Original Article

ISSN (O): 2456-7388; ISSN (P): 2617-5479

Comparison of Brachial Plexus Block Performed by Axillary Approach and Coracoid Infraclavicular Block for Upper Limb Surgery: A Clinical Study

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Abstract

Background: PNBs (Peripheral Nerve Blocks) have a vital role with increasing attention in subjects undergoing ambulatory anesthesia. PNBs also have properties near to ideal anesthesia in Outpatient surgical cases. It is also associated with facilitated discharge and postoperative analgesia. The aims of the present study were conducted to compare the efficacy of brachial plexus block given by Coracoid infraclavicular route or axillary route with peripheral nerve stimulator concerning success and failure rates, block duration, motor block intensity, onset, and performance time. **Subjects and Methods:** The study included a total of 50 subjects from both genders divided into two groups of 25 subjects each given brachial plexus block using either coracoid route or axillary route. The local anesthetic agent used was 2% lidocaine with 0.5% bupivacaine mixed in equal parts for all the subjects. **Results:** It was seen that the axillary approach was better in efficacy concerning few incomplete blocks, more comfort, less pain, long duration, more intensity, and fast onset with 4 injections of local anesthetic agents compared to the two injections used in the coracoid approach. The long duration helped in achieving better postoperative analgesia. However, the coracoid approach was advantageous in subjects with arthritis and stiff shoulder joints as it could be given in an arm in a neutral position. **Conclusion:** The present study concludes that the axillary approach using four injections is more efficacious than two injections of the coracoid approach in terms of long duration, faster onset, and better analgesia.

Keywords: Axillary Approach, Brachial Plexus, Bupivacaine, Coracoid Approach, Flexion, Lidocaine.

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Received: 22 September 2021 **Revised: 27 November 2021** **Accepted: 08 December 2021** **Published: 31 December 2021**

Introduction

Peripheral Neural blocks are practiced since ancient times with high success rates. In the 1880s injection of cocaine into peripheral sites like the infraorbital, supratrochlear, musculocutaneous, and the ulnar nerve was described by Halsted and Hall.[1,2] In 1885, the use of an Esmarch bandage was recommended by James Leonard Corning to arrest the local circulation, decrease uptake of local anesthetic from tissues, and prolong the cocaine-induced block.[3] In 1903, Heinrich F. W. Braun substituted epinephrine, a __chemical tourniquet. In 1914, the term conduction anesthesia was introduced by Braun in the textbook on local anesthesia covering the whole body.[4,5] Gaston Labat, in 1920 taught innovative methods of regional anesthesia; Its Technic and Application.[6] He published a book focusing on patient management in subjects undergoing extremity procedures, head and neck, and intra-abdominal procedures under neuraxial techniques like a splanchnic blockade, peripheral, plexus, and infiltration.

Off lately, recent technologies are incorporated, with improvement in identifying the location of nerves using electric current which further helped in identifying different motor responses from peripheral nerves, offering analgesics insurances, effectiveness, and reliability. One such technique is neurostimualtaion.[7] Hadzic et al pointed towards lack of refinement of the current neurostimulators. Atraumatic design was followed using no needles with high current to achieve motor response stimulation.[8] However, motor activity was not very specific, and needle tip proximity to the nerve was not definitive leading to an unsuccessful block. The newer technologies have overcome this issue. Regional anesthesia has entered a new era of neurostimulation or selective location of peripheral nerves and there is no return.[9]

Regional anesthesia success in upper extremities needs a thorough knowledge of the anatomical aspect of the brachial plexus, where the origin of the nerve is from the intervertebral foramina and termination as peripheral nerves. Brachial plexus is constituted by the first thoracic nerve (T1) four lower cervical nerves (C5-C8) intercommunications among ventral rami and is somatic nerve plexus.

The brachial plexus leads to motor supply in all muscles of the upper limb except the levator scapula and trapezius. It also communicates via gray rami to the sympathetic trunk joining all plexus roots and is derived from the first thoracic sympathetic ganglion and inferior and middle cervical sympathetic ganglia.[10] The block to brachial plexus can be given by axillary as well as coracoid route. However, the data comparing the two is scarce in the literature. Hence, the present study was conducted to compare the efficacy of brachial plexus block given by Coracoid infraclavicular route or axillary route with peripheral nerve stimulator concerning success and failure rates, block duration, motor block intensity, onset, and performance time.

