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Original research article

A study on the efficacy of onset and duration of brachial plexus blockade through axillary approach by using lignocaine chloride

[1]Dr. Kuppannagari Subbareddy, [2]Dr. Vootkur Ram Reddy, [3]Dr. Hareesh Tarigoppula, [4]Dr. Spoorthy Uppuleti

[1]Associate Professor, Department of Anaesthesiology, S.V.S. Medical College, Yenugonda, Mahabubnagar, Telangana, India

[2]Assistant Professor, Department of Anaesthesiology, Kamineni Institute of Medical Sciences, Narketpally, Nalgonda, Telangana, India

[3]Assistant Professor, Department of Anaesthesiology, Singareni Institute of Medical Sciences, Ramagundam, Telangana, India

[4]Assistant Professor, Department of Anaesthesiology, Kakatiya Medical College, Telangana, India

Corresponding Author:
Dr. Spoorthy Uppuleti

Abstract

Background: The brachial plexus block through the axillary approach involves using local anaesthetic to target the nerves in the axillary region, providing effective anaesthesia for surgeries of the forearm and hand. This technique is often preferred for its reduced risk of complications and greater patient comfort compared to other approaches. The purpose of our study was to observe axillary and other techniques for brachial plexus block in patients undergoing forearm and hand surgeries.

Materials and Methods: This prospective observational study was conducted in 75 patients who underwent brachial plexus blockage in the Department of Anaesthesia. A written informed consent was taken from all the patients and the procedure was explained.

Results: most of the patients were below 20 years of age in this study. Males comprised of 60% of the study population. Out of the 75 cases, 58 cases were elective brachial plexus blocks and 17 were emergency blocks. The mean time for onset of sensory and motor blocks is18.1±2.4 min and 15.7±6.4 min respectively. The mean duration of sensory and motor block is - 223.1±28.9 min and 189.8±26.7 min respectively.

Conclusion: Axillary nerve block is a reliable and efficient regional anesthesia method appropriate for various procedures in both inpatient and outpatient care. The use of ultrasound guidance has increased its effectiveness, enabling the use of smaller doses of local anesthetic.

Keywords: Axillary approach, sensory block, brachial plexus

Introduction

The brachial plexus supplies the nerve supply to the upper limb and is formed by the ventral rami of the lower four cervical nerves and the first thoracic nerve. The cords, the terminal branches, and the vessels lie within an incomplete fascial sheath derived from the scalene fascia, which is in turn derived from the prevertebral fascial layer [1]. The best approach to brachial plexus is determined by the sensory and motor innervations of the surgical site concerned and the potential adverse effects of each [2].

The axillary approach to brachial plexus was first demonstrated in 1884 by William Halsted when he injected cocaine under direct vision [3]. This approach provides good surgical anaesthesia for the elbow, forearm, and hand, as well as cutaneous anaesthesia of the inner upper arm. It is considered the safest of the four main options, as it does not risk blockade of the phrenic nerve and does not have the potential to cause pneumothorax, making it an ideal option for day case surgery.

Techniques of axillary block include peripheral nerve stimulation and ultrasound guided methods. The use of a nerve stimulator for peripheral nerve blockade provided a definite advantage over traditional paraesthesia or trans-arterial techniques of the 1980s. A multi injection technique using a nerve stimulator was found to be associated with a higher success rate [4, 5].

In 1981, the first use of Doppler ultrasound to identify the axillary artery aided the performance of axillary plexus block for upper limb surgery [6]. Ultrasound guidance has become the most favoured modality used

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for peripheral block performance as it has improved block success rates and decreased onset time along with lesser amount of anaesthetic is required for a successful block [7, 8].
This prospective study aims to assess the efficacy of axillary approach in brachial plexus block.

Materials and Methods
This prospective observational study was conducted in the Department of Anaesthesia, S.V.S Medical College over 12 month period, i.e., from Febrauary 2023 to January 2024. The study was conducted on 75 patients of age between 15 to 70 years of either sex (using 1.5% lignocaine hydrochloride with epinephrine).
Patients of either sex aged 15 to 65 years scheduled to undergo forearm and hand surgical procedures, and those classified as ASA physical status I and II were included in the study.

