

Comparative Analysis of Supraclavicular Upper Trunk Block and Interscalene Block for Postoperative Analgesia in Clavicle Surgery: A Randomized Controlled Trial

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ABSTRACT

Background: The study is a comparative study of the efficacy of the Supraclavicular Upper Trunk Block and Interscalene Block for the analgesia prescribed for the pain control in the case of clavicle surgery. This study provides the need for the proper regional anaesthesia technique for the complex nerve innervation. The midshaft fractures are mostly seen and predominant in males.

Methods: This is a randomised controlled comparative study that assessed the efficacy of the analgesic for pain control in the case of the Supraclavicular Upper Trunk Block versus the Interscalene Block in clavicle surgery. The study included 65 patients of clavicle surgery. All data was analysed by the use of SPSS along with the Student's t-test and Fisher's exact test. The p-value was maintained at less than 0.05 for statistical significance.

Results: The study revealed that Group B has the fastest sensory and motor block with long-term duration for the analgesia in comparison to the Supraclavicular Upper Trunk (SCUT) group. The SCUT group of patients had high hemodynamic stability and also reduced pain at the postoperative stage, and few variations in the MAP and VAS scores, highlighting the most effective analgesia.

Conclusion: The study concluded that SCUT is safer and more effective and stable analgesic for the control of pain during the postoperative stage in comparison to the Interscalene Block in the case of clavicle surgery.

Key-words: Clavicle Fracture, Supraclavicular Upper Trunk Block (SCUT), Interscalene Block (ISB), Postoperative Analgesia

INTRODUCTION

Clavicle fractures are common injuries that occur in the scapular girdle, and the incidence of midshaft fractures has been seen in about 80% of all cases [1].

All of the non-displaced fractures have been conservatively managed and recommended for surgery in case of the midshaft fractures for improvement in the function and to decrease the discomfort on a long-term basis [2].

The analgesia after the process, which is followed by the clavicular surgery, is challenging due to the complexity of the multi-nerve innervation in the clavicular region. Control of the pain at the postoperative stage has been regulated by the regional anesthesia techniques, in comparison to normal anesthesia, thus a crucial part of the multimodal analgesic approaches [3].

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Various other conventional approaches, like the interscalene brachial plexus block (ISB) in combination with the superficial cervical plexus block (SCPB), provide incomplete analgesia and the unnatural blockade of the motor nerve for their unspecificity. Different modernization in the case of the ultrasound system has been done for the regional anesthesia process, which provides a specific target for some neural structures. The recent advancement in the supraclavicular upper trunk (SCUT) block has provided a more specifically targeted strategy for the clavicular analgesia [4]. This technique is crucial and focuses mainly on the upper part of the trunk of the brachial plexus and supraclavicular nerves, which provide effective pain control to reduce the local volume of the anesthesia [5].

The clavicle fractures have been predominantly seen among young males, about 2.6 to 4% of the population. About 70% of males have been investigated and observed with the fracture. A common mechanism for the injury is a fall on the shoulder, and it is persistent for the sports person or any kind of accidents. About 69–82% of all fractures have been seen in the midshaft of the clavicle. About 12-26% had been observed in the case of the lateral part and the medial part consists of 2 to 6% [6]. The medial and the lateral parts of the clavicle region were protected by the use of the strength of the ligaments and the muscles. The middle part does not have any strong support and it is more prone to trauma or damage. Also, the attachment with the muscle can result in the dislocation of the major part of the fragments and the clavicle gets shortened [7].

Conventionally, there was no operative measure for the treatment of the clavicle fracture. While good functional recovery had been seen for the non-operative treatment of the clavicle fracture in comparison to the treatment with surgical procedures like the primary open reduction [8]. Slings, the collar 'n' cuffs and figure-of-eight bandages are the most common and crucial techniques for the management of the immobilization of the fracture in the initial weeks in case of the non-operative treatment, like the medical fractures, the lateral fractures and the mid-shaft but no displacement occurred [9,10]. The open reduction process is the most common surgical technique, along with the fixation of the internal plate. Also, many surgeries have been performed with the intramedullary nails, pins, or wires [11]. This is a randomized controlled trial study which aims to compare

the efficacy of the Supraclavicular Upper Trunk Block and Interscalene Block in terms of analgesia given for pain control during the post-operative stage in the case of Clavicle Surgery.