Subjects and Methods

The present study was conducted to compare the efficacy of brachial plexus block given by Coracoid infraclavicular route or axillary route with peripheral nerve stimulator concerning success and failure rates, block duration, motor block intensity, onset, and performance time. The study was carried out at Department of Anaesthesiology, Maharajah's Institute of Medical Sciences, Nellimarla, Vizianagaram, Andhra Pradesh, India after obtaining clearance from the concerned Ethical committee. The study population was comprised of 50 subjects from both genders who had to undergo elective surgery of the forearm, wrist, and hand. After explaining the detailed study design, informed consent was taken from all the subjects. The exclusion criteria were subjected to uncooperative patients, patients with allergies to local anesthetics, pregnant women, and subjects with affected sensory or motor functions of the upper extremity.

After final inclusion, vitals were monitored for all the subjects followed by premedication with intravenous fentanyl in a dose of 1μg/kg 5 min before the block performance. Subjects were then divided into two groups of 25 subjects each where they were treated as

- Group I: infraclavicular coracoid approach.
- Group II: Axillary approach.

These two groups were uniformly administered an equal part mixture of 2% lidocaine with 0.5% bupivacaine with a total volume of 40 ml using an insulated needle (50mm and 22-gauge) and nerve stimulator at 1.5 mA current at 1 Hz frequency for 0.1ms. The needle was inserted at 1c, caudal and 1cm medial to coracoid process deep to pectoralis muscle in coracoid approach. The nerve stimulation was noted as arm adduction for the pectoralis and Lattismus muscle. The axillary nerve was identified along with the deltoid muscle and Musculocutaneous nerve via the Biceps twitch.

For the axillary approach, following skin preparation, on the axilla, the axillary artery pulse was palpated and straddled between the middle and index finger to avoid its rolling during the block. The anesthetic agent was administered slowly using a 25-gauge needle using a nerve stimulator at 0.3–0.5 mA.

The time for the block was from needle insertion to needle removal. Sensory onset time was evaluated every 5 mins up to 30 minutes following the last injection for nerves of the forearm (medial side of the forearm), medial cutaneous nerves of the arm (medial side of the upper arm), the ulnar nerve (little finger), median nerve (thenar eminence), radial nerve (dorsum of the hand over the 2nd metacarpophalangeal joint), musculocutaneous nerve (lateral side of the forearm), and axillary nerve (lateral side of the upper arm).

The motor block efficacy was evaluated every 5 minutes until 30 minutes. This was done for 4 motor nerves including axillary (arm abduction), musculocutaneous (elbow flexion), ulnar (fifth finger flexion), median (third finger flexion), and radial (thumb abduction) nerve. The scoring was done as 0= no motor block; 1= minor movements; 2 = no movement. Adverse effects were also recorded including nausea or vomiting and anesthetic toxicity with failure rates, success rates, and block duration.

The collected data were subjected to the statistical evaluation using SPSS software version 21 (Chicago, IL, USA) and one-way ANOVA for results formulation. The data were expressed in percentage and number, and mean and standard deviation. The level of significance was kept at $p<0.05$.

Results

The present study was conducted to compare the efficacy of brachial plexus block given by Coracoid infraclavicular route or axillary route with peripheral nerve stimulator concerning success and failure rates, block duration, motor block intensity, onset, and performance time. 50 subjects were divided into two groups of 25 subjects each where they were treated as Group I: infraclavicular coracoid approach and Group II: Axillary approach. The demographic characteristics of the study subjects are listed in [Table 1]. The mean age of the study subjects in the coracoid and axillary group was 37.58±12.24 and 38.28±14.22 years respectively which was statistically non-significant with p=0.8528. There were 19 males and 6 females in the coracoid group, and 17 males and 7 females in the axillary group, this was also statistically significant with p=0.465. Mean weight was 70.23±5.76 and 70.58±6.36 kg respectively in the coracoid and axillary group, this was also statistically significant (p=0.8393).

On assessing the parameters concerning local anesthetic block, sensory block onset time was 30±3.59 and 19.03±1.95 for the coracoid and axillary group, which was significantly higher for the coracoid group (p<0.0001). Block performance time differ non-significantly between the coracoid and axillary group with p=0.8772. Block duration was significantly higher in the axillary group compared to the coracoid group with p<0.0001. Motor block intensity was good in 71% of subjects with axillary block and 30% subjects with the coracoid group and was poor in 19% subjects in the coracoid group and 7% subjects in the axillary route group. This difference was statistically significant with p=0.01 [Table 2].

