Section: Anaesthesiology

Original Research Article

COMPARATIVE EVALUATION OF CORACOID APPROACH AND RETRO CLAVICULAR APPROACH OF INFRACLAVICULAR BRACHIAL PLEXUS BLOCK FOR UPPER LIMB SURGERIES

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Abstract

Background: Peripheral nerve blocks offer tailored anaesthesia and pain management, with advantages over general anaesthesia, including patient cooperation and reduced complications. This study aimed to compare the classical coracoid approach of infraclavicular brachial plexus blocks retro clavicular approach of infraclavicular brachial plexus block for forearm surgeries using 0.5% bupivacaine under USG guidance. **Materials and Methods:** This prospective randomised study included 110 consecutive patients at Kanyakumari Government Medical College Hospital between 1 year and a month. Fifty-five patients each underwent a coracoid (group C) or retro clavicular (group R) ultrasound-guided infraclavicular block using 20 mL 0.5% bupivacaine. The outcomes included block success, procedural ease, pain (VAS), needle visibility (Likert scale), the needle passes, time, and complications. **Result:** There were no significant differences in age, height, weight, and BMI (p=0.854, p=0.509, p=0.495, and p=0.673) between the groups. However, group R showed significant differences in procedural time (p<0.0001), needle shaft visibility (p<0.0001), needle tip visibility (p<0.001), number of needle passes (p=0.001), and reduced block-related pain according to the VAS score (p<0.001). The comparison between groups C and R confirmed no significant differences in sex distribution (p=0.566), ASA classification (p=0.842), block satisfaction (p=0.567), or complete block failure rates (p=0.647), representing comparable baseline characteristics and overall block efficacy between the groups. **Conclusion:** The retro clavicular approach of the Infraclavicular Brachial plexus block has good needle tip and shaft visibility and minimal time requirement for block performance and block-related pain compared to the coracoid approach of the infraclavicular brachial plexus block.

INTRODUCTION

"Peripheral nerve blocks can be customized and used for anaesthesia, postoperative analgesia, and the diagnosis and treatment of chronic pain disorders". Nerves or plexuses supplying a particular region are blocked using local anaesthetic and are made insensitive to pain and reflex responses to surgical stimuli.[1] It is superior to general anaesthesia in many respects, such as sparing the CNS, keeping the patient awake and cooperative, and avoiding polypharmacy. It can be used for both elective and emergency surgeries.[2]

Viennese ophthalmologist Karl Koller introduced cocaine as the first local anaesthetic in 1884. He used a cocaine solution for topical corneal anaesthesia in patients undergoing ophthalmic surgeries. Amino ester compounds were the initial local anaesthetic agents developed during the first half of the 20th century. The main disadvantages were shorter duration of action, allergy, and systemic toxicity.[3] The amino amide compounds were then identified. Levo-bupivacaine is an amide-type long-acting local anaesthetic agent that facilitates prolonged surgeries in the extremities. Additives to local anaesthetic help to overcome the delayed onset of action and inadequate quality of blockade.[4]

"Brachial plexus block was first done by William Steward Halsted in the year 1889. He applied cocaine to the brachial plexus via a surgical approach. Later, different approaches were designed to block the brachial plexus at various levels. The use of electrical

stimulation to locate peripheral nerves was introduced in 1962". The important approaches to brachial plexus block include the interscalene approach, the classical supraclavicular approach by Kulenkampff, the subclavian perivascular approach by Winnie Collins, the infraclavicular approach by Raj, and the axillary approach by Accardo and Adriano.[5] However, complications such as pneumothorax, inadvertent arterial puncture, subarachnoid puncture, and phrenic nerve paralysis have been reported in these approaches." "In supraclavicular block, blockade occurs at the distal trunk – proximal division level." At this location, the brachial plexus is compact and even a small volume of local anaesthetic injection produces a rapid onset of reliable blockade of the brachial plexus.

"In Infraclavicular block, the blockade occurs at the level of cords and offers advantages of avoiding complications like pneumothorax, and this approach also offers blockade of musculocutaneous and axillary nerves".[6] The various techniques used to locate the peripheral nerves include paresthesia, peripheral nerve stimulation, and ultrasound guidance. The use of USG for nerve blockade has increased with the development of high-resolution equipment, portability, and decreased costs. The US-guided technique has several advantages, including ease of performance, visualization of soft tissues, real-time needle advancement, no exposure to radiation, and observation of the spread of the injected local anaesthetic. There is more available evidence for the superior onset, quality, and duration of block for US guidance versus other techniques for nerve localisation.[7]

Aim

This study aimed to compare the classical coracoid approach of Infraclavicular brachial plexus blocks with the retroclavicular approach of infraclavicular brachial plexus blocks for forearm surgeries using 0.5% bupivacaine under USG guidance.

MATERIALS AND METHODS

This prospective randomized study included 110 consecutive patients who underwent elective surgery in the Department of Orthopedic Surgeries at Kanyakumari Government Medical College Hospital between 1 year and 6 months. This study was approved by the Institutional Ethics Committee before initiation, and informed consent was obtained from all patients.

