

Original Research Article

Comparison between single point versus double point injection in supraclavicular block incidence: ulnar sparing

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ABSTRACT

Background: This study compared the efficacy of single-point versus double-point injection techniques in ultrasound-guided supraclavicular brachial plexus blocks, focusing on success rate, procedural time, onset and duration of sensory and motor block, and complications.

Methods: Twenty patients (20-80 years) undergoing forearm surgery over one hour were randomized into two groups. Group D received 20 ml of 0.5% bupivacaine divided into two 10 ml injections (superior cluster and inferior corner pocket). Group S received the entire 20 ml in the superior cluster pocket. Ultrasound guidance was used to locate the brachial plexus. Sensory and motor blockade onset were assessed by pinprick test and Bromage scale. Procedural time was recorded from ultrasound scanning to drug administration completion. Duration of blockade and adverse events were also noted.

Results: Group D showed a significantly higher success rate ($p < 0.0001$) and longer procedural time compared to group S. Onset of sensory and motor block was faster, and duration was significantly prolonged in group D.

Conclusions: Double-point injection results in faster onset, longer duration, and higher success rate of supraclavicular blocks compared to single-point injection, but requires more procedural time.

Keywords: Brachial plexus, Bupivacaine, Corner pocket, Superior pocket, Supraclavicular block

INTRODUCTION

Supraclavicular block is widely used regional anaesthesia technique for upper limb surgeries. However, one of the common complications of this block is ulnar sparing, which can lead to incomplete anaesthesia and compromise surgical outcomes. The technique of injection, specifically single point versus double point injection, may play a crucial role in minimizing ulnar sparing.

Ulnar sparing, defined as the incomplete anesthesia of the ulnar nerve distribution, occurs in up to 20% of supraclavicular blocks.¹ This phenomenon is often

attributed to the anatomical variability of the brachial plexus and the difficulty in achieving a uniform spread of local anesthetic around the nerves.

In supraclavicular block the targeted structures are trunks which are organized as a cluster posteromedial to the subclavian artery. Brachial plexus is tightly organized as a cluster here, and this helps in achieving a dense block with a faster onset.

The advantages of performing the block under the sonographic guidance is that the trajectory of the block needle is safely visualized under real time, which helps in avoiding injury to adjacent vital structures, ensuring

deposition of drug, and is spread around the plexus, and avoiding intraneural/intravascular injection. It also reduces the failure rate of the block. The conventional one-point injection technique requires deposition of local anesthetic near the plexus, but this mostly ends up in ulnar sparing, thus resulting in an incomplete block and targeting this specifically increases the risk of pneumothorax, “eight ball corner pocket technique” involving the deposition of local anesthetic solution in the corner pocket formed by subclavian artery laterally and first rib inferior resulted in the faster onset. However, this technique also achieves successful blockade of ulnar nerve in only 85% of the cases.²

Therefore, we hypothesized that the double point injection technique of supraclavicular block incorporating the “eight ball corner technique” along with hydro dissection using lower volumes of local anesthetic solution will increase the success and safety of the block compared to single point injection technique regarding ulnar sparing.

Aim

The aim of this study was to compare the success rate of single point injection versus double point injection technique in patients receiving supraclavicular block for upper limb surgeries.

Objectives

The objectives include to study the following among the patient undergoing upper limb surgeries where supraclavicular block is given: the success rate of the block; and to compare the incidence of ulnar sparing between single point and double point injection technique in supraclavicular block. We hypothesized that double point injection will result in a lower incidence of ulnar sparing compared to single point injection.

METHODS

Source of data, study setting, study subjects/participants

The study group comprised of patients admitted in Father Muller Medical College, Kankanady, posted for upper limb surgeries under local anesthesia (block) was given.

Place of study and duration

This was an observational study and will be carried out in Father Muller Medical College, Kankanady and performed by Nishana, MS under the guidance of Dr Devika Anil, Senior Resident, anesthesiology department, FMMCH and Dr Pooja S., Senior Resident, anesthesiology department, FMMCH. The study was started after obtaining ethical committee clearance. The study took place for a period of six months (September 2024- February 2025).