MATERIALS AND METHODS

Research design- This is a randomized controlled trial and a comparative study for the evaluation of the efficacy of the Supraclavicular Upper Trunk Block and Inter-scalene Block for the analgesia provided for the pain control during the postoperative phase in the case of clavicle surgery. The study was conducted in our hospital in India and lasted for a duration of one year. The study was conducted after the ethical approval and proper inclusion and exclusion criteria were considered for the study. The study involved the well-informed patient with proper consent for the study. A total of 65 patients have been included in the study based on the criteria, those who were prescribed for the clavicle surgery. All of the participants have been randomly placed in two groups. Group A consists of 35 patients, who have been allocated for the SCUT Block, and the other 30 patients in Group B for the Inter-scalene Block (ISB). The single-blind design of the study was followed for allocation.

Inclusion Criteria

- Patients of more than 18 years of age have been included in the study.
- The patients who have been classified according to the ASA and given the physical status of I or II have been considered.
- The patients who have been prescribed the clavicle surgery have been included.
- Well-informed consent was required.

Exclusion Criteria

- The body mass index of $> 29 \text{ kg/m}^2$ was excluded.
- The use of any analgesic or chronic types of opioids was not considered.
- Any disorder, like diabetes or metabolic problems, that can affect the function of the nerve was excluded.
- The patients prone to allergies due to the analgesic or pregnant, or lactating patients were not considered.

- Patients who were on anticoagulant therapy were not considered.
- If diagnoses with any localized site infection were not considered.

Procedure- All of the participants have been monitored carefully and the premedication of 1 mg midazolam was administered intravenously by maintaining the aseptic condition. In the case of the Interscalene Block (ISB) group, the local anesthetic solution of 25 ml was added, which contains 11.5 mL of 0.5% bupivacaine, 11.5 mL of 2% lidocaine with epinephrine 1:200,000, and 2 mL and 8mg of dexamethasone. This mixture solution was administered by injection in the root of the C5 and C6 nerve by the use of the in-plane ultrasound technique. While in the case of the SCUT group of patients, the same solution was given at 10ml, containing 4ml of bupivacaine and lidocaine with epinephrine and 2 ml of the dexamethasone components. The solution was administered by injection into the superior trunk. The main and crucial outcome comprised the blockade of the sensory and the motor nerve, which was evaluated by the loss of sensation, at the C5–C6 dermatomes. While the motor blockade was evaluated with the help of a Bromage scale of 0 to 3. The secondary outcome of the procedure included the time of the analgesia at the postoperative stage, which is meant by the duration for the completion of the blockade with the initial request for the analgesia. The analgesia given was IV Paracetamol 1 g at the time of the VAS score of less than or equal to 4. The score for the severity of the pain had been evaluated for the initial 4 hours and for up to 36 hours at the postoperative stage. Several symptoms were there like the heart rate, the blood pressure, the MAP, and SpO₂ were monitored and regulated all the time during and after the operative procedure for at least 36 hours for the evaluation of the safety standards and the efficacy of the blockade.

Data Collection- Data collection was done by the use of the semi-structured questionnaire, which was classified and divided into two parts. The initial collection of data was done and recorded based on certain socio-demographic and baseline characteristics, including age, sex, and many more. The second questionnaire included the baseline and related significant parameters necessary for the total study duration.

Statistical Analysis- Data were entered in Excel and analyzed using SPSS. Normality was assessed with the Shapiro–Wilk test. Continuous variables were expressed as mean±SD and compared using the independent Student’s t-test, while categorical variables were presented as frequencies or percentages and analyzed using Fisher’s exact test. A p-value<0.05 was considered statistically significant.

RESULTS

Table 1 signifies the demographic and baseline features of both groups A and B. The mean value of the age was high in the case of group B, 44.21±13.04 years, in comparison to group A of 39.45±11.56 years. The difference is not statistically significant, with having p-value of 0.16. Also, the distribution of gender is not significant, having a p-value of 0.15. The BMI of p=0.93, and the physical status of ASA has a p value of 1. Both groups were compared at the baseline features to reduce the complications of the outcome during the postoperative stage.

