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A clinical comparison of combined intermediate cervical plexus block and interscalene brachial plexus block versus general anaesthesia for clavicle surgeries.

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Abstract

Background: The innervation of clavicle is unclear and preferred choice of anaesthesia for clavicular surgeries is general anaesthesia. However, with the advent of ultrasound guided interscalene and cervical plexus blocks regional anaesthesia for clavicular surgeries is gaining importance esp. in patients with limitations for general anaesthesia. Previously, interscalene block in combination with superficial cervical plexus block has been used. In our study, we are comparing intermediate cervical plexus block with interscalene block against general anaesthesia.

Aims & objectives: The present study compares the ultra sound-guided interscalene brachial plexus nerve block combined with intermediate cervical nerve block to general anaesthesia in clavicular surgery.

Materials & methods: A prospective randomized double blind clinical study included 60 patients belonging to ASA I to ASA III aged between 18-70 years undergoing middle and lateral clavicular surgeries from February 2022 to November 2022 at Kempe Gowda Institute of Medical Sciences. After routine pre-operative evaluation, allocation sequence was generated using online rando mization. The allocation was con cealed in sealed envelopes, which were opened after obtaining patient consent written informed consent was obtained and patients were randomized into two groups to receive one of the following

Group B – 30 patients received ultrasound guided Inters calene block (10ml 0.5% Bupivacaine) + intermediate cervical plexus block (10ml 0.25% Bupivacaine)

Group G – 30 patients received general anaesthesia. The following were observed intra operatively, time duration

between the start of anaesthesia to the incision time and Hemo dynamic parameters. When the NRS score was more than 3, an injection of tramadol 1 mg kg-1 was given intra venously as a rescue analgesic.

Statistics & analysis: Statistical Package for Social Sciences [SPSS] for Windows Version 22.0

Results: Both the groups were compared demo graphi cally. The mean age in Group B- 30years, GroupG-31 years; Group B had 43.3% of males, 56.7% of females; Group G had 60% males, 40% females there was no statistical significance observed. The difference in mean procedural time was highly significant in group B-12.97minutes when compared to Group G-5.0minutes.

The difference in HR was high in Group G (90bpm) when compared to Group B (76bpm) which was statistically significant. P<0.001

The MAP was found to be high in Group G (89mmHg) when compared to Group B (78mmHg), which was statistically significant p<0.003.

The post-operative NRS scores were lower in Group B (1.97) when compared to Group G (7.53), which was statistically significant p<0.001

Conclusion: We conclude that combination of Ultra sound guided Intermediate cervical plexus block with Inter scalene block can be an alternative choice of anaesthesia for patients undergoing clavicular surgeries.

Keywords: clavicular surgery, intermediate cervical plexus block, interscalene block.

Introduction

From the anaesthesiologists' perspective, there are a number of challenges that are encountered to provide anaesthesia in the clavicular region, due to the com plexity of sensory innervation from supraclavicular, subclavian, and suprascapular nerves.

Previously, the use of regional anaesthetic techniques was associated with high risks due to the procedures essentially being "blind", depending on visible or palpable anatomic land marks, that may injure the structures in the vicinity. Additionally, the regional anaesthetic techniques did not provide adequate anaesthesia for procedures involving the medial third of the clavicle and the sternoclavicular joint, not to mention a steep learning. Hence, the use of general anaesthesia for procedures involving the clavicle were advocated.

However, with the recent advancements in ultrasound technologies, and its increasing adoption, regional anaesthetic techniques have once again come to the forefront, with the potential to provide comparable levels of anaesthesia and analgesia, without the associated risks of polypharmacy, postoperative nausea and vomiting, after effects of intubation, reduced duration of hospital stay and overall cost effectiveness.

In the present study, we look to evaluate the effective ness of ultra sound guided inter scalene block with intermediate cervical plexus block in comparison to general anaesthesia, using parameters such as time to administer the block, intraoperative hemodynamic Chara CT eristics, and patient comfort levels post-op.

Materials and methods

This prospective, randomized clinical study was carried out at the Kempe Gowda Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India, between February 2022 and November 2022. The study was approved by the institutional ethics committee on 24 April 2018 and was carried out per the Declaration of Helsinki. The trial was registered before patient enrolment on www.ctri.nic.in (Clinical Trials Registry of India): clinical trial registration number CTRI/ 2022/ 01/ 039732; date of registration: 27 January 2022.

All participants in the trial gave their written informed consent before participating in the study.

