Research Article

INTERNATIONAL RESEARCH JOURNAL OF PHARMACY

www.irjponline.com

ISSN 2230-8407 [LINKING]

COMPARITIVE CLINICAL TRIAL FOR BRACHIAL PLEXUS BLOCK PERFORMED BY AXILLARY APPROACH AND CORACOID INFRACLAVICULAR BLOCK FOR UPPER LIMB SURGERY

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How to Cite: Singh P, Paul K. Comparitive Clinical Trial For Brachial Plexus Block Performed By Axillary Approach And Coracoid Infraclavicular Block For Upper Limb Surgery. International Research Journal Of Pharmacy, 2022,13:6:12-16.

Doi: 10.32937/2230-8407.3729

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ABSTRACT

Background: Peripheral nerve blocks, or PNBs, are becoming more and more important for patients receiving ambulatory anaesthesia. In outpatient surgical procedures, PNBs also have qualities that are almost perfect for anaesthesia. Postoperative analgesia and easier discharge are also linked to it.

Aim: The purpose of this study was to assess the effectiveness of peripheral nerve stimulators and brachial plexus block administered by the Coracoid infraclavicular or axillary routes in terms of success and failure rates, block length, motor block intensity, onset, and performance time.

Methods: 50 participants in all, of both sexes, were split into two groups of 25, each of whom had a brachial plexus block via the axillary or coracoid routes. For each subject, the same proportions of 2% lidocaine and 0.5% bupivacaine were employed as the local anaesthetic.

Results: Compared to the two injections utilized in the coracoid route, it was seen that the axillary technique was more effective in terms of less incomplete blocks, greater comfort, less discomfort, extended duration, more intensity, and fast onset with four local anaesthetic agent injections. Better postoperative analgesia was achieved thanks to the extended duration.

Conclusion: coracoid technique could be administered in an arm in a neutral posture; it was beneficial for participants with arthritis and stiff shoulder joints. In terms of longer duration, quicker start, and superior analgesia, the current study finds that the axillary technique utilizing four injections is more effective than the coracoid strategy with two injections.

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

INTRODUCTION

Since ancient times, peripheral neural blocks have been used with great success rates. Halsted and Hall (1880s) described the injection of cocaine into peripheral locations such as the ulnar nerve, musculocutaneous, supratrochlear, and infraorbital. James Leonard Corning suggested using an Esmarch bandage in 1885 to stop the local blood flow, lessen the amount of local anaesthetic absorbed by tissues, and extend the duration of the cocaineinduced block.[1,2] Heinrich F. W. Braun replaced the chemical tourniquet epinephrine in 1903. Braun first used the phrase "conduction anaesthesia" in a textbook on total body local anaesthesia in 1914.

Innovative techniques for regional anaesthesia, including its technique and application, were presented by Gaston Labat in 1920.[3] He wrote and published a book on the topic of patient management for patients undergoing procedures related to the extremities, the head and neck, and intra-abdominal surgeries using neuraxial techniques such as plexus, infiltration, and splanchnic blockade.[4]

Recent technological advancements have improved the ability to locate nerves using electric current, which has further aided in recognizing various motor responses from peripheral nerves and provided analgesics with assurances of efficacy and dependability.[5] Neurostimulation is one such method. Hadzic and colleagues indicated that the existing neurostimulators have not been improved. Atraumatic design was used to accomplish motor response stimulation without the use of needles and with a high current. Nevertheless, the lack of specificity in motor activity and the indecisiveness of the needle tip's proximity to the nerve resulted in an ineffective block. This problem has been solved by more recent technologies. There is no turning back when regional anaesthesia enters a new era of neurostimulation or specific peripheral nerve localization.[6]

A comprehensive understanding of the anatomy of the brachial plexus, where the nerve originates from the intervertebral foramina and terminates as peripheral nerves, is necessary for the successful application of regional anaesthesia in the upper extremities. The somatic nerve plexus known as the brachial plexus is made up of the first thoracic nerve (T1), four lower cervical nerves (C5-C8), and their intercommunications among the ventral rami. All upper limb muscles, with the exception of the levator scapula and trapezius, receive their motor supply from the brachial plexus.[7]

It originates from the inferior and middle cervical sympathetic ganglia as well as the first thoracic sympathetic ganglion. It also connects via gray rami to the sympathetic trunk, which joins all plexus roots. Both the axillary and coracoid routes can be used to deliver the block to the brachial plexus. There is, however, a dearth of information in the literature comparing the two.[8]

Therefore, the goal of the current study was to compare the effectiveness of peripheral nerve stimulators with brachial plexus block administered by the Coracoid infraclavicular route or axillary route in terms of success and failure rates, block length, motor block intensity, start, and performance time.

