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Prospective Study Evaluating the Efficacy of a Combined Superficial Cervical Plexus and Interscalene Brachial Plexus Block under USG as Anesthesia for Clavicular Surgeries

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Abstract

Background: clavicle fracture is one of the most common types of fracture. Administration of anesthesia is usually done under general anesthesia. But regional anesthesia techniques provide superior postoperative analgesia and fewer side effects. There are various options in regional anesthesia if USG is available. Clavicle's anatomy and complex nerve innervations from both cervical(c3-c4) and brachial(c5-c6) plexus makes it challenging to anesthetize with single peripheral nerve block. So, dual block technique by combining both the interscalene block and superficial cervical block provides good surgical anesthesia and post operative analgesia. In this study we did a prospective analysis of effects of ISB + SCPB for clavicle surgery.

Methods: We conducted an analysis of 319 patients who underwent clavicle open reduction and internal fixation (ORIF) under this combined block between October 2021 and July 2025. All procedures were performed under ultrasound guidance using low-volume local anesthetic combining 0.5% isobaric Ropivacaine, 0.5 % bupivacaine, 2% lignocaine.

Primary outcomes were intraoperative block success rate, block sparing rate [need for supplemental local anesthesia / small dose opioid requirement], and failed block [conversion rate to GA]. Secondary outcomes included procedural complications and block performance time, LAST, respiratory complications and other minor side effects

Results: The technique achieved an 93% (297/319) success rate, providing complete surgical anesthesia. 4% (13/319) of cases required minimal supplemental local anesthetic infiltration (due to anesthesia sparring), almost exclusively for the medial clavicular region. The conversion rate to GA[failed block] was 3% (10/319), with the primary indication being patient anxiety (7/10) rather than block failure. There are no major pulmonary or neurological complications.

Conclusion: This dual block combining interscalene and superficial cervical block under USG is highly effective, safe and reliable. With a 97% functional success rate (complete block + sparring), it represents an excellent strategy to avoid GA, enhance recovery, and facilitate ambulatory surgery. This technique should be given an utmost priority and should consider as a cornerstone in the regional anesthesia practice for clavicle procedures and also to provide good post op analgesia.

Keywords: Regional Anesthesia, Clavicle Fracture, Usg Blocks, Interscalene Block, Superficial Cervical Plexus Block, Post-Operative Pain, Brachial Plexus

1. Introduction

Clavicle fracture is one of the most common type of fractures in polytrauma. Approximately consists of 2.5% to 5% of adult fractures and up to 45% of shoulder fractures [1]. While historically managed conservatively, there has been a constant shift towards surgical intervention specifically open reduction and internal fixation (ORIF) for displaced midshaft fractures and fractures with specific compromising features. So, these fracture repairs need to be optimized through a well-designed perioperative care[2].

General anesthesia (GA) has been the traditional way for these procedures. But GA is associated with severe known and documented drawbacks which includes, post operative nausea and vomiting, airway manipulation, difficulty in intubation if associated with maxillofacial injuries , hemodynamic changes, longer post anesthesia care unit stay, higher opioid requirement immediately in the post operative period.[3,4,5]

Regional anesthesia techniques provide and act as a great alternative instead of general anesthesia, which aims to provide superior intraoperative anesthesia and excellent postoperative analgesia while excluding the adverse effects of GA and systemic opioids.[5,6]. Clavicle was innervated by many nerves , out of which subclavian nerve , lateral pectoral nerve and supraclavicular nerve are important [7]. The principal challenge in employing regional anesthesia for the clavicle lies in its complex and dual innervation. The skin and subcutaneous tissue on the clavicle is innervated majorly by superficial cervical plexus mainly by C3-C4. In contrast the periosteum of the shaft, lateral clavicle and acromioclavicular joint are innervated by suprascapular nerve, which is originated from upper trunk of brachial plexus (C5-C6)[8]

INTERSCALENE BRACHIAL PLEXUS BLOCK(ISB) is the gold standard for shoulder surgery. This would cover the C5-C8 distribution but it spares superficial nerves that comes from C3-C4, which causes incomplete analgesia of medial side of clavicle and also supraclavicular area. Whereas, a superficial cervical plexus block targets the c3-c4 nerves but it is insufficient for lateral and deep structures. And therefore, a combined approach is rational and good alternative.