Type of study

It was a prospective, comparative, observational study, hospital based and randomised controlled study.

Inclusive criteria

Age between 20-70 years, Posted for upper limb surgery.

Exclusive criteria

Patients with psychological disorders, coagulopathy, know allergy to local anaesthetics, infection at the insertion site, neuropathy.

Method of data collection

The study was conducted on 20 patients admitted to Father Muller Medical College, Kankanady posted for upper limb surgeries. The study was conducted by consulted anesthesiologist by following the guidelines.

Demographic data collected during preoperative period include age, sex, weight, and ASA grading which was collected after ethical committee clearance and patient's consent.

Patient of the age between 20-70 years who are posted for surgery undergo one of technique between “single-point and double-point injection in supraclavicular block”. The procedure was conducted in an aseptic manner, consent for the procedure was taken from the patient after explaining the objective of the study, the two techniques of the procedure and the related complication.

Preoperative examination was done to the entire patient which include history and general physical and systemic examination. All the necessary investigations like complete blood count, serum creatinine, coagulation profile and blood grouping were done before the procedure and asked them to be nil per oral as per the standard ASA guidelines. The patients were divided into two groups named as group D: group S. These are the routine standardised procedures that are followed in the hospital. After shifting the patient to the block room ASA guideline vitals were checked and intravenous cannula was secured on the hand in which block was given and fluid (RL/NS/DNS) was given to the patient. The patient was in supine position. Vitals were assessed eventually while giving the block. For performing the block, the ultrasound screen and transducer, and a sterile trolley was arranged, an experienced anesthesiologist was performing supraclavicular block on the patient based on two approaches. The method of assessing the motor and sensory block was by pin prick method. Oxygen was administrated via face mask. Some patient was pre-medicated with intravenous midazolam 0.02-0.04 mg/kg to ensure patient remains calm but responsive to verbal commands. All precautions were taken to ensure proper a

sepsis. All essential materials and equipment's were arranged.

For performing the block, the USG screen, transducer was arranged on the side to be blocked so that all were in view of the operator. At the time of block patient was asked to tilt the head slightly away from the side to be blocked. The arm to be blocked was abducted and the other hand was asked to keep on the abdomen for the comfortable of the patient.

Sterile the area- cleaned and disinfect the skin with sterile solutions (chlorhexidine or povidone-iodine.). Sterile jelly was put on the transducer. Drape the area- cover the surrounding skin with sterile drapes or towels.

The transducer was moved from cephalic to caudal direction towards the supraclavicular fossa to bring subclavian vessels to the centre of the screen and then moved laterally to the point where plexus can be located laterally to the artery.

20 gm cannula was inserted 1-2 cm lateral to the transducer and directed in plane towards the plexus while visualising the needle on USG in real-time.

Drugs used- bupivacaine 0.5% + lignocaine + adrenaline and adjuvants were added as per the anaesthetist and based on which type of surgery and duration of the surgery.

Insert the needle- insert the needle at the designated site. (just above the clavicle) using aseptic technique.

Aspirate and inject: aspirate to ensure proper placement of needle and then inject the drugs (local anaesthetic) slowly.

For group D (double point injection technique), identify the brachial plexus and surrounding structures. Insert the needle in-plane, targeting the cluster nerves. Administrate 10ml of the dose of local anaesthetic agent in the superior pocket (in the cluster) and other 10 ml in the inferior pocket (corner pocket) between the plexus and subclavian artery using hydro dissection. Whereas in group S the total 20 ml of 0.5% bupivacaine was deposited in the superior pocket (in the clusters).

Anesthetist considered which of these two techniques that is "single point versus double point injection" is effective and convenient and which does not give ulnar sparing is taken, all the procedures were done aseptic manner.

This study primarily assessed the efficacy of the single point and double point techniques in achieving successful blocks, with secondary focuses on procedural time, block onset, duration, and complications.

