ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 02 | February - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ULTRASOUND-GUIDED SUPRACLAVICULAR BLOCK VERSUS COMBINED INFRACLAVICULAR AND SUPRASCAPULAR BLOCK

Anaesthesiology

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ABSTRACT

Background: The supraclavicular block (SCB) is commonly used for upper limb surgeries but carries risks such as phrenic nerve involvement, Horner's syndrome, and pneumothorax. The infraclavicular block (ICB), often combined with a suprascapular block (SSB), offers a safer alternative by avoiding these complications, although it may not provide complete shoulder analgesia. This study aimed to compare the efficacy of ultrasound-guided SCB versus combined ICB and SSB for upper limb surgeries under general anesthesia. **Methods**: A prospective, randomized controlled trial was conducted from April 2022 to April 2023, with 100 patients scheduled for upper limb surgeries (humerus and elbow) under general anesthesia. Patients were randomized into two groups: Group S received SCB (30 ml of 0.25% bupivacaine), and Group I received ICB (20 ml of 0.25% bupivacaine) combined with SSB (10 ml of 0.25% bupivacaine). The primary outcome was the total fentanyl consumption in the first 24 hours post-surgery. Secondary outcomes included the onset time and duration of sensory and motor blocks, postoperative pain scores (NRS), and incidence of complications. **Results:** The onset of both sensory and motor blocks was significantly faster in the SCB group ($P < 0.0001$). Sensory block duration was significantly longer in the ICB+SSB group ($P = 0.045$), but there was no significant difference in motor block duration. NRS pain scores were significantly lower in the ICB+SSB group at 3-, 4-, 5-, and 6-hours post-surgery ($P < 0.05$). Total fentanyl consumption was lower in the ICB+SSB group (51.45 ± 26.89 mcg vs. 61.78 ± 28.67 mcg), but this difference was not statistically significant ($P = 0.066$). Complications such as hemi-diaphragmatic paralysis were observed only in the SCB group. **Conclusion:** The combined ICB and SSB technique provided better postoperative analgesia and avoided complications like hemi-diaphragmatic paralysis, compared to the SCB. Although the onset time was longer and the reduction in fentanyl consumption was not significant, the combined approach offers a safer alternative for upper limb surgeries.

KEYWORDS

Supraclavicular block, Infraclavicular block, Suprascapular block, Upper limb surgery, General anesthesia

INTRODUCTION

William Halsted and Richard Hall utilised cocaine for upper limb blocks in the late 1800s.[1] In 1929, brachial plexus block anaesthesia was first described for upper limb procedures.[2] Countless websites, procedures, and approaches have been detailed since then. The supraclavicular block (SCB), sometimes called the "Spinal of the arm," is the most popular of these locations. It's a good choice since the brachial plexus nerve roots are close together in this area, so the nerve block is implemented quickly. Side effects such as neuropathy, pneumothorax, intraarterial injection, phrenic nerve involvement, Horner's syndrome, and intraarterial injection are possible with the SCB, even though it is the most used procedure with unquestionable benefits.

One localised anesthetic method that blocks the brachial plexus below the clavicle is the infraclavicular block (ICB).[3] Compared to SCB, ICB can avoid side effects and problems such as hemi-diaphragmatic palsy.4 A potential drawback of ICB is the potential for shoulder pain during preoperative placement and postoperatively because it spares the shoulder nerves.[3] The suprascapular nerve supplies the shoulder area and, at times, the skin above it with around 70% of the sensory information. If you want to alleviate pain in your shoulder without blocking the phrenic nerve, you can precisely target the suprascapular nerve.[5] A combination of ICB and SSB has proven effective as an analgesic for arthroscopic shoulder procedures.[6,7]

This study compared the relative efficacy of ultrasound-guided supraclavicular block with combined infraclavicular and suprascapular blocks in patients undergoing upper limb surgery under general anaesthesia (ga).

MATERIALS AND METHODS

We included male and female patients undergoing general anaesthesia for procedures involving the upper limbs (humerus and elbow) who were between the ages of 18 and 60 and rated as ASA class I to III. Participants were not allowed to participate if they had a history of bleeding disorders, infection, haematoma at the block site, allergy to local anaesthetics, clavicle or shoulder fracture or dislocation, pre-existing neurological deficits in the operated limb, or hemi diaphragmatic palsy as determined by ultrasound.

Each patient was given a thorough explanation of the procedures, and their written consent was acquired. Individuals were divided into two groups at random. A 30 ml supraclavicular brachial plexus block with 0.25% bupivacaine was administered to Group S, while 20 ml of infraclavicular brachial plexus and 10 ml of suprascapular nerve blocks were scheduled for Group I. Via an application on a computer.

The investigator evaluated analgesic needs, kind of block, postoperative pain score, intraoperative vitals, and block start time. Patients were brought to the operating room an hour before their procedures began; pre-operative Italy was noted after the usual non-invasive monitors were attached. Intravenous fluids (crystalloids) were started after securing a 20 G peripheral cannula on the non-operating hand. The portable ultrasound machine (Sono Site Edge II Ultrasound System, Fujifilm Inc.) was utilised to administer blocks to the upper limbs in both groups using a 5-13 Mhz linear ultrasound probe.

