

A RETROSPECTIVE STUDY ON ULTRASOUND-GUIDED COMBINED INTERSCALENE – SUPERFICIAL CERVICAL PLEXUS BLOCK FOR SURGICAL ANESTHESIA OF CLAVICLE FRACTURES IN A TERTIARY ORTHOPEDIC HOSPITAL

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ABSTRACT

Clavicle surgery is usually performed under general anesthesia while regional anesthesia has not been commonly performed in current anesthesia practice. This study reviewed the charts of 47 patients who underwent clavicular fracture repair surgery under ultrasound-guided combined interscalene – superficial cervical plexus block. Results showed that ultrasound-guided interscalene brachial plexus block combined with superficial cervical plexus block is a safe and effective surgical anesthesia in clavicle fracture across various demographic groups with risk factors and comorbidities. Vital signs of patients were stable preoperatively, intraoperatively, and postoperatively. Block procedural time took an average of 20 minutes. All patients completed their operation with a mean duration of 143.19 (SD±64.44) minutes. Out of 47 patients 2 (4.26%) required conversion to GA-mask and 3 (6.38%) were converted to GETA due to inadequate block. The mean duration of sensory block was 19 hours and 17.42 hours for motor function. Postoperatively, all patients received pain medications which include paracetamol, ketorolac, and tramadol. No patient requested a rescue dose for severe pain in the 1st 24 hours. Ultrasound-guided combined interscalene – superficial cervical plexus block may be considered as safe and effective alternative to general anesthesia for surgeries of the clavicle.

KEYWORDS

Anesthesia, Ultrasound-Guided Combined Interscalene – Superficial Cervical Plexus Block, Clavicle Fractures

BACKGROUND

Repair for fractures of the clavicle has usually been operated on under general anesthesia. However, this comes with hemodynamic risks and the airway becomes difficult to assess since patients are placed on the beach chair position¹. Post-operatively, patients under general anesthesia have higher pain scores and needed more analgesics². On the other hand, regional anesthesia typically provides the patient with good post-op pain control, with significant pain-free period and less intraoperative and postoperative opioid consumption than patients with general anesthesia, allowing earlier mobilization without the adverse effects of opioids. Currently, advent of using peripheral nerve blocks as a sole anesthetic technique provided alternatives in lieu of general anesthesia for clavicular surgery.

The clavicle has a rich innervation. In the literature, it has been described that the clavicle derives its sensory innervation from the cervical plexus and the brachial plexus³. For surgeries of the clavicle, using a regional technique should cover the essential innervations of the clavicle.

The surgical approach for clavicle repairs involves an interscalene nerve block paired with a superficial cervical plexus block. The interscalene nerve block selectively anesthetizes the brachial plexus, excluding the inferior trunk, and is commonly employed in shoulder, upper arm, or elbow surgeries. Simultaneously, the superficial

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cervical plexus nerve block provides anesthesia in specific dermatomal regions, such as the anterolateral neck and areas around the clavicle. This combined technique effectively prevents pain from surgical retractors. Documented in a case series, patients undergoing open reduction and internal fixation for clavicular fractures showed successful outcomes, affirming the efficacy of interscalene and superficial cervical plexus nerve blocks in ensuring surgical anesthesia and postoperative analgesia.^{4,5,6,7}

While the interscalene nerve block combined with superficial cervical plexus block is widely used in Asian countries for clavicle repairs, concerns persist about its adequacy as the sole anesthetic technique. Common side effects include hoarseness, Horner's syndrome, and temporary phrenic nerve palsy, with rarer complications such as infection and nerve injuries⁸.

Locally, there are no studies documenting the outcome of interscalene nerve block combined with superficial cervical plexus block under peripheral nerve stimulator and ultrasound guidance (dual guidance) in the surgical repair of the clavicle. This retrospective study aims to describe the outcomes of the mentioned technique in the Philippine Orthopedic Center.

This paper aimed to present the clinicodemographic characteristics and outcomes of patients who underwent interscalene with superficial cervical plexus block through dual guidance as sole anesthetic for Open Reduction Internal Fixation (ORIF) of clavicle. It also aimed to establish a baseline that could serve as reference for future studies and validation.

