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Original Research Article

Supraclavicular upper trunk block versus interscalene block for clavicle surgery: A prospective observational comparison of block onset and postoperative analgesia

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Abstract

Background: Effective postoperative analgesia for clavicle surgery is challenging due to the region's complex innervation. The interscalene block (ISB) is a common approach but is associated with phrenic nerve palsy. The supraclavicular upper trunk (SCUT) block is a more targeted alternative that may preserve diaphragmatic function. This study aimed to compare the block onset characteristics and postoperative analgesic efficacy of supraclavicular upper trunk block versus interscalene block in patients undergoing clavicle surgery**.**

Materials and Methods: In this prospective, randomized controlled trial, 70 patients undergoing elective clavicle surgery were allocated to receive either an ultrasound-guided ISB (n=35) with 25 ml of local anaesthetic (0.23% bupivacaine and 0.92% lidocaine with 8 mg dexamethasone) or an SCUT block (n=35) with 10 ml of local anaesthetic (0.2% bupivacaine and 0.8% lidocaine with 8 mg dexamethasone). The primary outcomes were the onset time of sensory and motor blockade. The secondary outcomes included the duration of analgesia (time to first rescue analgesic request for a VAS score ≥4) and pain scores (VAS) monitored for 36 hours.

Results: The onset of sensory blockade was significantly faster in the ISB group (3.48 ± 0.92 minutes) compared to the SCUT group (4.84 ± 1.03 minutes; $p < 0.0001$). Motor blockade onset was also faster with ISB (5.52 ± 1.01 minutes) than with SCUT block (9.00 ± 1.00 minutes; $p < 0.0001$). The duration of analgesia was significantly longer in the ISB group (11.24 ± 1.80 hours) compared to the SCUT group (10.08 ± 1.32 hours; $p = 0.013$). No significant adverse effects were reported in either group.

Conclusion: The interscalene brachial plexus block provides a faster onset of sensory and motor blockade and a longer duration of analgesia. In contrast, the supraclavicular upper trunk block achieves effective postoperative analgesia with a substantially reduced local anaesthetic volume. The supraclavicular upper trunk block thus represents a valuable alternative for clavicle surgery, where its targeted approach may lower the risk of complications such as phrenic nerve palsy, offering a favorable safety profile without compromising analgesic quality.

Keywords: Brachial plexus block, Interscalene block, Clavicle, Fracture fixation, Regional anaesthesia, Ultrasound-guided, Postoperative pain.

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1. Introduction

Clavicle fractures represent the most common injuries of the scapular girdle, with midshaft fractures accounting for approximately 80% of cases.[1] While non-displaced fractures are typically managed conservatively, surgical intervention is increasingly recommended for displaced midshaft fractures to improve functional outcomes and reduce long-term discomfort.[2] Effective postoperative analgesia following clavicular surgery presents a particular challenge due to the complex multi-nerve innervation of the clavicular region

Regional anaesthesia techniques provide superior postoperative pain control compared to general anaesthesia alone, forming an essential component of multimodal analgesic strategies.[3] However, traditional approaches such as interscalene brachial plexus block (ISB) combined with superficial cervical plexus block (SCPB) often result in incomplete analgesia or unnecessary motor blockade due to their non-specific nature.[4]

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Advancements in ultrasound technology have refined the practice of regional anaesthesia, enabling precise targeting of specific neural structures. The recent development of the supraclavicular upper trunk (SCUT) block offers a more targeted approach to clavicular analgesia.[5] This technique focuses specifically on the upper trunk of the brachial plexus and supraclavicular nerves, potentially providing comprehensive pain relief while minimizing local anaesthetic volume.[6] We hypothesized that the SCUT block would provide non-inferior postoperative analgesia compared to conventional ISB, while offering enhanced safety through reduced risk of complications such as phrenic nerve palsy.

2. Materials and Methods

This prospective, randomized, single-blind, controlled trial was conducted at a tertiary care hospital between November 2023 and August 2024, following approval from the Institutional Ethics Committee and registration with the Clinical Trials Registry, India (CTRI/2024/02/063293). This study followed the Good Clinical Practice (GCP) guidelines established by the Central Drugs Standard Control Organization (CDSCO) under the Ministry of Health, Government of India. It also adhered to the specified standards of ethics outlined in the Declaration of Helsinki (1975, revised in 2013) and the Ethical Guidelines for Biomedical Research on Human Participants issued by the Indian Council of Medical Research (ICMR) in 2006, New Delhi.