Inclusion Criteria

• Age between 18-70 years at the time of enrolment

• ASA Grade I-III

• Type of procedure: ORIF of middle- and lateral-third of clavicle be term February 2022 and November 2022

Exclusion Criteria

• Patients with allergies to local anaesthetic agents

• Patients with bleeding disorders or on anticoagulants

• Pregnant patients

• Patients with an active infection Patients were explained about both general anaesthesia and ultrasound guided block techniques. They were also explained about the use of NRS for assessment of post operative pain and were instructed to mark on a scale of 1–10 the point they felt was representative of their level of discomfort.

The allocation sequence was generated using online rando mization. The allocation was concealed in sealed envelopes, opened after obtaining patient consent.

Course in the Operating Room

• Standard monitors were attached (ECG, NIBP, and pulse oximetry)

Procedure of Interscalene Block

Following standard aseptic precautions, patients were positioned with a small pillow placed below the shoulder to obtain an adequate head extension, and the head was turned to the opposite side. The ultrasound machine was placed on the side opposite to the site of surgery to achieve proper ergonomics.

A high-frequency linear probe (13–6 MHz) was placed transversely over the supraclavicular fossa to identify the supraclavicular artery and brachial plexus. The probe was then guided cranially to locate cervical nerve roots in the interscalene groove.

Once this was identified, a 50 mm, 22-gauge stimulating needle was entered using an in-plane technique in a lateral to medial direction. After aspirating to confirm the location of the needle tip not being intravascular, 10 ml of 0.5% bupivacaine was deposited in the interscalene groove, primarily around the C5 nerve root.

Procedure of Cervical Plexus Block

With the patient and machine in same position, the probe was placed transversely over the neck. The carotid artery was identified and traced upwards to its bifurcation. The probe was then moved laterally to identify the tapering posterolateral end of the sternocleidomastoid muscle.

Using an in-plane technique, a 22-gauge, 50 mm stimulating needle was inserted in a lateral-to-medial direction. The needle tip was positioned below the lateral end of the sternocleido mastoid muscle. The needle tip was then guided deep to the investing layer of cervical fascia, 10 ml of 0.25% bupivacaine was deposited, and the spread was observed.

In addition to regional anaesthesia, all patients received 0.05 ml/kg intravenous midazolam and 5L oxygen via face mask supplementation throughout the procedure.

Assessment of nerve block: After 15 min, the sensory block was assessed with a pin prick on the skin overlying the clavicle. Motor block was assessed by an inability to abduct the shoulder.

Procedure of General Anaesthesia

All patients assigned to receive general anaesthesia were given preoxygenation. The following agents were used in all patients

• Inj. Glycopyrrolate 0.02mg/kg

• Inj. Ondansetron 0.1 mg/kg

• IV fentanyl 1-2mcg/kg

• IV propofol 1-2mg/kg

• IV atracurium 0.5mg/kg.

The airway was secured with an appropriately sized ET tube.

Intraoperatively, the patients were maintained with 3L oxygen, 3L nitrous oxide, and 1% Sevoflurane.

After the procedure, reversed of anaesthesia was done with Inj. Neo stigmine 0.05 mg/ kg and Inj. Gly copyrrolate 0.01 mg/ kg, and then extubated appro priately.

Intraoperative Monitoring

All characteristics assessments were made by an investigator blinded to the study group. In addition, the following observations were made intraoperatively.

• The time duration between the start of anaesthesia to the incision time

• Hemodynamic parameters, including heart rate, mean arterial pressure, and oxygen saturation.

Postoperative Course

After transferring the patient to the post-anaesthesia care unit, the pain intensity was assessed using the NRS scale at regular intervals. (NRS, 0 to 10 scale, 0 being no pain and 10 being the worst pain). When the NRS score was more than 3, tramadol 1 mg/kg was given intravenously as a rescue analgesic.

Statistical analysis & results

Statistical Package for Social Sciences [SPSS] for Windows Version 22.0 Released 2013. Armonk, NY: IBM Corp. was used to perform statistical analyses.

Descriptive Statistics

Descriptive analysis of all the explanatory and outcome parameters will be done using frequency and proportions for categorical variables, whereas Mean & SD for continuous variables.

Inferential Statistics

An Independent Student t-Test was used to compare the mean procedural time, hemodynamic parameters & duration of surgery between the two groups.

Mann-Whitney Test was used to compare the mean age & post-NRS scores between the two groups.

Chi-Square Test was used to compare gender distribution & administration of rescue analgesia between the two groups.

The level of significance was set at P<0.05.

