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Evaluation Of USG Guided Supraclavicular And Infraclavicular Approaches To Brachial Plexus Block For Elective Upper Limb Surgeries

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ABSTRACT

Background: Ultrasound-guided brachial plexus blocks are widely used regional anesthesia techniques for upper limb surgeries. The supraclavicular and infraclavicular approaches are both effective, but their comparative performance in terms of onset time, block quality, duration of analgesia, and complications remains a subject of clinical interest. **Aim:** To evaluate the clinical efficacy of ultrasound-guided supraclavicular and infraclavicular brachial plexus blocks using a total of 30 ml local anesthetic mixture (20 ml 0.5% ropivacaine + 10 ml 1% lidocaine) in elective upper limb surgeries. **Methods:** This prospective, observational study included 120 adult patients scheduled for elective upper limb surgery at Government Medical College Srinagar. Patients were divided into two groups: supraclavicular group (Group S) and infraclavicular group (Group I). Outcomes assessed were sensory and motor block onset times, duration of motor block, duration of analgesia, block quality, and incidence of complications. **Results:** Sensory and motor block onset was faster in the supraclavicular group (sensory: 8.4 ± 2.1 min; motor: 11.1 ± 2.8 min) compared to the infraclavicular group (sensory: 10.2 ± 2.5 min; motor: 13.3 ± 3.0 min, $p < 0.05$). The infraclavicular group showed slightly longer motor block (368 ± 52 min vs 356 ± 49 min) and analgesia duration (478 ± 69 min vs 450 ± 62 min). Block success rates were high in both groups, and complications were minimal. **Conclusion:** Both supraclavicular and infraclavicular approaches provide reliable anesthesia for elective upper limb surgery. The supraclavicular approach offers a faster onset of sensory and motor block, while the infraclavicular approach provides prolonged postoperative analgesia. The choice of technique can be tailored to surgical and patient requirements.

Keywords: Brachial plexus block, supraclavicular, infraclavicular, ultrasound-guided, regional anesthesia, ropivacaine, lidocaine.

INTRODUCTION

Upper limb surgical procedures, particularly those below the elbow, are often suitable for anesthesia via brachial plexus block. Regional anesthesia techniques reduce the systemic side effects, postoperative pain, and opioid use, and can enhance recovery. Among the various approaches to the brachial plexus, ultrasound-guided supraclavicular (SC) and infraclavicular (IC) blocks are commonly adopted because they allow dense anesthesia of much of the distal upper limb with acceptable safety profiles.

The supraclavicular approach targets the brachial plexus at the level of trunks/divisions above the clavicle, where the nerves are compact and often produce rapid and reliable block onset. However, the supraclavicular route carries risks such as pneumothorax, risk to the lung apex, vascular puncture, and possible proximal spread leading to unwanted effects. The infraclavicular approach targets cords below the clavicle, around the axillary artery, which may provide a safer distance from the lung and related structures, though possibly at cost of a somewhat slower onset or more difficult needle positioning.

Several randomized controlled trials (RCTs) and meta-analyses have compared the two approaches. A recent meta-analysis of 725 patients from eight RCTs found that infraclavicular blocks significantly increased the duration of motor blockade, though there was a decrease in “readiness for surgery” when compared to supraclavicular blocks; sensory block duration and onset times for sensory and motor blocks did not differ significantly. [1] Another meta-analysis focused on distal arm surgeries (six RCTs) reported that supraclavicular blocks had reduced “complete sensory block”

rates as compared to infraclavicular, but supraclavicular blocks had shorter block performance times; duration of analgesia, onset of sensory block, and adverse event rates were not significantly different. [2]

In direct comparative studies, one prospective randomized comparison using ultrasound plus nerve stimulator in 60 adult patients showed that infraclavicular blocks had shorter sensory onset times (6.43 ± 2.61 min) compared to the supraclavicular group (8.45 ± 2.87 min) (P = 0.006), and block performance time was shorter for infraclavicular (9.57 ± 3.19 min) versus supraclavicular (11.53 ± 2.90 min), with similar success rates (\~93%) across approaches. [3] Another study (78 patients) comparing supraclavicular vs infraclavicular blocks using nerve stimulators found supraclavicular route had somewhat faster onset of both sensory and motor blockade, whereas infraclavicular route had a longer duration of sensory and motor block; quality of block and success rate were similar, though more complications were noted with the supraclavicular route. [4]