At 0,10,20, and 30 minutes after the block was administered, the preoperative room vitals of both groups were observed. After the block, every 5 minutes for 30 minutes, we measured the time of onset of sensory block (lack of pinprick feeling) and motor block (using the Modified Bromage Scale). To exclude patients from our study, we used the term "block failure" to describe those who did not experience a loss of pinprick sensation or motor weakness in the upper limb within 30 minutes.

Following the block, each patient was administered general anesthesia using induction medications such as 2 mcg/kg fentanyl, 1.5 to 2.5 mg/kg propofol, and 0.1 mg/kg vecuronium. Then, an appropriately sized cuffed endotracheal tube was used to secure the airway. After that, the patient was prepared for the surgical procedure. Injecting neostigmine (50 mcg/kg, i.e.) and in. glycopyrrolate (10 mcg/kg, i.e.) at the end of the surgery was used to reverse neuromuscular blockade if the patient had sufficient spontaneous breathing efforts. The patients were moved to the PACU after being extubated, which was done after adequate reversal.

In the PACU, every patient was carefully observed. Using a numeric rating scale (NRS), patients' pain levels are evaluated immediately following surgery, every hour for the first six hours, every two to twelve hours, and every four to twenty-four hours thereafter. To deliver 25 microgrammes of fentanyl intravenously, an NRS score of 4 or above was required. After 24 hours, the total amount of fentanyl needed was determined by tallying up the bolus doses. Sensory (pinprick sensation) and motor (elbow flexion/figure motions) responses were used to measure the length of the block. Before, during, and after the procedure, patients were evaluated for hemi diaphragmatic paresis, palsy, pneumothorax formation, local anaesthesia systemic toxicity (LAST), and nerve injury.

Our major goal was to compare the total amount of intravenous fentanyl needed in the first twenty-four hours following surgery between the two groups. Secondary goals included comparing the two groups' relative occurrence of problems, the time it took for sensory block (loss of pinprick feeling) and motor block (Modified Bromage Scale 3 or lower) to set in after surgery, and the amount of discomfort patients reported (as determined by NRS score).

The sample size was determined by assuming an effect size of 0.6 (medium effect size) for our primary objective, which is the total requirement of intravenous fentanyl in the first 24 hours postoperatively, as no previous studies of this kind were found. This was done using Cohen's Convention. Using GPOWER 3.1.9.7, we ran a power analysis for the mean with the following parameters: 0.6 effect size, 0.05 alpha error, and 0.80 power. A total of 100 participants, divided evenly between two groups of 50, were surveyed using the parameters.

Statistical Analysis

Version 23 of IBM's statistics software for the social sciences was used for data analysis. When comparing groups of people using categorical data, researchers used either Fisher's Exact Test or a chi-squared test. A statistically significant result was defined as a p-value <0.05.

RESULTS

Baseline characteristics

The study compared two groups (S and I) across various parameters. No significant differences were found in age, gender, BMI, ASA grade, or surgery duration. However, the S group showed significantly faster onset times for both sensory and motor blocks (P < 0.0001), as well as a shorter motor block duration (P = 0.045), compared to the I group. Sensory block duration was similar between the groups.

NRS Score

No significant differences were found immediately after extubation or at 1, 2, 8, 10, 12, 16, 20, and 24 hours (P>0,05). However, the S group reported significantly higher pain scores at 3-, 4-, 5-, and 6-hours post-surgery compared to the I group (P<0.05).

24-hour Fentanyl (mcg) Consumption

The S group received an average dose of 61.78 ± 28.67 mcg, while the I group received 51.45 ± 26.89 mcg. The difference between the groups was insignificant (P = 0.066).

DISCUSSION

One hundred patients scheduled for procedures on their upper limbs while under general anaesthesia were part of our randomised controlled trial. Regarding our main goal, we discovered that the ICB+SSB group had a lower average fentanyl dose in the first day, but this difference was not statistically significant (61.78±28.67 vs 51.45±26.89; P=0.066). When comparing the two groups' block onset times, the SCB group demonstrated noticeably quicker motor and sensory blocks. There was no statistically significant change in the duration of the motor block between the ICB+SSB groups, but there was a substantial increase in the duration of the sensory block. Compared to the control group, the one I worked with in the first six hours after surgery had much lower NRS scores. After six hours and up to twenty-four hours, the NRS score remained unchanged.