MATERIALS AND METHODS

The goal of the current study was to assess the effectiveness of peripheral nerve stimulators and coracoid infraclavicular or axillary brachial plexus blocks in terms of success and failure rates block length, motor block intensity, onset, and performance time. Fifty patients of both genders who required elective surgery on their wrists, hands, and forearms made up the study population. All subjects gave their informed consent after being fully told about the study's design. Patients who were uncooperative, those who had allergies to local anaesthetics, pregnant women, and individuals with impaired upper limb sensory or motor function were among the exclusion criteria.

Following final inclusion, all subjects' vital signs were tracked, and five minutes prior to the block performance, fentanyl was premedicated intravenously at a dose of 1μg/kg. Following that, the participants were split into two groups of twenty-five each, and they were assigned to either the Axillary approach (Group II) or the Infraclavicular Coracoid method (Group I).

The two groups were given a 40 ml mixture of 2% lidocaine and 0.5% bupivacaine in equal parts. The injection was done using an insulated needle (50 mm, 22 gauge) and a nerve stimulator set to deliver 1.5 mA current at 1 Hz frequency for 0.1 ms. The coracoid technique was used to implant the needle at 1c, caudal, and 1cm medial to the coracoid process, deep to the pectoralis muscle.

The pectoralis and Lattismus muscle exhibited arm adduction in response to the nerve stimulation. The biceps twitch was used to identify the axillary nerve, deltoid muscle, and musculocutaneous nerve. In order to prevent the axillary artery from rolling during the block, the axillary artery pulse was palpated on the axilla after skin preparation and straddled between the middle and index fingers. Using a nerve stimulator set to 0.3–0.5 mA, a 25-gauge needle was used to gradually give the anaesthetic drug. From the moment the needle was inserted until it was removed, the block took place.

The sensory onset time for the following nerves was measured every 5 minutes up to 30 minutes after the last injection: the ulnar nerve (little finger), the median nerve (thenar eminence), the radial nerve (dorsum of the hand over the 2nd metacarpophalangeal joint), the musculocutaneous nerve (lateral side of the forearm), and the axillary nerve (lateral side of the upper arm). Up to thirty minutes, the motor block efficacy was assessed every five minutes. Four motor nerves were affected: the radial (thumb abduction), ulnar (fifth finger flexion), median (third finger flexion), musculocutaneous (elbow flexion), and axillary (arm abduction).

A motor block was scored as 0, 1 for minor motions, and 2 for no movement. Along with failure rates, success rates, and block duration, adverse effects such as nausea or vomiting and anaesthetic toxicity were also noted. Using SPSS software version 21 (Chicago, IL, USA) and one-way ANOVA for result formulation, the gathered data were statistically evaluated. The data were presented as a mean, standard deviation, percentage, and number. At $p<0.05$, the significance threshold was maintained.

RESULTS

The goal of the current study was to assess the effectiveness of peripheral nerve stimulators and coracoid infraclavicular or axillary brachial plexus blocks in terms of success and failure rates block length, motor block intensity, onset, and performance time. 50 participants were split into two groups of 25, each, and given different treatments: Group II received the axillary approach while Group I had the infraclavicular coracoid approach. Table 1 contains a list of the study individuals' demographic details. The research participants' average age in the axillary and coracoid groups was 38.28±14.22 years and 37.58±12.24 years, respectively. This difference was not statistically significant, with a p-value of 0.8528.

The axillary group had 17 males and 7 females while the coracoid group had 19 males and 6 females; the difference was statistically significant ($p=0.465$). The mean weight of the axillary and coracoid groups was 70.58±6.36 kg and 70.23±5.76 kg, respectively. These values were statistically significant ($p=0.8393$).

When evaluating the parameters related to local anaesthetic block, the axillary and coracoid groups' sensory block start times were 19.03±1.95 and 30±3.59, respectively, and the coracoid group's was substantially higher ($p<0.0001$). Block performance times in the axillary and coracoid groups differed non-significantly ($p=0.8772$). The axillary group exhibited a considerably longer block duration ($p<0.0001$) than the coracoid group.

In 71% of participants with axillary block and 30% of subjects in the coracoid group, motor block intensity was good; in 19% of subjects in the coracoid group and 7% of subjects in the axillary route group, it was poor. With $p=0.01$, this difference was statistically significant (Table 2).

The current study evaluated side effects in both axillary blockage strategies. In the Coracoid group, 12% (9n=3) of the individuals reported having pain at the injection site; in contrast, none of the subjects in the axillary group reported any pain ($p=0.001$). There was a non-significant difference in tourniquet pain, with 4% (n=1) of participants in the coracoid group and 20% (n=5) in the axillary group reporting discomfort ($p=0.39$).