Written informed consent was obtained from all participants. Seventy adult patients (aged ≥18 years) of American Society of Anaesthesiologists (ASA) physical status I or II, scheduled for elective clavicle surgery, were enrolled. Exclusion criteria included a body mass index (BMI) >29 kg/m², chronic opioid or analgesic use, known diabetes mellitus, allergy to local anaesthetics, coagulopathy, or infection at the injection site.

Patients were randomly allocated into one of two groups (n=35 per group) using a computer-generated sequence, with Group ISB receiving an ultrasound-guided interscalene brachial plexus block and Group SCUT receiving an ultrasound-guided supraclavicular upper trunk block. The allocation was concealed using sealed, opaque envelopes. While the performing anaesthesiologists could not be blinded, the patients and outcome assessors responsible for postoperative data collection were blinded to group assignment.

After standard monitoring and IV premedication with 1 mg midazolam, the designated nerve block was performed under strict aseptic conditions. For Group ISB, a total of 25 mL of local anaesthetic (11.5 mL of 0.5% bupivacaine, 11.5 mL of 2% lidocaine with epinephrine 1:200,000, and 2 mL [8 mg] dexamethasone) was injected around the C5 and C6 nerve roots using an in-plane technique. For Group SCUT, 10 mL of the same anaesthetic mixture (4 mL of 0.5% bupivacaine, 4 mL of 2% lidocaine with epinephrine 1:200,000, and 2 mL [8 mg] dexamethasone) was injected deep to the superior trunk in the supraclavicular fossa after negative aspiration.

The primary outcomes were the onset time of sensory blockade, assessed by loss of pinprick sensation in the C5-C6 dermatomes, and motor blockade, assessed using a modified Bromage scale (0-3). The secondary outcome was the duration of postoperative analgesia, defined as the time from block completion to the first request for rescue analgesia (IV Paracetamol 1 g) when the Visual Analog Scale (VAS) pain score was ≥4. VAS scores were recorded hourly for the first 4 hours and then every 4 hours up to 36 hours postoperatively. Vital parameters including heart rate (HR), systolic and diastolic blood pressure (SBP, DBP), mean arterial pressure (MAP), and peripheral oxygen saturation (SpO_2) were monitored intraoperatively at two-minute intervals for the first ten minutes, followed by five-minute intervals for the next thirty minutes. Postoperatively, these measurements were recorded every four hours for the first twelve hours and subsequently every six hours until thirty-six hours.

Data collection utilized a semi-structured questionnaire comprising two sections: the first captured socio-demographic and baseline characteristics (age, sex), and the second recorded the baseline and subsequent vital parameters.

The sample size was calculated from the previous study by Ryung A Kang et al,[7] requiring 34 patients per group to detect a mean difference of 0.8 with a standard deviation of 2.0, at a power of 90% and an alpha error of 0.05. We enrolled 35 patients per group to account for potential dropouts. Data were collected in a Microsoft Excel spreadsheet and analyzed using the Statistical Package for the Social Sciences (SPSS). The normality of the distribution for continuous data was assessed using the Shapiro-Wilk test. Continuous variables with a normal distribution are presented as mean ± standard deviation and were compared between the two groups using the independent Student's t-test. These variables included demographic data, sensory and motor block onset times, duration of analgesia, and vital parameters (HR, SBP, DBP, MAP). Categorical variables, such as gender and ASA physical status, are presented as counts (percentages) and were compared using Fisher's exact test. A p-value of less than 0.05 was considered statistically significant.