Age and gender distribution among 2 groups

Variable	Category	Group B		Group G		P-Value
		Mean	SD	Mean	SD	
Age	Mean	30.43	2.73	31.37	3.66	0.27[a]
	Range	25 - 35		24 – 37		
		n	%	n	%	
Sex	Males	13	43.3%	18	60.0%	0.20[b]
	Females	17	56.7%	12	40.0%	

Note: a. Mann Whitney Test; b. Chi-Square Test

The mean age in Group B is 30.43years, and in Group G, it is 31 years, with a range (of 24-37) years. In group B-43.3% were males, and 56.7% were females. In group G-60% were males, and 40% were females.

Comparison of mean Procedural Time (in mins) between 2 groups using Independent Student t-test

Parameter	Group	N	Mean	SD	Mean Diff	p-value
Procedural time	Group B	30	12.97	2.55	7.97	<0.001*
	Group G	30	5.00	0.26		

* - Statistically Significant

Note: Procedural time means the time between the Start of Anaesthesia and Incisional Time

In Group B, the mean procedural time was 12.97 minutes, whereas, in Group G, it was 5 minutes. The difference between the two groups was statistically significant, with p<0.001

Comparison of mean values of Vital Parameters between 2 groups using Independent Student t Test						
Parameter	Group	N	Mean	SD	Mean Diff	p-value
HR	Group B	30	76.13	6.21	-14.07	<0.001*
	Group G	30	90.20	2.12		
MAP	Group B	30	78.60	5.31	-10.63	0.003*
	Group G	30	89.23	18.36		
SPO2	Group B	30	100.00	0.00	0.00	..
	Group G	30	100.00	0.00		

* - Statistically Significant

The heart rate in Group G that is, patients receiving general anaesthesia, was found to be higher than patients who received block in group B. the difference was statistically significant with p<0.001

The mean arterial pressure in patients receiving general anaesthesia was significantly high when compared to patients receiving block.

Comparison of mean Duration of Surgery (in hrs) between 2 groups using Independent Student t-test						
Parameter	Group	N	Mean	SD	Mean Diff	p-value
Duration of surgery	Group B	30	2.20	0.21	0.01	0.82
	Group G	30	2.19	0.17		

The mean duration of surgery was similar in both the patients receiving general anaesthesia and block. It was statistically insignificant.

Comparison of mean Post-Op Numerical Rating scale scores between 2 groups using Mann Whitney Test						
Parameter	Group	N	Mean	SD	Mean Diff	p-value
Post-op NRS	Group B	30	1.97	0.56	-5.56	<0.001*
	Group G	30	7.53	0.86		

* - Statistically Significant

Comparing the postoperative NRS scores, patients in Group B were lower than those in Group G, which was statistically significant.

Comparison of administration of Rescue Analgesic between 2 groups using Chi-Square Test						
Variable	Category	Group B		Group G		P-Value
		n	%	n	%	
Rescue Analgesic	Given	0	0%	30	100%	<0.001*
	Not Given	30	100%	0	0%	

* - Statistically Significant

All patients who received general anaesthesia received rescue analgesia, whereas none who received block needed rescue analgesia.

Discussion

Clavicular fractures account for approximately 5-10 % of all fractures, with fractures of the middle third of the clavicle accounting for approximately 70-80% of the same [12] . Due to the complex sensory innervation of the region, general anaesthesia is preferred to reduce these and fix clavicular fractures. Cadaveric studies [2] have demonstrated that the supraclavicular nerves provide sensory innervation to the entire length of the clavicle. Additionally, the subclavian nerve relays sensory innervation of the middle- and medial third of the clavicle, and the lateral pectoral nerve relays the sensory innervation of the middle- and lateral third of the clavicle. The sternoclavicular joint receives its sensory innervation via the supraclavicular nerves, and the acromioclavicular joint via the supraclavicular and lateral pectoral nerves.

Anatomical knowledge of the brachial plexus is also essential to provide regional anaesthesia in this area. It is formed by the union of the anterior primary divisions (ventral rami) of the fifth through the eighth cervical nerves, and the first thoracic nerve. Contributions from C4 and T2 are often minor, or absent. These roots join to form superior (C5, C6), middle C7, inferior trunks C8, T1 above clavicle. The trunks branch into anterior and posterior divisions.