The present study also assessed adverse effects in both the routes used for axillary block. It was seen that pain at the injection site was significantly higher in subjects of the Coracoid group with 12% 9n=3) subjects having pain, whereas, in the axillary group no subject felt any pain (p=0.001). Tourniquet pain differ non-significantly with 4% (n=1) subject feeling pain in coracoid group and 20% (n=5) subjects feeling pain in axillary group (p=0.39). Vascular puncture was seen in 4% (n=1) subject of coracoid group and 16% (n=4) subjects in axillary group (p=0.43). No other adverse effect was noticed [Table 3]. The success rates for the two techniques were statistically significant. The coracoid group had a success of 60% (n=15) subjects which were significantly lesser than the axillary group had a success rate of 88% (n=22) subjects with p=0.04.

Discussion

The present study was conducted to compare the efficacy of brachial plexus block given by Coracoid infraclavicular route or axillary route with peripheral nerve stimulator concerning success and failure rates, block duration, motor block intensity, onset, and performance time. 50 subjects were divided into two groups of 25 subjects each where they were treated as Group I: infraclavicular coracoid approach and Group II: Axillary approach. The mean age of the study subjects in the coracoid and axillary group was 37.58±12.24 and 38.28±14.22 years respectively which was statistically non-significant with p=0.8528. There were 19 males and 6 females in the coracoid group, and 17 males and 7 females in the axillary group, this was also statistically significant with p=0.465. Mean weight was 70.23±5.76 and 70.58±6.36 kg respectively in the coracoid and axillary group, this was also statistically significant (p=0.8393). The demographics of the study subjects were comparable to the studies of Fleischmann E et al in 2003 and Jandard C et al in 2002 where authors assessed subjects with similar demographics in their studies.[11,12]

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The present study also assessed adverse effects in both the routes used for axillary block. It was seen that pain at the injection site was significantly higher in subjects of the Coracoid group with 12% 9n=3) subjects having pain, whereas, in the axillary group no subject felt any pain (p=0.001). Tourniquet pain differ non-significantly with 4% (n=1) subject feeling pain in coracoid group and 20% (n=5) subjects feeling pain in axillary group (p=0.39). Vascular puncture was seen in 4% (n=1) subject of coracoid group and 16% (n=4) subjects in axillary group (p=0.43). No other adverse effect was noticed. The success rates for the two techniques were statistically significant. The coracoid group had a success of 60% (n=15) subjects which were significantly lesser than the axillary group had a success rate of 88% (n=22) subjects with p=0.04. These results were consistent with the findings of Desroches A in 2003 and Neal JM et al in 2002 where similar adverse outcomes and success rates were reported in respective studies.[15,16]

Conclusion

Within its limitations, the present study concludes that for the brachial plexus axillary approach using four injections is more efficacious compared to the coracoid approach with two injections concerning fast block onset, longer anesthesia duration, and better analgesia spread. The study had few limitations as smaller sample size, short monitoring period, single institutional study, single geographical area, and hence, this study could not depict the overall picture. More prospective clinical trials with a larger sample size and longer monitoring period are required to reach the definitive conclusion.

Table 1: Demographic characteristics of the study subjects

Characteristics	Coracoid Group	Axillary Group	p-value
Age Range (years)	21-68	20-70	
Mean age (years)	37.58±12.24	38.28±14.22	0.8528
Gender			
Males	19	17	0.465
Females	6	7	
Weight Range	59-78	57-84	
Mean Weight	70.23±5.76	70.58±6.36	0.8393

Table 2: Parameters related to the block in the study subjects

Parameters	Coracoid Group	Axillary Group	p-value
Sensory Onset	30±3.59	19.03±1.95	<0.0001
Block Performance	5.84±1.32	5.78±1.41	0.8772
Block duration	48.48±8.55	58.13±1.62	<0.0001
Motor Block Intensity (%)			
Good	30	71	0.01
Satisfactory	51	22	
Poor	19	7	
Total	100	100	

Table 3: Adverse effects related to the block in the study subjects

Adverse Effects	Coracoid Group		Axillary Group		p-value
	Percentage (%)	Number (n)	Percentage (%)	Number (n)	
Pain at the injection site (muscle)	12	3	0	0	0.001
Pain due to Torniquet	4	1	20	5	0.39
Vascular Puncture	4	1	16	4	0.43
Other	0	0	0	0	-

Table 4: Success rates with the two routes in the study subjects

Parameter	Coracoid Group		Axillary Group		p-value
	Percentage (%)	Number (n)	Percentage (%)	Number (n)	
Success Rates	60	15	88	22	0.04

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How to cite this article: Dora VP, Ramesh C, Raju DSSK. Comparison of Brachial Plexus Block Performed by Axillary Approach and Coracoid Infraclavicular Block for Upper Limb Surgery: A Clinical Study. Acad. Anesthesiol. Int. 2021;6(2):45-49.

DOI: dx.doi.org/10.21276/aan.2021.6.2.9

Source of Support: Nil, **Conflict of Interest:** None declared.