The block was deemed successful when it provided complete analgesia to the dermatomes associated with the radial, ulnar, and median and musculocutaneous nerves. Incomplete block was defined as the absence of analgesia

in one or more dermatomes innervated by the radial, ulnar, median, and musculocutaneous nerves 30 minutes post injection. The surgery was started after achieving successful block or waiting for 30 minutes.

The procedural time is defined as the total time taken from imaging the brachial plexus till the time when needle is taken out. The sensory block was assessed by pin prick method on the dermatomes which is median, ulnar, radial nerves.

Pin prick method

Grade 0: sharp sensation to pin prick. Grade 1: analgesia, dull sensation to pin prick. Grade 2: anesthesia, no sensation to pin prick.

Total duration of sensory block was the time from grade 2 (2/10) up to 3/10 which was the recovery (postoperative).

The motor block was evaluated using Bromage scale.

Bromage scale

Bromage 0: no nerve block, Bromage 1: partial block, Bromage 2: almost complete block, Bromage 3: complete block

Duration of motor block was the time taken for the patient to go from grade 3 to grade 0 postoperative.

In all the patient we have observed for any complications were present like (paresthesia, pneumothorax, arterial puncture, local anaesthesia toxicity, ulnar sparing).

Ulnar sparing means the condition when local anesthetic is not appropriately injected into the corner pocket there by resulting in sparing around the distribution of ulnar nerve.

Statistical analysis

The focus of our research was to evaluate the success rates of double point versus single point injection methods in ultrasound guided supraclavicular block.

A previous study by Choudhary demonstrated that the double point injection technique significantly improved the success rate of ultrasound-guided supraclavicular block, achieve success compared to with the single point technique.³ Based on this, to have power of study we took 20 patients in which 10 patients in each group, statistical analysis was conducted for the data, we employed frequencies and t-test to compare demographic data.

RESULTS

A total of 20 patients were included in this observational study, demographic data with respect of (age, height, weight, BMI) were comparable between two groups.

Table 1: Comparison of demographic characteristics between the two groups.

Variables	Overall, Mean (SD) (n=20)	Group D, Mean (SD) (n=10)	Group S, Mean (SD) (n=10)
Age (years)	46.50 (19.198)	41.70 (20.667)	51.30 (17.314)
Weight	61.40 (11.780)	62.50 (10.201)	60.30 (13.647)
Height	167.05 (12.471)	168.70 (13.953)	165.40 (11.296)
BMI	22.35 (4.006)	22.33 (2.690)	22.37 (5.161)

Table 2: Comparison of sensory characteristics between the two groups.

Variables	Overall, Mean (SD) (n=20)	Group D, Mean (SD) (n=10)	Group S, Mean (SD) (n=10)	P value
Sensory block	9.00 (3.839)	12.00 (2.582)	6.00 (2.108)	<0.0001
Sensory block duration	233.00 (74.275)	294.00 (48.580)	172.00 (31.903)	

Table 3: Comparison of motor characteristics between two groups.

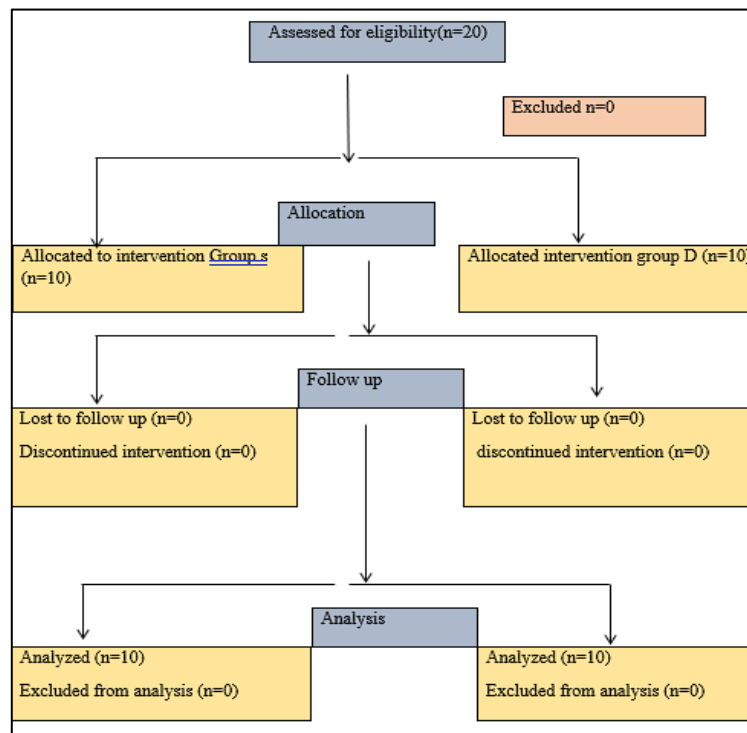
Variables	Overall, Mean (SD) (n=20)	Group D, Mean (SD) (n=10)	Group S, Mean (SD) (n=10)	P value
Motor block	16.25 (6.257)	22.00 (2.582)	10.50 (1.581)	<0.0001
Duration of motor block	412.75 (87.381)	483.00 (55.588)	342.50 (45.415)	