Local anaesthetic may be deposited at any point along the brachial plexus, depending on the desired block effects: interscalene for shoulder and proximal humerus surgical procedures, or supra clavicular, infraclavicular, and axillary for surgeries distal to the mid-humerus. [8]

An interscalene brachial plexus block is indicated for procedures involving the shoulder and upper arm. The C5–C7 roots are most densely blocked with this approach. However, the ulnar nerve originating from C8 and T1 roots may be spared, which makes these blocks ineffective for surgeries distal to the level of elbows. For complete surgical anaesthesia of the shoulder, the C3 and C4 cutaneous branches may need to be supp lemented with a superficial cervical plexus block or local infiltration, which may also be indicated for anaesthesia and analgesia for surgeries of the shoulder, humerus, and distal clavicle. [8,10] The local anaesthetic is injected around superior and middle trunks of the brachial plexus in the interscalene triangle, between anterior and middle scalene muscles. [8]

The cervical plexus is formed from the anterior rami of first four cervical vertebrae C1to C4 lateral to transverse processes of the vertebrae. It has superficial and deep branches supplying sensation to jaw, neck, occiput, shoulder and clavicle [8,10]. Cervical plexus blocks can be classified as superficial, intermediate and deep level. They are primarily indicated to provide anaesthesia and analgesia for carotid endarterectomy, superficial neck procedures and clavicle surgeries.

In the present study, we used intermediate cervical plexus block to provide sensory anaesthesia of the anterolateral neck, and the skin overlying and imme diately inferior to clavicle. The local anaesthetic is injected at C4-C5 level, between the prevertebral fascia and the investing layer of deep cervical fascia, under the sternocleidomastoid muscle.

Unlike the present study that evaluates the utility of intermediate cervical plexus block with interscalene block and general anaesthesia, previous studies have been conducted to investigate the utility of combining an interscalene block with a superficial cervical plexus block for clavicular surgeries. With this study, we look to address the paucity of data that exists regarding the utility of this combination of regional anaesthetic techniques using 10ml of 0.5% bupivacaine for interscalene block and 10ml of 0.25% bupivacaine for intermediate cervical plexus block.

In our study comparing regional and general anaesthesia the following parameters were observed: demographic data, procedure time (mean time between start of anaesthesia to incisional time), heart rate, mean arterial pressure, duration of the surgeries, Post-op NRS scores, usage of rescue analgesia.

In the present study, the mean age of patients receiving interscalene with intermediate cervical plexus block was 30 years, and in patients who received general anaesthesia was 31years. The differences in the age and gender between the two groups was statistically insignificant which correlates with the findings from the work of Banerjee et al. [8]

The procedure time, which we defined as the mean time between start of anaesthesia to incisional time, was prolonged in patients who received interscalene with intermediate cervical plexus block when compared to the patients who received general anaesthesia (12.97 min [SD 2.55] vs 5 min [SD 0.26]). The difference between the two groups was statistically significant, similar to observations by Banerjee et al. [8]

Hemodynamic monitoring with heart rate (90 [SD 2.12] vs 76 [6.21]) and mean arterial pressure (89.23 [SD 18.36] vs 78.60 [SD 5.31]) was demonstrably higher in patients receiving general anaesthesia when compared with patients who received combined interscalene with intermediate cervical plexus block. The difference

between the two groups was statistically significant, similar to observations by Banerjee et al. [8]

The mean duration of surgery (in hours) in patients who received interscalene block was similar to patients who received general anaesthesia (2.20 [SD 0.21] vs 2.19 [SD 0.17])

Post-op NRS scores were found to be lower among the patients who received combined interscalene with intermediate cervical plexus block (1.97 [SD 0.56] vs 7.53 [SD 0.86]) when compared with patients who received general anaesthesia.

The difference between the two groups were found to be statistically significant. All patients in both the groups were monitored for percentage of oxygen saturation and patients who received general anaesthesia required rescue analgesia.

The time spent in post anaesthesia care unit, and associate complications due to block such as Horner's syndrome, arterial puncture, hematoma formation; and success rate of blocks were not observed in this study. However, with the advent of ultrasound guided interscalene block and intermediate cervical plexus block it is easier to identify anatomical structures which reduces the risk of complications and improves the success rate of blocks. In the studies by Balaban et al. and Brown et al. there were no complications associated with combined interscalene with superficial cervical plexus block and general anaesthesia.

In the study conducted by Basu [1] et al., concludes that interscalene block with superficial and deep cervical plexus block is better for clavicular surgeries. However, the risk of injuring the phrenic nerve with deep cervical block exists. In the present study, we used a combination of interscalene block with intermediate cervical plexus block which reduces the risk of injury to phrenic nerve.

Conclusion

General anaesthesia was the choice of anaesthesia for clavicular surgeries owing to variable innervation of clavicle. In recent times, regional anaesthesia is preferred for clavicular surgeries and when administered precisely using ultrasound guided, the risks involved reduces. Regional anaesthesia is cost effective when compared with general anaesthesia. Studies have been conducted using brachial plexus block. Hence, we conclude that combined interscalene block with intermediate cervical plexus block is superior to general anaesthesia and a good alternative to general anaesthesia for clavicular surgeries.

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