Exclusion criteria
- Uncooperative patients; or
- Patients who refused to give their consent to participate; or
- Patients unable to abduct their arm; or
- Patients with infection or cellulitis at the block site; or
- Patients with upper extremity neurological diseases; or patients with a history of hypersensitivity to drugs; or
- Patients with history of documented bleeding tendencies or those on anticoagulants; or
- Patients in whom adrenaline is contraindicated are excluded from the study.

A detailed history was documented. General and systemic examination was done. All patients were subjected to routine haematological tests (Hb%, TC, DC, ESR, BT, CT, urea, serum creatinine, blood sugar, viral markers), urinary tests (albumin, sugar, microscopy), ECG, chest X-ray (P.A. view).
Ethical committee approval was taken prior to the onset of the study. A written informed consent was taken.
All patients were cannulated with an intravenous catheter appropriate to the age in the contralateral upper limb under aseptic conditions. Premedication involved intravenous administration of diazepam at 0.2mg/kg body weight, over three minutes, 10 minutes before the block, with a maximum dose of 10mg. The local anesthetic used was 1.5% lignocaine hydrochloride with epinephrine, at a dose of 7mg/kg body weight.
Patient vitals were monitored using pulse oximetery and sphygmomanometer.

Procedure: The arm is positioned at a 90-degree abduction and elbow flexion. The axilla is cleaned aseptically, and a high-frequency linear probe scans transversely along the lateral border of the pectoralis major muscle. The axillary artery is located and individual nerves are identified around it. By easing transducer pressure, the axillary vein becomes visible. Nerves at this level have a honeycomb appearance but vary in location. Typically, the median nerve is at the 9-12 o'clock position, the ulnar nerve at 2 o'clock, and the radial nerve at 5 o'clock relative to the artery. The musculocutaneous nerve is usually between the biceps and coracobrachialis muscles or within the coracobrachialis. It appears flattened with a bright border and often a hypoechoic core, gliding in the fascial plane as scanning moves up and down the arm. The radial nerve, deeper and medial to the artery, is hardest to visualize and can be confused with postcystic ultrasonographic enhancement beneath the artery. To avoid this, techniques such as using a peripheral nerve stimulator, scanning from the radial groove to the axilla, or blind injection at the 5 o'clock position are employed. Local anaesthetic is injected in a "horse-shoe" pattern to block the radial nerve effectively. Alternatively, a "donut" technique circumferentially deposits anaesthetic around the axillary artery to block the median, ulnar, and radial nerves.
After probe positioning, local anaesthetic is infiltrated subcutaneously to block the intercostobrachial nerve. A short-bevelled 5 cm needle is inserted in-plane or out-of-plane relative to the probe towards the four nerves for individual blocks. The in-plane approach keeps the needle's entire length in view, while the out-of-plane approach may require hydrolocation of the needle tip.

Results
75 patients underwent brachial plexus blockade via axillary method in this prospective observational study conducted in the Department of Anaesthesia.

Table 1: Shows the distribution of patients

Sex	Elective	Emergency	Total
Male	35	10	45 (60%)
Female	23	7	30 (40%)
Total	58 (77.3%)	17 (26.6%)	75 (100)

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In the present study, majority of the patients were males (60%), followed by females (40%). 77.3% of the patients underwent elective axillary blockage while 26.6% of the patients underwent emergency blockade.

Table 2: Age distribution

Age in years	Male	Female	Total
≤ 20 years	16	10	26
21-30 years	10	9	19
31-40 years	9	5	14
41-50 years	6	4	10
51-60 years	4	2	6
>60 years	45	30	75

Most of the patients were below 20 years (34.6%), followed by 21-30 years (25.3%).

Table 3: Grades among study population

	ASA Grade-I	ASA Grade -II	Total
Emergency	9	8	17
Elective	45	13	58
Total	54	21	60

Majority of the patients who had underwent elective surgery belonged to ASA Grade - I (60%), followed by ASA grade - II (17.3%).