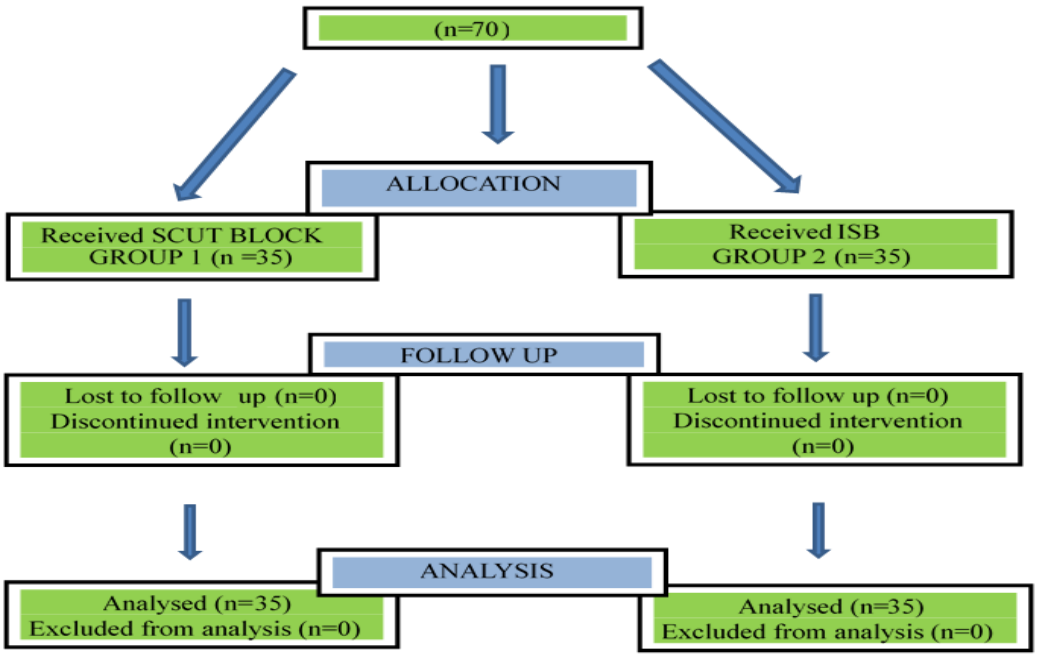

Figure 1: Consort flow diagram

3. Results

70 patients were studied in the two groups, 35 in each group (**Figure 1**). The demographic characteristics, including age, gender, BMI, and ASA physical status, were comparable between the two groups, with no statistically significant differences ($p > 0.05$ for all parameters) (**Table 1**)

Table 1: Comparative demographic data of study population

Parameter	Group		p-value-Fischer's exact test
	Group I (n=35)	Group II (n=35)	
Age (in years), mean (SD)	38.96 (11.212)	43.72 (12.989)	0.172
Gender (Female/Male) (n)	6/29	11/24	0.163
BMI (SD)	25.04 (2.071)	25.08(1.847)	0.943
ASA I/II (n)	29/6	29/6	1.000

SD=Standard deviation n= number of patients p value <0.05 – significant

The characteristics of the nerve blocks are summarized in **Table 2**. The onset of sensory blockade was significantly faster in the ISB group (3.48 ± 0.92 minutes) compared to the SCUT group (4.84 ± 1.03 minutes; $p < 0.0001$). Similarly, the onset of motor blockade was significantly faster in the ISB group (5.52 ± 1.01 minutes) than in the SCUT group (9.00 ± 1.00 minutes; $p < 0.0001$). The duration of analgesia, defined as the time to first request for rescue analgesia (VAS ≥ 4), was significantly longer in the ISB group (11.24 ± 1.80 hours) compared to the SCUT group (10.08 ± 1.32 hours; $p = 0.013$).

Table 2: Comparative data on block charecteristics

Parameter	Group		p value-Mann Whitey U test
	Group I (n=35)	Group II (n=35)	
Sensory Block Onset (min), Mean (SD)	4.84 (1.028)	3.48 (0.918)	<0.0001
Motor Block Onset (min), Mean (SD)	9.00 (1.000)	5.52 (1.005)	<0.0001
Duration of Analgesia (hrs.), Mean (SD)	10.08 (1.320)	11.24 (1.809)	0.013

SD=standard deviation n=number of patients p value <0.05 – significant, <0.001 highly significant

Hemodynamic parameters, including Mean Arterial Pressure, were comparable between the two groups during the preoperative, intraoperative, and postoperative periods (**Figure 2**). Postoperative pain scores followed similar trends in both groups, with the maximum observed VAS score being 5 in the SCUT group and 4 in the ISB group (**Figure 3**). No significant adverse effects were reported in either group throughout the study period.