Clinicodemographic profile described in this paper would hopefully contribute future analysis and correlation of risk factors of patients presenting for surgery of clavicle. For eligible patients, nerve block of the clavicle could serve as sole anesthetic, reducing risks, complications, hospital cost and post op pain associated with general anesthesia thereby enhancing recovery, improving patient care and outcomes.

METHODOLOGY

STUDY POPULATION

This retrospective study reviewed the medical records of patients who underwent ORIF clavicular surgery under interscalene with superficial cervical plexus blocks.

INCLUSION CRITERIA

All Filipino, male and female, ages 18 – 65 years of age, ASA 1-3, who successfully underwent elective ORIF-clavicle surgery under ISB + SCPB.

EXCLUSION CRITERIA

Chart and anesthesia records which did not include the parameters to be measured will not be included in this study.

RESEARCH DESIGN

All patients who underwent ORIF of the clavicle under ultrasound guided ISB + SCPB in Philippine Orthopedic Center was included in this study. The regional anesthesia census from January 2021 to January 2023 was used to gather the population and record of patients. Sampling for this study is non-consecutive and based on exposure and outcome. The following demographics were obtained from the records of eligible patients: age, height, weight, gender, BMI, ASA, surgical indication, co-morbidities, baseline and postop sensory and motor function of upper extremity.

RESULTS

A total of 47 patients were included in the study. **Table 1** presents the demographic and clinical characteristics of the study population. The mean age of study participants was 34.74 (SD±9.88) years old. Majority of the patients were males (85.11%). The mean BMI was 23.59 kg/m². More than half of the patients with available data were overweight and obese (53.33%). Furthermore, 31.91% of patients were categorized under ASA I while 68.09% were ASA II.

The vital signs of study participants are presented in **Figure 1**. The mean baseline, intraoperative, and postoperative values of the vital signs were as follows: mean arterial pressure (94.24±9.99; 90.62±8.85; 84.49±6.36); heart rate (80.00±14.43; 79.77±14.65; and 78.64±11.10); and 99.47±0.68; 99.52±0.67; and 98.54±0.99 respectively. This figure showed little to no deviation of intraop and post op vital signs from baseline.

Table 2 presents the comorbidities and risk factors of patients. The majority of the patients were alcohol drinkers (76.59%). Only a quarter were smokers. The most common comorbid condition was obesity (40%) followed by hypertension 10.64% and diabetes mellitus. About 2.13% were allergic to paracetamol.

The distribution of the study population according to intraoperative variables is presented in **Table 3**. On average, the block procedural time was 20 minutes with a mean onset of sensory blockade of 5.94 minutes. In patients who were given propofol for intraoperative sedation the average dose was 45.93 mg, while in 3 patients given ketamine, the average dose was 51.67 mg, both of which are minimal doses for sedation. The total duration of operations on average was 143.19 minutes.

Out of 47 subjects, 2 were converted to GA mask and 3 led to conversion to GETA due to inadequate block (**Table 5**).

All patients were given paracetamol and ketorolac as round the clock (RTC) post op pain medications. Tramadol was given either as needed or RTC. For 23 patients (86.95%) with completely filled out PNB forms sensory function returned to baseline within 24 hours with an average sensory block of 19 hours. Among 22 patients with data, 20 (90%) of them reported return to baseline of motor function within 24 hours with an average of 17.42 hours for the motor block. No patient complained of severe pain requiring rescue opioid medication for the first 24 hours.

DISCUSSION

This current study reports the clinicodemographic profiles and outcomes of patients who received ultrasound-guided combined interscalene-cervical plexus block for surgical anesthesia in clavicular fracture repair surgery at the Philippine Orthopedic Center. The results of this retrospective descriptive study showed that the regional anesthetic approach with ultrasound-guided interscalene and superficial cervical plexus block was safe and efficient in clavicular fracture surgeries. It is safe in terms of both method and the amount of local anesthetics utilized, allowing for the execution of several blocks with fewer attempts. According to Azikakath et al., its benefits over the landmark-based method include the ability to immediately observe the nerves (structures) and the dissemination of local anesthetic in the proper plane, both of which increase the success rate and prevent accidental puncture of nearby structures and the associated consequences.¹⁰ The nerve supply of the clavicle includes contributions from both the cervical and the brachial plexus. This approach involves blocking the brachial plexus at root and proximal trunk level when it traverses between the anterior and middle scalene muscles which causes anesthesia and analgesia for skin over the distal clavicle, skin, and muscles over the deltoid, and proximal humerus level.