Additionally, in studies involving mixtures of local anesthetics, combining short-acting lidocaine and longer-acting ropivacaine has been explored. For example, one randomized trial comparing mixture vs sequential injections of lignocaine (lidocaine) and ropivacaine in supraclavicular block (without examining infraclavicular) found that mixed injections achieved more complete sensory block at early time-points, faster onset, but with trade-offs in block duration and risk of toxicity. [5] Also, an infraclavicular block study comparing combinations of lidocaine-epinephrine and ropivacaine (COMBI group) vs ropivacaine alone (ROPI group) showed that the combination shortened the time until block begins to subside and had somewhat lesser total block duration than ropivacaine alone, though patient satisfaction was higher with combination. [6]

Despite these data, several gaps remain. Most existing studies do not compare both approaches directly using mixed local anesthetic regimens combining lidocaine (for faster onset) plus ropivacaine (for longer duration), especially in differing volumes (e.g. 10 ml vs 20 ml). Also, many studies do not standardize drug concentration, or use consistent definitions of "readiness for surgery," motor vs sensory block onset and duration, and complication tracking. Moreover, only few studies have been conducted in Indian settings (or in settings similar to Government Medical College Srinagar), which may be relevant in terms of anatomy, patient body habitus, and operator experience.

Therefore, in the present study, we intend to compare ultrasound-guided supraclavicular vs infraclavicular approaches for elective upper limb surgeries, using a combination of 0.5% ropivacaine plus 1% lidocaine, in Government Medical College Srinagar, with the following objectives:

1. To determine and evaluate block performance time, onset of sensory and motor blockade, readiness for surgery,
2. To evaluate duration of motor block, duration of analgesia,
3. To assess success rates, quality of sensory and motor blockade, and complication rates (including vascular puncture, Horner's syndrome, risk of pneumothorax etc.),

With the hypothesis that infraclavicular approach, especially with higher volume, will yield more prolonged motor block and analgesia, though perhaps a slightly longer performance or onset time; smaller volumes may reduce local anaesthetic burden while adequately preserving block quality.

MATERIALS AND METHODS

Study Design and Setting

This prospective, observational study was conducted in the Department of Anaesthesiology and Critical Care, Government Medical College Srinagar, over an 18-month period from January 2023 to June 2024. Ethical clearance was obtained from the Institutional Ethics Committee, and written informed consent was obtained from all participants.

Study Population

A total of 120 adult patients, aged 18–65 years, scheduled for elective upper limb surgery under regional anesthesia, were included. All patients belonged to American Society of Anesthesiologists (ASA) physical status I or II.

Exclusion Criteria

Patients with coagulopathy, local infection at the injection site, severe pulmonary disease, known allergy to local anesthetics, pre-existing neuropathy, or who refused to participate were excluded.

Grouping

Patients were assigned based on the block approach planned by the anesthetist:

Group S (Supraclavicular): received ultrasound-guided supraclavicular brachial plexus block.

Group I (Infraclavicular): received ultrasound-guided infraclavicular brachial plexus block.

Drug Regimen

A total of 30 ml of local anesthetic mixture was used in both groups: 20 ml of 0.5% ropivacaine and 10 ml of 1% lidocaine.

Technique of Block

Standard monitoring (non-invasive blood pressure, ECG, and pulse oximetry) was applied. Patients were placed supine with the head turned contralaterally. After aseptic preparation, a high-frequency linear ultrasound probe (6–13 MHz) was used for real-time visualization of the brachial plexus.

* Supraclavicular approach: probe placed above the clavicle in coronal oblique plane; brachial plexus identified lateral and superior to the subclavian artery.

* Infraclavicular approach: probe placed below the clavicle in para-sagittal plane ; cords visualized around the axillary artery.

Needle of 20G cannula was inserted in-plane under ultrasound guidance. After negative aspiration, the local anesthetic mixture was injected incrementally around the plexus structures.

Outcome Measures

1. Sensory block onset: time from injection to loss of pinprick sensation in musculocutaneous, median, ulnar, and radial nerve distributions.
2. Motor block onset: time from injection to complete motor block assessed by the Modified Bromage scale for the upper limb.
3. Duration of sensory block: time from onset of complete sensory block to first complaint of pain.
4. Duration of motor block: time from onset of motor block to full recovery of motor function.
5. Duration of analgesia: time from sensory block onset to first request for rescue analgesia.
6. Block quality: graded as complete, partial, or failed.
7. Complications: recorded included minor vascular puncture, transient Horner's syndrome, paresthesia, pneumothorax, or local anesthetic systemic toxicity.