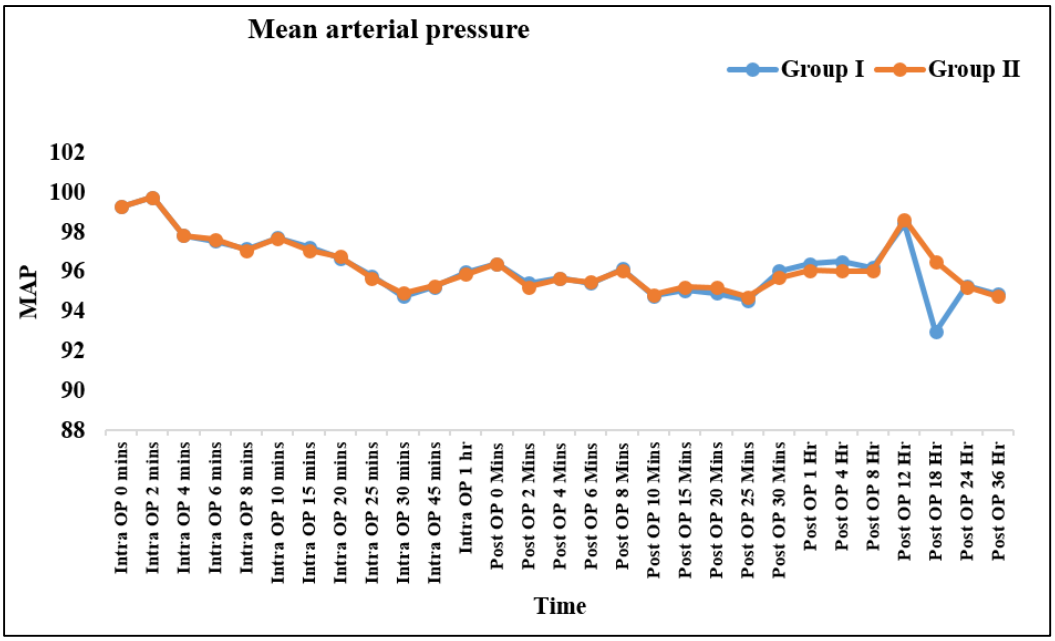

Figure 2: Comparative data on hemodynamics

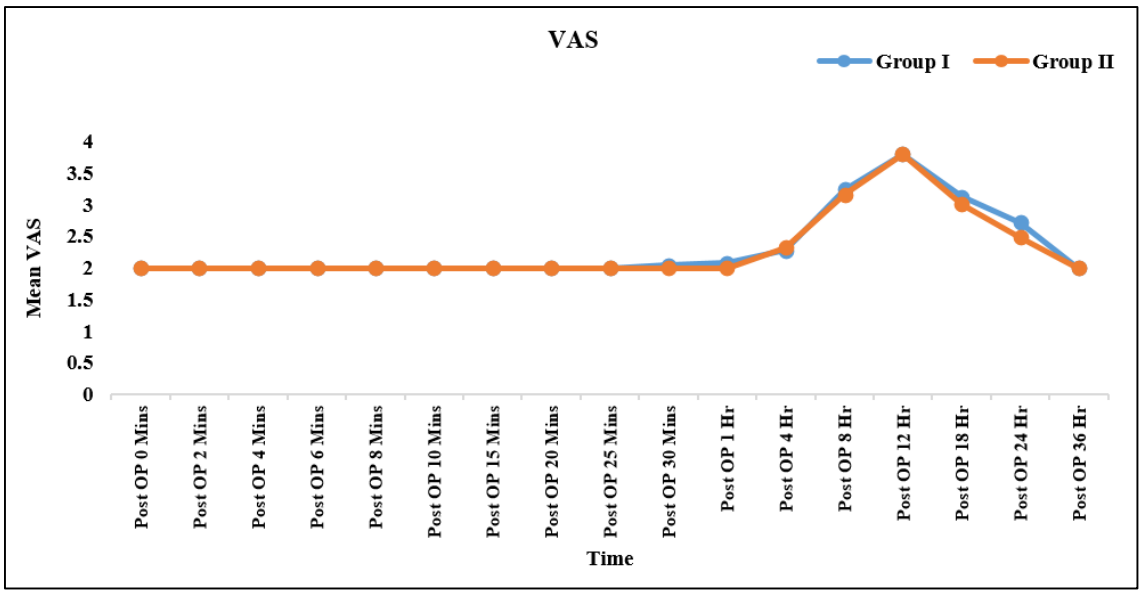

Figure 3: Comparative data on VAS trends

4. Discussion

Clavicle surgeries are commonly performed procedures, and the choice of anaesthetic technique can have a significant impact on the patient's postoperative outcomes.[8] Two popular regional anaesthesia techniques for clavicle surgeries are the supraclavicular upper trunk block and the interscalene block. Due to its selective targeting of the supraclavicular nerves and upper brachial plexus, the SCUT block may offer a lower risk of complications compared to the interscalene block.[9] The interscalene block, which targets C5-C7 nerve roots, is associated with potential side effects such as phrenic nerve blockade, hoarseness, Horner's syndrome and sensorimotor block of the entire ipsilateral upper limb.