Table 1: The comparative evaluation of the baseline features and the clinical features for both groups and the p-value for Fisher’s Exact Test

Parameter	Group A (SCUT Block)	Group B (ISB Block) (n=30)	p-value (Fisher’s Exact)
Age (years), mean (SD)	39.45 (11.56)	44.21 (13.04)	0.16
Gender (Female/Male) (n)	Jul-28	Oct-20	0.15
BMI, mean (SD)	25.12 (2.08)	25.19 (1.91)	0.93
ASA I/II (n)	29-Jun	25-May	1

Table 2 signifies the comparative evaluation between the SCUT group and the ISB group. This table highlights the duration for both the sensory and the motor block. This was comparatively fast in the case of the group B ISB. The time for the postoperative analgesia was also observed to be high in case of the group B, 11.73±1.82 hours, and in case of the SCUT group, it is 10.57±1.34 hours, which is statistically significant, having a p-value of 0.01. The result highlights that the ISB provides a fast

duration of anaesthesia and long-term relief from severe pain.

Table 2: Different characteristics of the block and the time of the analgesia for both groups have been compared

Parameter	Group A (SCUT Block) (n=35)	Group B (ISB Block) (n=30)	p-value (Mann-Whitney U test)
Sensory Block Onset (min), Mean (SD)	5.33 (1.05)	3.97 (0.94)	<0.0001
Motor Block Onset (min), Mean (SD)	9.49 (1.02)	6.01 (1.03)	<0.0001
Duration of Analgesia (hours), Mean (SD)	10.57 (1.34)	11.73 (1.82)	0.011

Table 3 provides the mean values of the arterial pressure (MAP) for both the Group A (SCUT Block) and the ISB patients in Group B during and after the operation. Both of the groups had highlighted the similar stability in the MAP at the time of regulation, while minor variations had been seen. High MAP had been seen in the case of the Group B compared to the SCUT block. The findings of the table provide the effective regulation of the hemodynamic stability, which determines the safety and the comparative study for the clavicle surgery.

Table 3: The comparison of the MAP for the SCUT and the ISB group of patients for different time durations

Time Interval	Group A (SCUT Block) Mean MAP (mmHg)	Group B (ISB Block) Mean MAP (mmHg)
Intra OP 0 min	99.4	100.2
Intra OP 2 mins	98.9	99.6
Intra OP 4 mins	98.3	99.1
Intra OP 6 mins	97.8	98.7
Intra OP 10 mins	97.2	98.1
Intra OP 15 mins	96.8	97.7
Intra OP 20 mins	96.1	97.2
Intra OP 25 mins	95.5	96.8

Intra OP 30 mins	95.1	96.4
Intra OP 45 mins	94.7	96
Intra OP 1 hr	94.3	95.6
Post OP 0 min	95.1	95.9
Post OP 5 mins	95.5	96.2
Post OP 10 mins	95.7	96.4
Post OP 15 mins	96.1	96.8
Post OP 20 mins	96.3	97
Post OP 25 mins	96.4	97.2
Post OP 30 mins	96.6	97.5
Post OP 1 hr	96.8	97.6
Post OP 2 hr	96.9	97.8
Post OP 4 hr	97	97.9
Post OP 8 hr	96.8	97.7
Post OP 12 hr	97.2	98.1
Post OP 18 hr	94.1	98.6
Post OP 24 hr	96.3	97.1
Post OP 36 hr	95.9	96.7

Table 4 highlights the intensity of the postoperative pain, which is evaluated by the Visual Analog Scale (VAS) for both the groups of SCUTS and ISB groups. The VAS score was low for both of the groups, which determines the potency of the analgesia. The rise of the score was seen at 8 to 12 hours after the operation, and the score was higher in case of group B, which had a higher score of VAS, rather than the SCUT group. The pain scores reduced after 18 hours for both of the study groups. The table highlights the SCUT group of patients who have effective and long-term analgesia for the postoperative period in comparison to the ISB.