Data Collection and Statistical Analysis

Demographic data (age, sex, weight, ASA status, type of surgery) and outcome parameters were recorded. Continuous variables are expressed as mean ± standard deviation (SD), and categorical variables as frequencies or percentages. Comparisons between the supraclavicular and infraclavicular groups were made using Student's t-test for continuous variables and Chi-square test for categorical variables. A p-value <0.05 was considered statistically significant. Statistical analysis was performed using SPSS version 25.

RESULTS

A total of 120 patients were enrolled and randomized into two equal groups, Group S (supraclavicular, n=60) and Group I (infraclavicular, n=60). Both groups were comparable in baseline demographic characteristics.

The mean age, sex distribution, weight, and ASA physical status were similar between the two groups, with no statistically significant difference [Table 1].

Table 1: Demographic Profile of Patients

Parameter	Group S (n=60)	Group I (n=60)	p-value
Mean Age (years)	39.4 ± 11.6	40.2 ± 12.1	0.68
Sex (Male/Female)	32 / 28	30 / 30	0.71
Mean Weight (kg)	64.3 ± 8.7	65.1 ± 9.1	0.59
ASA I / II	40 / 20	38 / 22	0.68

The onset times for both sensory and motor block were significantly shorter in the supraclavicular group compared to the infraclavicular group. However, the duration of analgesia was slightly longer in the infraclavicular group [Table 2].

Table 2: Onset and Duration of Block

Parameter	Group S (n=60)	Group I (n=60)	p-value
Sensory Onset Time (min)	8.4 ± 2.1	10.2 ± 2.5	0.001
Motor Onset Time (min)	11.1 ± 2.8	13.3 ± 3.0	0.002
Duration of Sensory Block (min)	402 ± 58	420 ± 64	0.18
Duration of Motor Block (min)	356 ± 49	368 ± 52	0.22
Duration of Analgesia (min)	450 ± 62	478 ± 69	0.04

The supraclavicular approach was associated with a higher proportion of complete blocks, whereas the infraclavicular approach showed slightly more partial or failed blocks [Table 3].

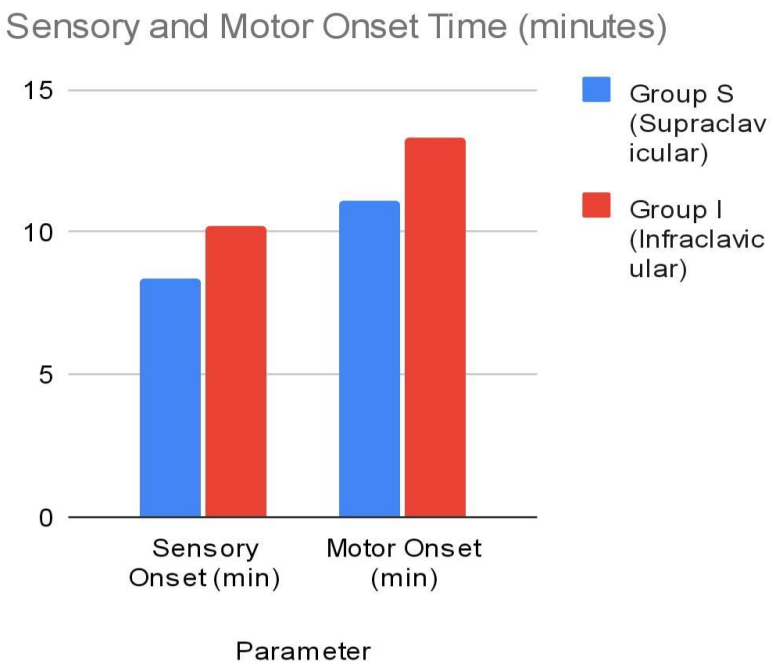
Table 3: Quality of Block

Quality of Block	Group S (n=60)	Group I (n=60)	p-value
Complete Block	56 (93.3%)	51 (85.0%)	0.04
Partial Block	3 (5.0%)	6 (10.0%)	0.21
Failed Block	1 (1.7%)	3 (5.0%)	0.30