Inclusion criteria

Patients with ASA physical status 1 and 2, 20-60 years of age, scheduled to undergo surgery on the elbow, forearm, or hand under regional anaesthesia were included.

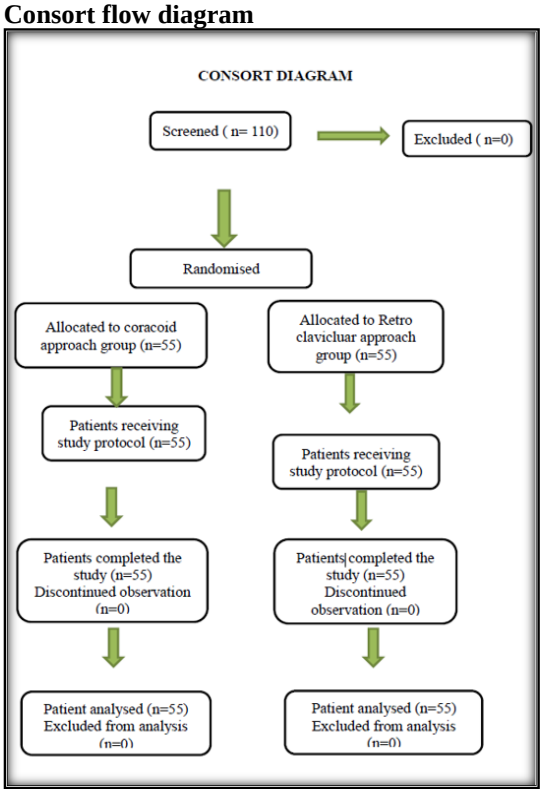
Exclusion criteria

Patients with refusal, ASA PS III and IV, with airway diseases and Recent URI, with anatomical abnormality at the clavicular region, local infections, neurological disease, coagulopathy, known allergy to local anaesthetics, body mass index (BMI) >24 kg/m2 were excluded.

Methods: Patients were divided into two groups and received a coracoid approach of infraclavicular plexus block (group C, n=55) and a retro clavicular approach of infraclavicular brachial plexus block (group R, n = 55). On shifting to the preoperative holding area, an 18 G intravenous cannula was inserted in the contralateral arm, and maintenance fluid was administered. Standard ASA monitors were attached once the patient was transferred to the operating room.

The patient was positioned supine, with the head turned contralaterally. A high-frequency linear probe (6–13 Hz) was placed below the medial clavicle to the coracoid process to visualise the axillary vessels and cords. Under aseptic precautions, a 20 G echogenic needle was inserted in-plane into the probe, navigating beyond the clavicle's acoustic shadow with the trajectory avoiding the lungs and pleura. A local anaesthetic (20 mL 0.5% bupivacaine) was injected in a U-shaped manner around the axillary artery under ultrasound guidance. Using a defined scoring system, sensory and motor block efficacy was assessed for the radial, median, ulnar, musculocutaneous, and medial cutaneous nerves. Pain during the procedure was rated on a VAS scale, and needle visibility was rated on a 5-point Likert scale. The monitored parameters included demographic data, needle shaft, tip visibility, number of needle passes, block success, procedural time, complications, and intraoperative vitals. The primary outcomes were procedural ease and block success, while the secondary outcomes included complications and procedural parameters.

Consort flow diagram



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Statistical analysis: Data are presented as mean, standard deviation, frequency, and percentage. Continuous variables were compared using an independent-sample t-test. Categorical variables were compared using Pearson's chi-square test. Significance was defined as $p < 0.05$ using a two-tailed test. Data analysis was performed using IBM-SPSS version 21.0 (IBM-SPSS Corp., Armonk, NY, USA).

RESULTS

Among the patients undergoing brachial plexus block for upper limb surgeries, there was no significant difference in age distribution between group C (36.29±13.49) and group R (36.76±13.32) with a (p=0.854). There was no significant difference in height distribution between group C(1.59±0.08) and group R (1.60±0.08) with a (p=0.509). There was no significant difference in weight distribution between group C (59.04±6.22) and group R (59.85±6.33) with a (p=0.495). There was no significant difference in BMI distribution between group C (23.36±0.55) and group R (23.40±0.56) (p=0.673).

However, group R showed significance in procedural time (350.07±19.57 vs. 442.22±49.91 seconds, $p < 0.0001$), needle shaft visibility (3.98±0.49 vs. 2.84±0.71, $p < 0.0001$), needle tip visibility (3.91±0.62 vs. 3.05±0.72, $p < 0.001$), the needle passes (1.15±0.36 vs. 1.42±0.50, $p = 0.001$), and reduced block-related pain as per VAS score (1.15±0.40 vs. 1.53±0.66, $p < 0.001$) [Table 1].

The comparison between groups C and R demonstrated no significant differences in sex distribution (p=0.566), ASA classification (p=0.842), block satisfaction (p=0.567), or rates of complete block failure (p=0.647), indicating comparable baseline characteristics and overall block efficacy between the groups [Table 2].