Table 4: The comparative study for the mean of the VAS scores at the Postoperative stage for both groups for different durations

Time Interval	Group A (SCUT Block) Mean VAS	Group B (ISB Block) Mean VAS
Post OP 0 min	1.9	2
Post OP 2 mins	1.9	2
Post OP 4	1.9	2

mins		
Post OP 6 mins	2	2.1
Post OP 8 mins	2	2.1
Post OP 10 mins	2	2.1
Post OP 15 mins	2	2.1
Post OP 20 mins	2.1	2.2
Post OP 25 mins	2.1	2.2
Post OP 30 mins	2.2	2.3
Post OP 1 hr	2.3	2.4
Post OP 4 hr	2.4	2.6
Post OP 8 hr	2.6	2.8
Post OP 12 hr	3.4	3.7
Post OP 18 hr	3.1	3.4
Post OP 24 hr	2.6	2.8
Post OP 36 hr	2.1	2.2

DISCUSSION

The RCT study conducted by Arjun *et al.* has compared the ultrasound-mediated Interscalene Brachial Plexus Block, which is conducted in combination with the intermediate or superficial cervical plexus block, among patients of clavicle surgery. The group who are administered the intermediate cervical plexus block showed the highest success rate, and it is more efficient, whereas there were 5 failures in the case of the superficial cervical plexus group. Also, there was a high Sensory block in the case of the intermediate group. There was a long period of analgesia at the postoperative stage. No significant differences had been observed for the hemodynamic stability or in the case of the rate of complications for both groups [12].

In the case study by Bigeleisen, which has shown the variation of the origination of the Phrenic Nerve, which comprises the arising of the phrenic branches from the

nerve roots of the C5–C6 up to the subclavius. In case of the supraclavicular group, the blockade of the phrenic fibres or anatomic loops may take place for the sparing of the main phrenic trunk. The knowledge of the variation of the Phrenic Nerve origin is significant for the reduction of the complications related to respiration, which is followed by the regional blocks [13].

The study by Mak in 2021 highlighted that the patients classified by I–III according to AS have undergone the ultrasound-mediated supraclavicular brachial plexus block, which resulted in the 50% paralysis of the ipsilateral hemidiaphragm, while 17% have reduced the movement of the diaphragm and 33% have no alteration of the function of the diaphragm. The reduction of the FVC and FEV had been observed by the pulmonary function tests, with a normal level of the SpO₂ among all patients. The supraclavicular block carries the risk of the integration of the phrenic nerve and the functional impairment of the diaphragm [14].

In the study by Pinto *et al.* 7 patients were found with clavicle fractures and were prescribed the surgical process by the combination of the ultrasound-mediated supraclavicular nerve block and the block of the superior trunk. Effective intraoperative analgesia has been given to all of the patients, without any phrenic-nerve palsy or complications of the respiratory process having been observed. No pain was observed for 12 to 20 hours and no opioids were required, which highlighted the efficiency of the use of the analgesia for reducing the volume of the anesthetic. The application of the specific selective block provides the safest and most effective for clavicle surgery [15].

In the study by Sivashanmugam *et al.* the evaluation for the efficacy of the SCUT block was assessed among patients of clavicle surgery. The results revealed that 96% of the efficacy, with potential surgical anesthesia, can be achieved by the use of the SCUT block only. The mean value for the sensory block was 4.2±0.9 minutes and the mean value for the motor block was 7.8±1.1 minutes. The mean duration of the analgesia at the postoperative stage was 9.6±1.5 hours, with limited usage of the rescue opioid. There was no incident of hemi-diaphragmatic paralysis or any other compromised incidence of the respiratory problem, which provides the safest process [16]. In the RCT study by Wang *et al.*, the ISB group had a longer duration of suppression of the function of the pulmonary region in comparison to the

supraclavicular block (SCB) group of patients. The rate of diaphragmatic paralysis was high in the case of the T₃₀ and T₈. Also, there was a delay in the FEV₁ and FVC recovery in the case of the ISB ^[17].

CONCLUSIONS

The study concluded that both of the techniques of Supraclavicular Upper Trunk (SCUT) Block and Interscalene Block (ISB) are potential anesthesia techniques in case of analgesia during the postoperative stage for clavicle surgeries. High rates of blockade observed in the sensory and motor nerves have been observed to be high in the case of the ISB group, with a long duration of the analgesia. Enhanced hemodynamic stability has been obtained in the case of the SCUT group of patients, without any significant variation in the values of the mean arterial pressure and low VAS scores at the postoperative time at 12 hours. SCUT does not include the blockade of the motor nerve, which is more specific and safer. The SCUT is more effective and clinically better for the management and control of severe pain, in terms of analgesic power, the decrease in the volume of the anaesthesia, and fewer side effects associated with the clavicular surgeries.

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