Traditionally, general anesthesia has been the widely preferred modality in clavicular surgery among anesthesiologists as it provides satisfactory surgical conditions wherein patients are completely relaxed and unaware. However, there are some disadvantages like multi-drug usage, postoperative nausea, vomiting, headache, risks of raised hemodynamic stress response and airway complications. Taking these into consideration, ultrasound-guided interscalene and superficial cervical plexus block seems to be an effective method for adequate surgical anesthesia changing the standard of daily institutional practice of clavicle surgeries.

In the context of this study, efficacy and safety profile of ultrasound-guided interscalene and superficial cervical plexus block across various demographic groups with risk factors and comorbidities were evaluated in terms of vital signs, intraoperative outcomes, and adverse events. Vital signs of patients were stable preoperatively, intraoperatively, and postoperatively. Intraoperatively, the average procedural time of ultrasound-guided interscalene and superficial cervical plexus block was noted to be 20 minutes with mean duration of surgery of 143.19 minutes. Usually for general anesthesia, according to Brown et al., the procedural time takes an average of 25 minutes.⁹ The mean onset of sensory blockade was 5 minutes in our study population which is similar to the study of Azikakath et al wherein sensory blockade was achieved in about 4-5 minutes.¹⁰ Furthermore, the mean duration of sensory block was 19 hours and 17.42 hours for motor function. Motor function returned to baseline within 24 hrs in 77.27% of patients while sensory function returned to baseline within 24 hrs in 82.6% of cases. According to Azikakath et al, compared to general anesthesia, ultrasound-guided interscalene and superficial cervical plexus block provides adequate anesthesia, gives early postoperative functional outcomes and shortens the length of hospital stay. Furthermore, in our study population, postoperative analgesia was achieved by using pain medications such as paracetamol, ketorolac, and tramadol. No patient required rescue medications for severe pain within first 24 hours after the operation. Brown et al. reported that the postoperative pain medication requirements of patients under ultrasound-guided interscalene and superficial cervical plexus block were significantly lower than those in the general anesthetic group.⁹

A successful block is defined as one which does not necessitate conversion to general anesthesia. In our study population, only 4.26% required conversion to GA-mask and 6.38% to GETA. For this percentage of incomplete blockade, patient factors and skill of the operator could be attributed to this. No huge change in blood pressures and heart rates intraoperatively were observed. Furthermore, no other surgical complications and early complications related to the blocks occurred probably because the use of ultrasound delineated the anatomical structures better and reduced requirement of drugs as compared to blind technique where there is an untoward flow of drugs to undesired surrounding structures.⁵ Ultrasound guided combined interscalene-cervical plexus block provides adequate and safe anesthesia in clavicular fracture surgeries.

CONCLUSION

Ultrasound-guided interscalene brachial plexus block combined with superficial cervical nerve block was shown to be safe and effective surgical anesthesia for ORIF of clavicle across various demographic groups with risk factors and comorbidities. Vital signs of patients were stable preoperatively, intraoperatively, and postoperatively. All patients who received anesthesia care using this modality completed their operation with few patients requiring conversion to general anesthesia. It provided adequate anesthesia and enhanced postoperative functional outcomes. Ultrasound-guided combined interscalene – superficial cervical plexus block may be considered as an alternative to general anesthesia for surgeries of the clavicle.

RECOMMENDATIONS

Understanding the clinical scenario, utilizing patient-specific data regarding the expected benefits and harms, and individualizing clinical decisions are fundamental for the provision of safe and effective anesthesia and should consider the demographic and clinical profile of the patients. Ultrasound-guided combined interscalene – superficial cervical plexus block is effective and safe for achieving surgical anesthesia for surgeries of the clavicle. The limitations of this study include its descriptive and retrospective nature and lack of control group. Temporal relationships are difficult to assess and cannot determine causation. As clavicle repair is a rarely performed intervention, the low number of cases was also a limitation. Larger sample size, longer study period and multi-center studies are recommended to obtain more robust data.