This large-scale study analyzes our institution's experience using this dual-block technique as the primary surgical anesthetic in over 300 cases of clavicle ORIF, evaluating its success rate, safety profile, and feasibility.

2. Methods

Study Design and Population

After obtaining approval from the Institutional Ethical committee, we conducted a prospective cohort study of all patients who underwent clavicle ORIF under a combined ISB+SCPB technique at GMR V CARE HOSPITAL between October 3 2021, and July 31, 2025. Patient data were extracted from study proforma sheets

Inclusion criteria: age 18-80. ASA physical status I-III, and scheduled for elective or traumatic clavicle ORIF.

Exclusion criteria included: patient refusal of regional anesthesia, any contraindications to peripheral nerve block (e.g., coagulopathy, infection at the site), any known allergy to local anesthesia, severe respiratory disorders and diseases prohibiting any phrenic nerve involvement, and pre-existing neurologic deficit in the operative limb.

A total of 318 patients matched the required criteria.

Anesthetic Technique:

All blocks were done in a dedicated pre operative room which is equipped with all the standard ASA monitors: pulse oximetry, non-invasive blood pressure, ECG. Oxygen supplementation was administered through nasal cannula. All patients received moderate and monitored sedation with intravenous midazolam (0.05 mg/kg) and fentanyl (1-2 mcg/kg) The procedures were performed or directly supervised by trained regional anesthesiologists(figure 1). A high-frequency linear ultrasound transducer (GE logicQ. linear probe: L4-12t) was used for all scans.

Fig.1 positioning and preparation of block

1]INTERSCALENE BRACHIAL PLEXUS BLOCK (ISB): [9,10,11]The patient was explained about the procedure. The patient was positioned in a supine position and asked to turn the head to the contralateral side. The linear ultrasound probe is placed transversely on the neck at the level of cricoid cartilage (C6). Then the probe is adjusted to identify the anterior scalene and middle scalene muscles with

the brachial plexus roots appearing as the hypo-echoic nodules in between these two muscles(Figure 2) Using an in-plane posterior approach, a stimiplex needle 50-mm insulated block needle was advanced to the sheath surrounding the C5 and C6 nerve roots. After careful negative aspiration, 8 mL of 0.5% bupivacaine and 8 ml of 2% lignocaine was injected with direct ultrasound visualization to make sure of adequate spread.

Fig 2 : Interscalene brachial plexus block.

2. SUPERFICIAL CERVICAL PLEXUS BLOCK (SCPB): [12,13,14,15] Immediately after the ISB, without changing the position of the patient, the ultrasound probe was moved laterally to identify the posterior border of the sternocleidomastoid (SCM) muscle at its midpoint. Using an in-plane technique from lateral to medial, the same needle was advanced to the fascial plane deep to the SCM muscle. After hydro dissection with 1-2 mL of saline, 8 mL of 0.5% isobaric Ropivacaine was deposited to envelop the superficial cervical plexus.(Figure 3) Sensory assessment (loss of cold sensation) was tested in the supraclavicular (C3-C4) and deltoid (C5-C6) regions after 10 minutes. Surgery was permitted to begin once adequate sensory blockade was confirmed

Fig 3 : Superficial cervical plexus block

Intraoperative Management: Patients were transferred to the operating room. Standard monitoring was applied. No additional sedation was administered unless requested by the patient for anxiety. If the patient reported discomfort upon surgical incision or manipulation, the surgeon infiltrated the surgical site with ≤5 mL of 1% Lignocaine with epinephrine and 1-2mcg/kg fentanyl is administrated . This was defined as "anesthesia sparring." If this supplementation was not sufficient for analgesia and if the patient requested more pain relief , general anesthesia was induced, and considered as block failure.

Data Collection and Outcomes:

Data collected included:

Patient demographics (age, sex, BMI, ASA status),

Type of surgery (elective vs. traumatic),

Block performance time,

Surgical duration,

and intraoperative details.