t-test.

Table 4: Comparison of ulnar sparing between two groups.

Variables	Group D, N (%) (n=10)	Group S, N (%) (n=10)	P value
Yes	0 (0.0)	5 (50)	<0.033
No	10 (100)	5 (50)	

Chi-square tests (Fisher's exact test)

**Figure 1: CONSORT diagram showing the division of patient at every stage of randomize control trial.**

All two groups were comparable with respect of age, height, weight, BMI and data was analyzed using

frequencies for the two groups and it was not statistically significant.

Based on t-test overall analysis of sensory characteristics was done, based on independent sample test/t-test there was statistically significance between the two groups based on sensory characteristics. P value was <0.001.

There was statistically significance between the two groups with respect two motor characteristics based on t-test with the p value of <0.001.

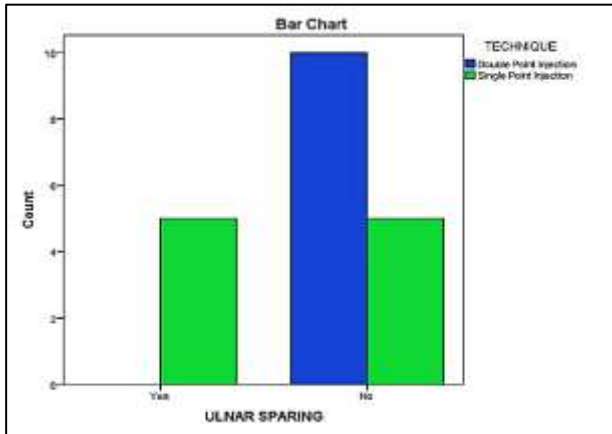


Figure 2: Ulnar sparing.

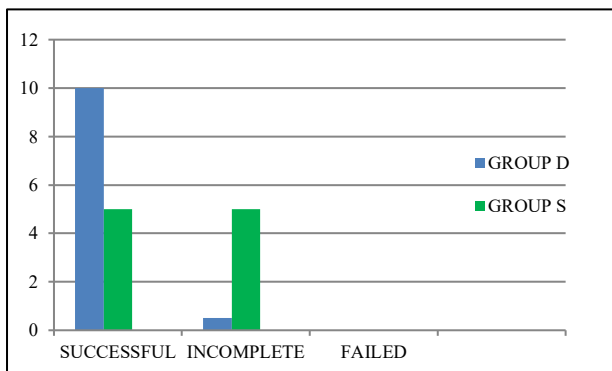


Figure 3: Adequacy of block.

The t-test for equality of means revealed a statistically significant difference between the double point and single point injection technique, as evidence by the positive t-test result indicates that the double point injection technique yields better outcomes compared to the single point injection technique.

Based on Fisher's exact test there was statistically significance between two groups with respected of ulnar sparing with p value <0.03.

The consort flow diagram illustrates the patient enrolment process. A total of 20 patients meeting the inclusion criteria participated in the study. The demographic profiles of two groups, including age, sex, weight, height, and BMI were compared.