The ICB+SSB group decreased cumulative fentanyl consumption within the first 24 hours, but this difference was not statistically significant. Regarding research conducted by **Kukreja P et al.**, The researchers found that the infraclavicular group consumed more morphine on average after surgery. At the same time, the difference was not statistically significant, as compared to the supraclavicular group.[8] Our study may have differed from others since suprascapular blocks were not used. Twenty patients who had shoulder arthroplasty were the subjects of a different study that used a hybrid approach, combining ICB and SSB. The authors showed that postoperative analgesia was effective and that sequelae such hemi diaphragmatic paralysis were less common.[9]

Our results show that there is a statistically significant difference in the time it takes for sensory and motor block to set in between groups I and S. **Arcand G et al.**, In a related study, 80 patients underwent infraclavicular and supraclavicular ultrasound-guided blocks; the researchers found no difference in the groups' block onset times and that the performance times and block quality of the two types of blocks were comparable.[10] Abhinaya RJ et al.'s findings from a related study indicated that sensory block began sooner in the ICB group than in the SCB group.[11] We used the corner pocket method for brachial plexus blocks, and it's possible that this is why these studies found differing results. Only 0.25 percent bupivacaine was administered in our trial because its primary purpose was to evaluate postoperative analgesia.

Group I had a longer sensory blackout, on average, in terms of hours. The ICB+SSB group had longer motor and sensory blocks, but no statistically significant difference existed in how long the motor block lasted. The authors of a study on distal arm surgery randomly assigned 120 patients to one of three groups for an ultrasound-guided brachial plexus block: supraclavicular, infraclavicular, or axillary. They found that the infraclavicular group had a much longer block, consistent with our findings.[12]

Group I's NRS ratings were lower for the first half an hour. The two groups differed significantly to NRS at 6 hours, with the SCB group having the greatest mean NRS at rest. Contrary to our findings, Kukreja et al. found that the infraclavicular block group had a greater post-operative pain score on the visual analogue scale compared to the supraclavicular group. There was no statistically significant change, though.[8] Since the suprascapular block (SSB) was not used in conjunction with the infraclavicular block (ICB) in their investigation, it is possible that the inclusion of SSB in our study would have reduced pain scores at most (but not all) locations during rest and movement.

Our investigation found that only the SCB group experienced problems following block administration, specifically hemi diaphragmatic paralysis and paresis. A study compared two types of brachial plexus blocks: ultrasound-guided interscalene (ICB) and supraclavicular (SCB). Nearly one-third of patients in the SCB group had full hemi diaphragmatic paralysis, according to the study. On the other hand, this consequence was far less common in the ICB group. After conducting nerve stimulator-guided SCB on 30 patients, Mak PH et al. discovered that half of the patients experienced full ipsilateral diaphragmatic palsy and seventeen percent had diminished diaphragmatic mobility.[13] It is possible that the reduced medication concentration and the use of ultrasonography in all patients contributed to the lower incidence of hemi diaphragmatic paresis and paralysis in our study.

A study examining different volumes of supraclavicular brachial plexus blocks found that hemi diaphragmatic paralysis and phrenic nerve involvement were more common with larger block volumes.[14] Another study done by **Renes SH et al.**, examined USG versus nerve stimulation

CONCLUSION

For patients undergoing upper limb surgeries, the use of Combined Infraclavicular and Suprascapular block, compared to the Suprascapular block alone, resulted in increased duration of sensory block and no incidence of hemi diaphragmatic paresis or paralysis. However, the onset time of the block was longer, and 24-hour cumulative fentanyl consumption was not significantly reduced.

Table 1: Baseline characteristics

Baseline characteristics	Group		P value
	S (n=50)	I (n=50)	
Age (Years)	31.86 ± 11.64	32.19 ± 8.57	0.435
Gender			
Male	35 (69.4%)	40 (80.6%)	0.248
Female	15 (30.6%)	10 (19.4%)	
BMI (kg/m^2)	21.25±2.82	21.22±2.32	0.765
ASA Grade			
Grade I	36	42	

Grade II	14	8	
Duration of Surgery	47.56±4.57 min	48.98±3.65 min	0.670
Onset time			
Sensory block (min)	8.47±3.12	13.75±4.69	<0.0001
Motor block (min)	15.56±5.32	24.17±5.67	<0.0001
Duration of Block			
Sensory block (min)	6.03±0.94	6.21±1.48	0.266
Motor block (min)	7.03±0.99)	7.64±1.44	0.045

Table 2: NRS Score

NRS score	**Group**		**P value**
	S (n=50)	**I (n=50)**	
After Extubation	0.14 ±0.49	0.08±0.28	0.953
1 Hour	1.22±0.99	0.78±0.93	0.055
2 Hours	1.81±0.47	1.50±0.88	0.121
3 Hours	2.42±0.65	1.97±0.81	0.017
4 Hours	2.75±0.60	2.39±0.77	0.037
5 Hours	3.06±0.79	2.56±0.81	0.013
6 Hours	3.92±1.46	3.08±1.00	0.043
8 Hours	4.42±1.71	3.81±1.28	0.218
10 Hours	4.81±1.88	4.22±1.48	0.211
12 Hours	4.36±1.73	4.03±1.34	0.590
16 Hours	3.89±1.35	3.69±1.01	0.728
20 Hours	3.33±1.10	3.42±1.02	0.635
24 Hours	3.08±0.81	3.22±0.93	0.483

Table 3: 24-Hour Fentanyl (MCG) consumption

	Group		**P value**
	S (n=50)	**I (n=50)**	
Dose of Rescue Analgesia Fentanyl (mcg)	61.78±28.67	51.45±26.89	0.066

REFERENCES