A vascular puncture was observed in 16% (n=4) of the axillary group and 4% (n=1) of the coracoid group of patients ($p=0.43$). There were no further negative effects observed (Table 3). Both methods' success rates were statistically significant. The axillary group had a success rate of 88% (n=22) participants with $p=0.04$, which was considerably higher than the 60% (n=15) subjects in the coracoid group.

DISCUSSION

The goal of the current study was to assess the effectiveness of peripheral nerve stimulators and coracoid infraclavicular or axillary brachial plexus blocks in terms of success and failure rates block length, motor block intensity, onset, and performance time. 50 participants were split into two groups of 25, each, and given different treatments: Group II received the axillary approach while Group I had the infraclavicular coracoid approach. The research participants' average age in the axillary and coracoid groups was 38.28±14.22 years and 37.58±12.24 years, respectively. This difference was not statistically significant, with a p-value of 0.8528. The axillary group had 17 males and 7 females while the coracoid group had 19 males and 6 females; the difference was statistically significant ($p=0.465$).

The mean weight of the axillary and coracoid groups was 70.58±6.36 kg and 70.23±5.76 kg, respectively. These values were statistically significant ($p=0.8393$). The study subjects' demographics aligned with those of studies conducted by Fleischmann E et al. (2003, 11) and Jandard C et al. (2002), wherein the authors evaluated subjects with comparable demographics.

The parameters pertaining to local anaesthetic block were also evaluated in this study. The axillary group's sensory block onset time was 19.03±1.95 and the coracoid group's was 30±3.59, respectively, with a significant difference ($p<0.0001$) between the two groups.

Block performance times in the axillary and coracoid groups differed non-significantly ($p=0.8772$). The axillary group exhibited a considerably longer block duration ($p<0.0001$) than the coracoid group. In 71% of participants with axillary block and 30% of subjects in the coracoid group, motor block intensity was good; in 19% of subjects in the coracoid group and 7% of subjects in the axillary route group, it was poor. With $p=0.01$, this difference was statistically significant. The anaesthetic block parameters aligned with the findings of Ababou A et al. (2007) and Hadzic A et al. (2003), whose results were similar to those of the current investigation. The current study evaluated side effects in both axillary blockage strategies. In the Coracoid group, 12% (9n=3) of the individuals reported having pain at the injection site; in contrast, none of the subjects in the axillary group reported any pain ($p=0.001$).

There was a non-significant difference in tourniquet pain, with 4% (n=1) of participants in the coracoid group and 20% (n=5) in the axillary group reporting discomfort ($p=0.39$). A vascular puncture was observed in 16% (n=4) of the axillary group and 4% (n=1) of the coracoid group of patients ($p=0.43$). No other negative effects were observed. Both methods' success rates were statistically significant.

The axillary group had a success rate of 88% (n=22) participants with $p=0.04$, which was considerably higher than the 60% (n=15) subjects in the coracoid group. These findings aligned with those of Desroches A15 (2003) and Neal JM et al. (2002), who reported comparable unfavourable outcomes and success rates in their separate investigations.

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 anaesthesia 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.

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TABLES

S. No	Characteristics	Coracoid Group	Axillary Group	p-value
1.	Age Range (years)	21-68	20-70	
2.	Mean age (years)	37.58±12.24	38.28±14.22	0.8528
3.	Gender			
a)	Males	19	17	0.465
b)	Females	6	7	
4.	Weight Range	59-78	57-84	
5.	Mean Weight	70.23±5.76	70.58±6.36	0.8393

Table 1: Demographic characteristics of the study subjects

S. No	Parameters	Coracoid Group	Axillary Group	p-value
1)	Sensory Onset	30±3.59	19.03±1.95	<0.0001
2)	Block Performance	5.84±1.32	5.78±1.41	0.8772
3)	Block duration	48.48±8.55	58.13±1.62	<0.0001
4)	Motor Block Intensity (%)			
a)	Good	30	71	0.01
b)	Satisfactory	51	22	
c)	Poor	19	7	
d)	Total	100	100	

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

S. No	Adverse Effects	Coracoid Group		Axillary Group		p-value
		Percentage (%)	Number (n)	Percentage (%)	Number (n)	
1.	Pain at the injection site (muscle)	12	3	0	0	0.001
2.	Pain due to Torniquet	4	1	20	5	0.39
3.	Vascular Puncture	4	1	16	4	0.43
4.	Other	0	0	0	0	-

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

S. No	Parameter	Coracoid Group		Axillary Group		p-value
		Percentage (%)	Number (n)	Percentage (%)	Number (n)	
1.	Success Rates	60	15	88	22	0.04

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