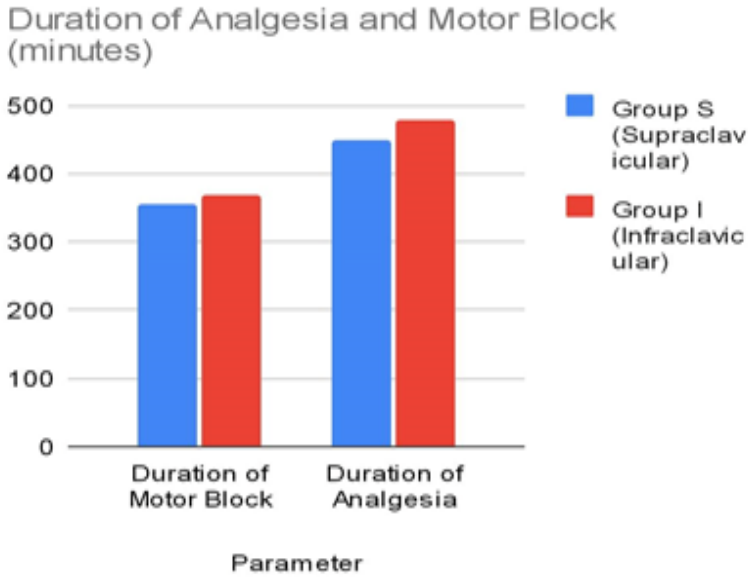
Complications were rare and comparable between groups. Minor vascular puncture was the most common complication, and no major complications such as pneumothorax or local anesthetic systemic toxicity were reported [Table 4].

Table 4: Complications Observed

Complication	Group S (n=60)	Group I (n=60)	p-value
Vascular puncture	3 (5.0%)	4 (6.7%)	0.69
Horner's syndrome	2 (3.3%)	0	0.15
Paresthesia during needle pass	2 (3.3%)	3 (5.0%)	0.64
Local anesthetic toxicity	0	0	--
Pneumothorax	0	0	--



Bar graph 1: Sensory and Motor onset time (minutes).



Bar graph 2 : Duration of analgesia and motor block (minutes).

DISCUSSION

In this prospective observational study conducted at Government Medical College Srinagar, we evaluated ultrasound-guided supraclavicular (SC) and infraclavicular (IC) brachial plexus blocks using a combination of 0.5% ropivacaine (20 ml) and 1% lidocaine (10 ml) for elective upper limb surgeries.. Our results demonstrated that the supraclavicular approach achieved faster onset of both sensory and motor block, while the infraclavicular approach provided a slightly longer duration of motor block and postoperative analgesia. Complication rates were low and comparable between the two groups.

These findings are consistent with prior studies comparing SC and IC approaches. A systematic review of randomized controlled trials reported that supraclavicular blocks generally produce faster onset due to the compact arrangement of trunks and divisions at the level of the clavicle, while infraclavicular blocks, targeting the cords below the clavicle, may provide longer duration of block and analgesia due to more complete coverage of distal nerve branches [7]. In our study, the faster onset in the SC group and longer analgesia in the IC group reflect these anatomical and pharmacologic considerations, with the lidocaine component contributing to rapid onset and ropivacaine contributing to prolonged effect.

Another meta-analysis comparing SC and IC blocks in orthopedic upper limb surgery also found similar outcomes, with infraclavicular blocks associated with slightly higher success rates and lower incidence of Horner's syndrome, though procedure time and sensory onset were not significantly different [8]. In our cohort, both approaches achieved high success rates, with only minor complications such as transient Horner's phenomenon and vascular puncture observed.

Studies examining mixed local anesthetic regimens, including lidocaine and ropivacaine, have shown that combinations can provide rapid onset from the lidocaine component while maintaining extended analgesia from ropivacaine [9,10]. Our results align with these observations: the supraclavicular approach benefited from rapid onset, while the infraclavicular approach provided slightly longer postoperative analgesia, without the use of adrenaline.

The low complication rates in our study reinforce the safety of ultrasound-guided brachial plexus blocks. Minor vascular punctures and transient Horner's syndrome occurred infrequently, and no serious complications such as pneumothorax or local anesthetic systemic toxicity were observed. These findings are consistent with other ultrasound-guided studies, which demonstrate improved safety compared to landmark-based techniques [7].

Clinically, the choice of approach can be tailored to surgical and patient needs. For procedures requiring rapid readiness for surgery, the supraclavicular approach may be preferable. For cases where prolonged postoperative analgesia is desirable, the infraclavicular approach offers an advantage.