The time required to perform the block was significantly longer in group D. Group D demonstrated a higher success

rate (100%) compared to group S (50%) with the p value 0.0001. Ulnar sparing resulted in incomplete blocks in 5 patients of group S and there was no failed block/incomplete in group D, this indicates group D, double point injection technique ("eight corner pocket technique") is gold standard than single point injection technique in supraclavicular block.

DISCUSSION

Supraclavicular brachial plexus block is a preferred technique for upper limb surgeries due to its consistent and dense anesthesia. However, ulnar nerve sparing remains a significant concern, often resulting in incomplete anesthesia and necessitating conversion to general anesthesia or additional blocks. This limitation becomes especially problematic in procedures involving the ulnar aspect of the forearm and hand, where reliable and comprehensive anesthesia is crucial.^{3,4}

The phenomenon of ulnar sparing is multifactorial but is primarily attributed to inadequate spread of local anesthetic to the inferior trunk or lower divisions of the brachial plexus, which give rise to the ulnar nerve.⁵ Anatomically, the ulnar nerve fibers lie posteroinferior and lateral to the subclavian artery, making them less accessible when only the superior cluster (main neural cluster) is targeted.⁶

In this study, the double-point injection involved depositing local anesthetic both at the superior neural cluster and in the "corner pocket"- a space bordered by the first rib, subclavian artery, and pleura. This technique leverages hydrodissection, promoting better separation of fascial planes and facilitating the spread of local anesthetic to neural structures that may otherwise be missed by single-point injection methods.⁷

Our findings are corroborated by Choudhary et al, who emphasized that targeting the corner pocket enhances the likelihood of achieving complete anesthesia, particularly of the ulnar nerve.⁸ Similarly, Thiruchelvan et al and Choi et al have reported that single-point injections may fail to anesthetize critical neural components, especially when fascial septae or compartmentalized architecture of the brachial plexus is present.^{7,10}

The significantly longer duration of motor and sensory blockade in the double-point group is likely a result of the more uniform and circumferential spread of anesthetic around the plexus, ensuring greater nerve fiber exposure and absorption. This not only provides complete anesthesia but also prolongs the analgesic effect, which is advantageous for longer surgeries or for enhanced postoperative pain control.⁸

Although the procedural time was statistically longer in the double-point group, the increase of approximately 1-2 minutes was not clinically detrimental. This trade-off is justifiable considering the improved anesthetic reliability

and surgical conditions it provides. As supported by Lee et al, the learning curve associated with the technique is manageable and can lead to faster performance with experience.⁷

Importantly, no major complications were observed in either group. The use of ultrasound guidance allowed for real-time visualization, which significantly improved the safety profile of the procedure, helping to avoid vascular puncture, pleural injury, or intraneural injection.⁸ This underscores the dual role of ultrasound in enhancing both efficacy and safety.

From a clinical perspective, the implications are clear: adopting the double-point injection technique, particularly incorporating the corner pocket approach, results in a more reliable, longer-lasting, and complete supraclavicular block. This is especially relevant in surgeries involving the medial or ulnar side of the forearm and hand, where block failure is most likely to compromise surgical success and patient comfort.^{3,8}

Despite the promising results, the study has limitations. Small sample size (n=20) limits generalizability and statistical power. Operator variability and experience could influence block success and timing. Long-term outcomes such as patient satisfaction or incidence of nerve injury were not studied. Further multi-center trials with larger populations would help validate and expand upon these findings.

CONCLUSION

The incorporation of the corner pocket technique into ultrasound guided double point injection for supraclavicular blocks enhances success rates, accelerates onset, and prolongs sensory and motor blockade duration, surpassing single point injection technique

Proficiency in double point injection technique enables healthcare providers to navigate needles with greater accuracy, minimizing the risk of complication.

The DI technique may allow for more precise and uniform distribution of anesthetic solution, minimizing the risk of ulnar sparing

Double point injection technique is considered as the golden standard for achieving optimal block outcomes.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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