Table 4: Onset and duration of blockade

		Sensory block	Motor block
Onset of block	Minimum onset time (min.)	10 min	5 min
	Maximum onset time (min.)	28 min	22 min
	Average onset time from all the cases (min.) ±SD	18.1±2.4	15.7±6.4
Duration of block	Least duration (min.)	95 min	125 min
	Maximum duration (min.)	255 min	200 min
	Average from all cases (min.)±SD	223.1±28.9 min	189.8±26.7 min

Sensory block onset was determined by the inability to perceive pin prick over the areas of distribution. The fastest time for onset of sensory block was 10 min and the slowest time was 28 min with a mean of 18.1±2.4 min. The fastest time for motor block was 5 min and the slowest time was 22 min with a mean time of onset of 15.7±6.4 min.

Duration of sensory blockade on an average was 223.1±28.9 min, shortest being 95 minutes; longest being 255 minutes. Similarly duration of motor blockade on an average was 189.8±26.7 min, minimum duration being 125 minutes and maximum duration being 200 minutes.

Discussion

Brachial plexus block, a regional anaesthesia technique practiced since 1884, remains popular today. The technique is comparable to peridural anaesthesia, but offers advantages due to the perivascular space being surrounded by soft tissue, allowing for better distribution of local anaesthetic. Despite some challenges to its anatomical concepts, clinical evidence supports the effectiveness of brachial plexus anaesthesia for achieving extensive nerve block with a single injection.

The present study of axillary brachial plexus block was undertaken at Department of Anaesthesiology, SV.S Medical College, Mahaboobnagar. 75 patients of both sexes were included in the study.

Amongst the 75 patients, majority of them were males (60%). 17 cases were emergencies and the rest 58 cases were elective brachial plexus block.

The present study group ranged from 17 - 68 years with a mean of 25.3 years. Most of the patients belonged to <20 years of age. In study done by Adriani *et al*. [9], patients as young as 1 year were included in the study. Winnie *et al*. [10] studied nerve blocks in infants and children.

In present study, 58 elective and 17 emergency brachial plexus blocks were done. Local anaesthetic agent used was 1.5% of Lignocaine Hydrochloride with epinephrine the volume being 30 ml (Max.). Atkinson *et al*. [11] advocated use of 1.5 to 2% lignocaine (20-25 ml) with adrenaline for axillary brachial plexus block. Moore D.C. *et al*. [12] advocates that local anaesthetic of choice for axillary approach should be lignocaine or mepivacaine.

Onset of sensory blockade

In present study, fastest time for onset of sensory block was 10 min and the slowest time was 28 min with a mean of 18.1±2.4 min. the onset of sensory block as seen in study by Moore D.C. *et al*. [12] was 7 min (minimum). Mackay *et al*. [13] observed the maximum time for onset of anaesthetic effect as 32.5 min,

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which is higher in comparison with present study.
The onset of motor blockage in present study was 5 min (minimum) and the slowest time was 22 min with a mean time of onset of 15.7±6.4 min. this is similar to study by Egon *et al*. [14]. They also observed the onset of motor block earlier than sensory block. This could be due to the arrangement of motor fibres in the mantle and sensory fibres in the core of the trunks and cords.

Duration of sensory and motor blockade
In present study, shortest duration of sensory blockade was 95 minutes; and the longest being 255 minutes. Similarly minimumduration of motor blockade was 125 minutes and maximum duration being 200 minutes.
Mackay *et al*. [13] observed maximum duration of sensory block of 240 min. Moore D.C. *et al*. [12] observed maximum duration of sensory block of 120-180 min.
Winnie *et al*. [10] observed that the duration of analgesia can be prolonged by adding vasoconstrictors.

Conclusion
From the observations in this study of 75 patients undergoing procedures with the axillary brachial plexus block, it is clear that this technique can be performed with minimal equipment. It is a viable alternative for providing anesthesia for forearm and hand surgeries in emergency situations across different age groups. The perivascular double injection technique is easy to perform, reliable, safe, well-tolerated by patients, efficient, cost-effective, and provides the benefit of postoperative analgesia, requiring minimal preoperative preparation and postoperative care.

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Conflict of interest
No conflict of interest.

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