Table 1: Comparison of ultrasound-guided nerve block techniques between group

	Mean±SD		P value
	Group C	Group R	
Age (in years)	36.29±13.49	36.76±13.32	0.854
Height (cm)	1.59±0.08	1.60±0.08	0.509
Weight (kg)	59.04±6.22	59.85±6.33	0.495
BMI (kg/m2)	23.36±0.55	23.40±0.56	0.673
Time for procedure	442.22±49.91	350.07±19.57	<0.0001
Needle shaft visibility	2.84±0.71	3.98±0.49	<0.0001
Needle tip visibility	3.05±0.72	3.91±0.62	<0.001
Number of needle passes	1.42±0.50	1.15±0.36	0.001
Block-related pain (VAS score)	1.53±0.66	1.15±0.40	<0.001

Table 2: Comparison of block satisfaction and efficacy in ultrasound-guided nerve block techniques

		Group C	Group R	P value
Sex	Female	27 (49.1%)	24 (43.6%)	0.566
	Male	28 (50.9%)	31 (56.4%)	
ASA	I	35 (63.6%)	36 (65.5%)	0.842
	II	20 (36.4%)	19 (34.5%)	
Block satisfactory	No	8 (14.5%)	6 (10.9%)	0.567
	Yes	47 (85.5%)	49 (89.1%)	
Complete failure	No	52 (94.5%)	53 (96.4%)	0.647
	Yes	3 (5.5%)	2 (3.6%)	

DISCUSSION

Brachial plexus blockade avoids the complications of general anaesthesia, such as delayed recovery, polypharmacy, and patient unconsciousness. Infraclavicular blockades, targeting the brachial plexus at the cord level, minimise risks such as pneumothorax and ensure early and complete nerve blockade, including the musculocutaneous and axillary nerves. Compared with paresthesia techniques, ultrasound guidance enhances success rates and reduces nerve injuries by enabling real-time visualisation of the needle.

In our study, the ultrasound-guided coracoid, and retro clavicular approaches for infraclavicular brachial plexus blocks. The retro clavicular approach demonstrated superior needle tip (3.91±0.62) and shaft visibility (3.98±0.49) compared to the coracoid approach (mean=3.04±0.72 and 2.84±0.71; $p<0.0001$). It also essential needle passes (1.15±0.36 vs. 1.42±0.50; p=0.001) and shorter procedural time (350.0±19.5 vs. 442.2±49.91 seconds; $p<0.0001$), indicating improved efficiency and safety.

The retro clavicular approach was first described by Hebbard et al. where they described this technique to improve the needle visibility over the classical technique.8 Our study had similar results with a comparable success rate (95%) in both the approaches of the block. Charbonneau et al. did a noncomparative feasibility study in 62 patients with more than 90% sensory and surgical success rate and claimed that the retro clavicular approach had the added advantage of better needle tip and shaft visibility; this finding was reaffirmed by Kavrut et al. They performed a prospective randomized study of 100 patients, comparing both techniques. They concluded that the retro clavicular approach is better in standings of the needle tip and shaft visibility,

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reduced performance time, and fewer needle passes.[9,10]

Our study also showed better needle tip visibility, needle shaft visibility, and reduced block performance time in the clavicular approach group. Kavrut et al. observed the rate of paresthesia to be as high as 12% during the coracoid approach.[10] This was like the rate reported by Frederiksen et al. (17.5%) observed paresthesia.[11] Tran et al. reported that (7.5%) paresthesia techniques were associated with nerve injuries and high failure rates. Therefore, we did not attempt the paresthesia-induced techniques. Needle tip and shaft visibility were significantly better ($p < 0.005$) in the retro clavicular group.[12]

Our study had lower pain scores with the clavicular approach than with the classical approach ($p < 0.05$). Charbonneau et al. reported a lower VAS score while performing the retroclavicular approach (1.9 ± 1.2).[9] In our study, results also show block-related pain score in group C (1.53 ± 0.66) when compared to group R (1.15 ± 0.40) which is significant $p<0.0001$. Chin et al. earlier stated in their review that good visibility in infraclavicular blocks provides a safer technique with lesser needling time.[13]

In a case series performed by Beh et al., technical difficulty was reported in patients with short and thick necks and anatomical variations of the clavicle. Patients with anatomical variations and BMI >24; hence, it is difficult to comment on previous findings. Another limitation is that a larger sample size might be required to comment on the complications associated with these techniques. Infraclavicular blocks offer the advantage of improved catheter fixation. There was no difference in demographic data between group R and group C. There was no significant difference in block satisfaction between groups C and R ($p=0.567$). There was no significant difference in complete block failure between group C and group R with a ($p=0.647$) and no complications were noted in either group.[14]

CONCLUSION

The retro clavicular approach of the Infraclavicular Brachial plexus block has good needle tip and shaft visibility, and minimal time requirement for block performance and block-related pain compared to the coracoid approach of the Infraclavicular brachial plexus block.

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