AUTHORS' CONTRIBUTION

Krystle Ayn C. Arcangel, MD: Conceptualization, Methodology, Writing -Original draft preparation, Review and Editing, Visualization, Validation Paolo L. Zabala, MD Investigation, Data Curation, Software Formal Analysis. Maria Rhodelia Vinluan, MD: Conceptualization, Methodology, Supervision, Project Administration, Review and Editing

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Marco Dimaano, MD: Writing- Review and Editing

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FIGURES AND TABLES

Figure 1. Preop, intraop and post op vital signs

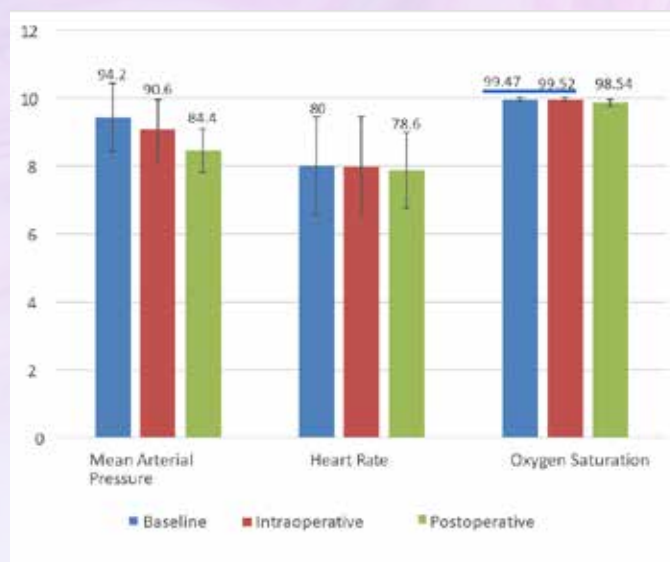


Table 1. Demographic and clinical characteristics of the study population

Variables	Mean ± SD
Age (n=47)	34.74 ± 9.88
Height (n=45)	167.09 ± 7.64
Weight (n=47)	63.38 ± 13.43
BMI (n=45)	23.59 ± 3.82
No. (%)	
BMI Status based on Asia-Pacific Classification (n=45)	
Underweight	4 (8.89)
Normal	17 (37.78)
Overweight	6 (13.33)
Obese	18 (40.00)
Sex	
Male	40 (85.11)
Female	7 (14.89)
ASA	
1	15 (31.91)
2	32 (68.09)
3	0 (0.00)
4	0 (0.00)

Table 2. Distribution of the study population according to risk factors and comorbidities

Comorbidities and risk factors	N (%)
Alcohol Drinker	36 (76.59)
Smoke	12 (25.53)
Obesity	18 (40.00)
Hypertension	5 (10.64)
Diabetes Mellitus	3 (6.38)
Pulmonary tuberculosis	1 (2.13)
Asthma	1 (2.13)
Allergy to paracetamol	1 (2.13)

Table 3. Distribution of the study population according to intraoperative outcomes

Block procedure and intraoperative variables	Mean ± SD
Procedural Time (minutes) (n=28)	20 ± 10.64
Onset of sensory blockade (minutes)	5.94 ± 4.98
Intraoperative Sedation	
- Propofol (ave mg) (n=9)	45.93 ± 30.25
- Ketamine (ave mg) (n=3)	51.67 ± 34.03
Total duration of operation (n=47)	143.19 ± 64.44

Table 4. Documented adverse events (n=47)

Adverse Events	No. (%)
Conversion to GA-mask Conversion to GETA	2 (4.26)
	3 (6.38)

Table 5. Post-operative indicators among patients

Post op Variables	N (%)
Post op Pain Medications	
- Paracetamol	
1 gram q6	9 (100.00)
1 gram q8	13 (100.00)
- Ketorolac	
30 mg q6	13 (100.00)
30 mg q8	8 (100.00)
Tramadol	
50 mg q6	3 (100.00)
50 mg q8	1 (100.00)
Sensory function returned to baseline within 24 hrs (n=23)	20 (86.95%)
Motor function returned to baseline within 24 hrs (n=22)	20 (90%)
Hours	
Time to return of sensory in dermatomal distribution (n=20)	19
Time to return of motor function (5/5 MMT) (n=19)	17.42
Time to first rescue dose (in hours)	-
Total Opioid consumption	-