mantel–Haenszel method to calculate risk ratios (RRs), each with a 95% confidence interval (CI).
For continuous outcomes reported as medians with interquartile ranges or ranges, means and standard deviations will be estimated using the methods proposed by Wan et al. when appropriate.
Between-study heterogeneity will be assessed using Cochran's Q test and the I^2 statistic. A P value below 0.10 will indicate statistically significant heterogeneity. Fixed-effect models will be applied when $I^2 \leq 50\%$, whereas random-effects models will be used when $I^2 > 50\%$.
Statistical significance for pooled effect estimates will be assessed at a two-sided $P < 0.05$.
When more than 10 studies are available for an individual outcome, funnel plots will be generated, and Begg's and Egger's tests will be performed using Stata software to investigate potential publication bias and small-study effects.

Subgroup analysis Subgroup analyses will be conducted for block performance time according to differences in timing definitions.
Studies will be categorized into three subgroups:
(1) Performance time including ultrasound scanning or localization.
(2) Performance time including needle manipulation only.
(3) Studies with unclear timing definitions.
Subgroup differences will be evaluated using a test for subgroup interactions.

Sensitivity analysis Leave-one-out sensitivity analyses will be performed for outcomes with a

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relatively large number of included studies, where appropriate.

Country(ies) involved China.

Keywords Costoclavicular approach; Infraclavicular brachial plexus block; Ultrasound guidance; Upper-limb surgery; Randomized controlled trials; Systematic review; Meta-analysis.

Contributions of each author
Author 1 - Aihua Li
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