The findings of our study align with the existing literature on the subject. A 2021 descriptive study by Sivashanmugam T et al. on 70 patients who underwent clavicle surgery using SCUT block showed excellent results.[3] Their study demonstrated that the SCUT block effectively blocked nerve conduction in all patients who received it. Also, the SCUT block provided sufficient anaesthesia for the completion of 96% of surgeries without needing additional anaesthetic techniques. The mean duration of postoperative analgesia was approximately 5 hours, with minimal complications reported (only one patient experienced ptosis).

Our results are further supported by a recent comparative study by Lee et al., which directly compared the SCUT block with the interscalene block for clavicle surgeries.[10] In their randomized controlled trial, the authors found that the SCUT

block provided non-inferior analgesia compared to the interscalene block, while demonstrating a significantly lower incidence of hemi diaphragmatic paralysis. This finding is crucial as it substantiates the theoretical safety advantage of the SCUT block with objective clinical evidence, reinforcing its role as a diaphragm-sparing alternative for proximal upper limb surgery.

Our findings are consistent with a growing body of literature comparing targeted trunk blocks with the traditional interscalene approach. The study by Kim et al. supports our main findings, showing that both blocks provide similar pain relief.[11] However, their research also demonstrated that the superior trunk block was more effective at reducing difficult side effects, such as shortness of breath and hand weakness. This is mechanistically explained by the block's more distal site of injection, which confines the local anaesthetic spread and minimizes exposure to the phrenic nerve (responsible for diaphragmatic function) and the inferior trunks of the brachial plexus (which supply the hand). This functional advantage is a critical differentiator, even when pain relief is equivalent.

This conclusion is further reinforced by Kang et al., whose results mirror our own in demonstrating the non-inferior analgesic profile of the SCUT block.[7] Their study provides direct comparative evidence that effective surgical analgesia for clavicle procedures can be achieved without the high rate of hemi diaphragmatic paralysis associated with ISB. Similarly our study also supports this observation by confirming the technique's clinical feasibility and safety, as we observed no significant adverse effects in either group.

Our study demonstrates the distinct characteristics of the SCUT block compared to the conventional interscalene block for clavicle surgery anaesthesia.[12] While both techniques proved effective, we observed important differences in their pharmacological profiles. The SCUT block exhibited slower onset times for both sensory and motor blockade, which can be attributed to its more precise anatomical targeting of the upper trunk and supraclavicular nerves, requiring careful deposition of a smaller anaesthetic volume.[13]

The interscalene block provided a longer duration of analgesia (11.24 hours versus 10.08 hours, p=0.013), though this difference may not be clinically substantial in routine postoperative care.[14] This extended duration likely reflects the higher total bupivacaine dose used in the interscalene block (57.5 mg versus 20 mg) rather than inherent superiority of the technique. The marginally shorter analgesia with SCUT block represents a reasonable trade-off for its more focused approach, which potentially reduces the risk of complications associated with broader interscalene blockade.[15]

Both techniques demonstrated excellent safety profiles. Three patients in each group required supplemental analgesics intraoperatively, but no other complications were observed in either group. These findings position the SCUT block as a valuable alternative to interscalene block, particularly when minimizing side effects is a priority.

This study also had several limitations. The single-center design and modest sample size of 70 patients may affect the generalizability of our findings. The significant disparity in local anaesthetic volume and dose between the two groups represents a major confounder, making it difficult to attribute outcomes solely to the block technique. While randomization strengthens the study design, the findings are limited by the lack of a standardized protocol to objectively diagnose complications such as phrenic nerve palsy. Moreover, the reliance on subjective patient-reported VAS scores for pain assessment introduces potential measurement variability. Future multicenter studies with larger cohorts, standardized complication assessments, and dose-matched protocols are needed to validate these findings.

5. Conclusion

The supraclavicular upper trunk (SCUT) block represents an effective alternative to the interscalene block (ISB) for clavicle surgery. While the SCUT block demonstrates a slower onset and marginally shorter analgesic duration, it provides comparable pain relief with a 60% reduction in local anaesthetic volume, enhancing its safety profile. The SCUT block's targeted approach potentially reduces the risk of phrenic nerve palsy, though this requires validation through larger studies incorporating objective methods for diaphragmatic assessment such as ultrasonography. The choice between techniques should balance the need for rapid onset against the advantages of reduced local anaesthetic dose.

6. Source of Funding

None.

7. Conflict of Interest

None.

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