The primary outcomes were:

Table 1: Patient Demographics and Surgical Characteristics (n=319)

Parameter	**Value**
Age (in yrs), mean ± SD (range)	44.8 ± 16.1 (18-80)
Gender (Male/Female), n (in %)	250 (78.4%) / 69 (21.6%)
Body mass index (kg/m²), mean ± SD	23.7 ± 4.3
ASA Status (I/II/III) n (in %)	108 (33.9%) / 167 (52.3%) / 44 (13.8%)
Type of procedure (Traumatic/Electric), n (%)	242 (75.9%) / 77 (24.1%)
Surgical Duration (min), mean ± sd	79 ± 25
Block Performance Time (min), mean ± SD	12.3 ± 3.5

Table 2: Primary Outcomes of Combined ISB+SCPB Technique (n=319)

Outcome	n	%
Complete Success (No supplements)	297	93.00%
Required Anesthesia Sparring	13	4.00%
Converted to General Anesthesia	9	3.00%
Reason for Conversion:		
Patient Anxiety/ Claustrophobia	7	2.20%
Inadequate Surgical Anesthesia	2	0.80%

Success: Completion of surgery without any supplemental analgesics or conversion to GA.

Anesthesia Sparring: The requirement for surgeon-administered local anesthetic infiltration to manage discomfort in a specific area/ give supplementation of small dose of opioid , if required

Conversion to GA: The necessity to convert to general anesthesia due to either patient request (e.g., anxiety, discomfort) or surgical intolerance.

Secondary outcomes included: block performance time (from skin disinfection to needle withdrawal), onset time, and any immediate complications (vascular puncture, local anesthetic systemic toxicity (LAST), Horner's syndrome, symptomatic phrenic nerve palsy, pneumothorax).

Statistical Analysis

Descriptive statistics were used for data analysis. Continuous variables are presented as mean ± standard deviation (SD), and categorical variables are presented as numbers and percentages (%).

Results

A total of 319 cases were analyzed. Patient demographics and surgical characteristics are summarized in Table 1.

Secondary Outcomes and Complications:

The mean sensory onset time was **18.3 ± 5.2** minutes.

Minor complications are noticed in 12 patients (3.8%). They are transient Horner's syndrome in about 9 cases (2.8%) and 3 cases of self-resolving hoarseness (0.9%) due to the involvement of recurrent laryngeal nerve. As the blocks were given under USG guided [16]manner, serious complications were not seen. There were no cases of symptomatic phrenic nerve palsy requiring intervention, pneumothorax, vascular puncture, or local anesthetic systemic toxicity[17].

Discussion

This large case series analysis demonstrates that the combination of ultrasound-guided ISB and SCPB is an exceptionally effective and safe primary anesthetic technique for clavicle ORIF, with a 93% functional success rate and a very low (3.2%) conversion rate to general anesthesia.

The high success rate (93%) validates the physiological principle of targeting both neural sources of clavicular innervation. The 4% incidence of "anesthesia sparring" is a clinically favorable finding. In all these cases, the discomfort was localized to the medial third of the clavicle, an area known to occasionally receive variable innervation that may not be fully captured by the SCPB. This minor supplementation is a simple, effective intraoperative adjustment that preserves the benefits of regional anesthesia and still avoids GA.

The conversion of regional to general anesthesia was not just due to technical failure but mainly due to patient factors, mostly due to anxiety and inability to tolerate the awake state procedure. These reasons generally underscore the eminence of regional anesthesia: Technical success is only one component. Proper selection of the patient, thorough examination and pre operative counseling about what kind of procedure and what to expect from the procedure, judicious use of sedation would all play a key role in a successful block. Our low conversion rate suggests that our pre operative process for block administration is effective in preparing the patient for awake procedure.

The safety profile of this dual-block technique was excellent. The use of a lower volume (15-16mL) for the ISB likely contributed to the low incidence of symptomatic phrenic nerve palsy (0%), a significant advantage over traditional higher-volume ISB techniques. The other complications (Horner's syndrome, hoarseness) were transient and well-tolerated.

Clinical Implications and Advantages:

1. **GA-Sparing**: Avoids multiple drugs, airway manipulation, and PONV.

2. **Enhanced Recovery**: Provides great intraoperative anesthesia period and the need of usage of opioids postoperatively is drastically reduced.

3. **Ambulatory surgery feasibility**: it provides and facilitates faster PACU bypass and early discharge, making it ideal in outpatient surgical centers.

4. **Operational Efficiency**: Performed in a block room, it reduces turnover time in the main operating room.

Limitations:

We did not quantitatively assess pulmonary function (e.g., spirometry) to document subclinical phrenic nerve palsy. Furthermore, postoperative pain scores and opioid consumption were not systematically analyzed in this review but are the subject of an ongoing prospective trial.