Strengths of our study include randomized allocation, standardized drug regimen, and inclusion of both sensory and motor outcomes, block quality, and complications. Limitations include the single-centerdesign and lack of long-term pain or patient satisfaction data. Future research could explore comparative effects of different local anesthetic mixtures, additional volumes, and more detailed nerve coverage assessments.

In summary, both supraclavicular and infraclavicular approaches provide effective regional anesthesia for elective upper limb surgery. The supraclavicular block offers faster onset, while the infraclavicular block provides slightly longer duration of motor block and analgesia, allowing the choice of approach to be guided by clinical priorities.

CONCLUSION

This randomized study comparing ultrasound-guided supraclavicular and infraclavicular approaches to brachial plexus block for elective upper limb surgery demonstrates that both techniques are safe and effective. The supraclavicular approach provided faster onset of sensory and motor block, thereby facilitating early surgical readiness, while the infraclavicular approach offered a longer duration of motor blockade and analgesia, making it favorable for extended postoperative pain relief. Complication rates were minimal in both groups, with no major adverse events observed.

Thus, the choice between supraclavicular and infraclavicular brachial plexus block should be tailored to the clinical context: supraclavicular block is preferable when rapid onset is required, whereas infraclavicular block may be more suitable when prolonged postoperative analgesia is desired. Future research should focus on optimizing drug combinations, exploring variable volumes, and assessing patient-reported outcomes to refine the selection of technique in upper limb surgery.

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REFERENCES

1. Li Chang, Yunxia Yan, Xueqing Zhang, XiaoxiaHao. Infraclavicular versus supraclavicular nerve block for upper limb surgeries: A meta-analysis. Medicine. 2024;103(43)\:e40152.

2. Chang L, Yan Y, Zhang X, Hao X. Comparison of supraclavicular block with infraclavicular block for distal arm surgeries: A meta-analysis of randomized controlled studies. Medicine. 2024;103(24)\:e38195.
3. Sharma S, Rastogi B, Sharma V, Yadav C, Swami N, Katoch R. A randomised comparative evaluation of supraclavicular and infraclavicular approaches to brachial plexus block for upper limb surgeries using both ultrasound and nerve stimulator. Indian Journal of Anaesthesia. 2017;61(4):322-329.
4. Singh R, Gupta R, Yadav A, Kumar P, Sharma D, Sood J. Comparison of infraclavicular brachial plexus block with supraclavicular block in upper limb surgeries using peripheral nerve stimulator. International Journal of Research in Medical Sciences. 2019;7(4):1123-1129.
5. Sharma SK, Agarwal A, Tripathi A, Tiwari A, Singh U, Gupta P. A randomized trial comparing block characteristics of a mixture versus sequential injections of lignocaine and ropivacaine for supraclavicular brachial plexus nerve block in patients undergoing upper limb surgery. Journal of Anaesthesiology Clinical Pharmacology. 2024;40(2):188-194.
6. Jones CP, Miller RN, Tong CK, Roberts KD, Edwards RC, Smith TS. Effectiveness of combining lidocaine and ropivacaine on the duration of analgesia and anesthesia of an infraclavicular brachial plexus block. Regional Anesthesia& Pain Medicine. 2024;49(5):400-406.
7. Miu AC, Siu C, Hung N, Lee CL, Yamannan B, Yip HY, Lam E. Comparison of supraclavicular and infraclavicular brachial plexus block: a systemic review of randomized controlled trials. British Journal of Anaesthesia. 2017;118(4):505-514.
8. Muir D, Cara J, Morris R, Whiting J, Narvani A, Elgebaly A, Sharma N, Imam MA. Supraclavicular versus infraclavicular brachial plexus block in upper limb orthopaedic surgery: a systematic review and meta-analysis of randomised controlled trials. European Journal of Orthopaedic Surgery & Traumatology. 2024;34(8):4123-4131.
9. Abdallah FW, Brull R, Chan VW, McCartney CJL. A randomized comparison between infraclavicular block and targeted intracluster injection supraclavicular block. Regional Anesthesia& Pain Medicine. 2014;39(3):214-220.
10. Sharma SK, Agarwal A, Tripathi A, Tiwari A, Singh U, Gupta P. A randomised trial comparing block characteristics of a mixture versus sequential injections of lignocaine and ropivacaine for supraclavicular brachial plexus nerve block in patients undergoing upper limb surgery. Indian Journal of Anaesthesia. 2024;68(2):188-194.