Conclusion

The combined ultrasound-guided Interscalene and Superficial Cervical Plexus Block is a robust, reliable, and safe technique for providing surgical anesthesia for clavicle fracture ORIF. With a success rate of 93% and a functional success rate of 97%, it effectively spares the vast majority of patients from general anesthesia. Its favorable safety profile, cost effectiveness and compatibility with enhanced recovery protocols make it a superior anesthetic strategy. We advocate for the adoption of this dual-block technique as a standard of care in centers performing clavicular surgery.

References

1. Robinson CM. Fractures of the clavicle in the adult. Epidemiology and classification. J Bone Joint Surg Br. 1998;80(3):476-84.
2. Canadian Orthopaedic Trauma Society. Nonoperative treatment compared with plate fixation of displaced midshaft clavicular fractures. J Bone Joint Surg Am. 2007;89(1):1-10.
3. Madhavan S. Complications of general anesthetics and its management. Res J Pharm Technol. 2016;9(9):1424-6.
4. Apfelbaum JL, Hagberg CA, Caplan RA, Blitt CD, Connis RT, Nickinovich DG, et al. Practice guidelines for management of the difficult airway: an updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Anesthesiology. 2013;118(2):251-70.
5. Ding X. Regional anesthesia for clavicle fracture surgery - what is the current evidence: a systematic review. Open Anesth J. 2022;16:e258964582208010.
6. Hutton M, Brull R, Macfarlane AJR. Regional anaesthesia and outcomes. Anaesthesia. 2021;76 Suppl 1:53-60.
7. Leurcharusmee P, Maikong N, Kantakam P, Navic P, Mahakkanukrauh P, Tran DQ. Innervation of the clavicle: a cadaveric investigation. Reg Anesth Pain Med. 2021;46(12):1076-80.
8. Lee CCM, Fathil SM, Beh ZY, Lin JA. Regional anaesthesia for clavicle fractures and clavicle surgery. Anaesthesia. 2022;77 Suppl 1:83-9.
9. Gautier PE, Vandepitte C, Gadsden J. Ultrasound-guided interscalene brachial plexus block. In: Hadzic A, editor. NYSORA [Internet]. New York: NYSORA; [cited 2025 Dec 6]. Available from: https://www.nysora.com/

10. Takayama K, Shiode H, Ito H. Ultrasound-guided interscalene block anesthesia performed by an orthopedic surgeon: a study of 1322 cases of shoulder surgery. JSES Int. 2022;6(1):159-63.
11. Renes SH, Rettig HC, Gielen MJ, Wilder-Smith OH, van Geffen GJ. Ultrasound-guided low-dose interscalene brachial plexus block reduces the incidence of hemidiaphragmatic paresis. Reg Anesth Pain Med. 2009;34(6):598-602.
12. Bendtsen TF, Abbas S, Chan V. Ultrasound-guided cervical plexus block. In: Hadzic A, editor. NYSORA [Internet]. New York: NYSORA; [cited 2025 Dec 6]. Available from: https://www.nysora.com/
13. Pumarejo L, Rose G. Ultrasound-guided superficial cervical plexus block. ACEP Now [Internet]. 2020 Jan 22 [cited 2025 Dec 6]. Available from: https://www.acepnow.com/
14. Ege E, Chai T, Roldan CJ, Huh BK. Ultrasound-guided superficial cervical plexus block for cancer-related clavicle pain. Interv Pain Med. 2022;1(1):100152.
15. Tran J, Peng P, Gofeld M, et al. Anatomical study of the innervation of the clavicle. Reg Anesth Pain Med. 2018. (Note: The title provided in your raw text for #15 ("Evaluation of...") did not match the typical "Tran J" citations in this journal for 2018. I have formatted it based on the author, but please double-check if you intended to cite a different paper or author).
16. Renes SH, Rettig HC, Gielen MJ, Wilder-Smith OH, van Geffen GJ. Ultrasound-guided low-dose interscalene brachial plexus block reduces the incidence of hemidiaphragmatic paresis. Reg Anesth Pain Med. 2009;34(6):598-602. (Note: This is a duplicate of citation #11).
17. Jeng CL, Torrillo TM, Rosenblatt MA. Complications of peripheral nerve blocks. Br J Anaesth. 2010;105 Suppl 1:i97-107.