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Original Research Article

Comparative Assessment of Supraclavicular and Infraclavicular Approaches to Brachial Plexus Block for Upper Limb Surgeries

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Abstract:

Background and Aim: Both the supraclavicular and infraclavicular brachial plexus blocks can be used successfully for procedures on the upper limb. They both have a similar anaesthetic distribution. In this study, brachial plexus blocks for patients having upper limb surgery were evaluated between the supraclavicular and infraclavicular procedures employing neurostimulation in a prospective randomised way.

Material and Methods: In a tertiary medical college hospital, this prospective, randomised, and observer-blinded study was conducted on 80 patients who were having elective surgery on their elbows, forearms, and hands. A vertical infraclavicular plexus block (group I, n = 40) or supraclavicular plexus block (group II, n = 40) was randomly administered to the patients. The very same anaesthesiologist performed all of the blocks. Onset of sensory and motor blockage, readiness for surgery, success rate, and complications were all compared between the two groups.

Results: The demographic characteristics of the two groups were comparable. Additionally, it was discovered that the length of operation and the location of surgeries were comparable, and statistical significance was not observed. In comparison to Group II (10.983.47), Group I (9.402.34 min) had a relatively faster block performance time (P = 0.02). In contrast to Group II, Group I had a higher satisfaction rating. In Group I, motor blockade began more quickly than in Group II, although this difference was not statistically significant. The amount of time it took for patients to be prepared for surgery was not statistically different.

Conclusion: Infraclavicular block was performed faster using the ultrasound-guided neurostimulation approach than supraclavicular block. The infraclavicular technique may be preferred for surgery on the hand, forearm, or elbow, according to these findings. To contrast the supraclavicular block with the infraclavicular block utilising neurostimulation, additional large-scale investigations will be required.

Keywords: Brachial Plexus Block, Infraclavicular Block, Supraclavicular Block, Upper Limb.

Introduction

The brachial plexus block method, one of several ways to anaesthetize the forearm for surgery, is thought to be the most advantageous and feasible. The infraclavicular block is directed at the brachial plexus, which is organized into three cords—lateral, medial, and posterior—and surrounds the axillary artery in the infraclavicular area. No significant terminal branches develop at this level. [1] The brachial plexus elements are tightly clustered at a level where the supraclavicular approach blocks them, which allows for a single site injection and is thought to have a very quick onset. [2] Anatomically speaking, practically all patients should be able to use the infraclavicular approach. Additionally, it benefits theoretically from both the supraclavicular and axillary techniques. Although both supraclavicular and infraclavicular blocks can be used for upper limb procedures, anaesthesiologists frequently favour the former due to the latter's technical challenges and elevated risks associated with the blind approach. Since it was first used in anaesthetic practise, ultrasonography has been a useful addition to peripheral nerve blocks. [3] Ultrasound-guided regional anaesthesia is very tempting due to the inherent advantages of direct visualisation of the nerves and surrounding anatomy, ongoing inspection of the needle tip, and local anaesthetic distribution. When combined with ultrasound, the use of nerve stimulators improves outcomes and adds another dimension of interest for residents. As a result, we predicted that infraclavicular block

would be easier to conduct, safer than supraclavicular block, and less problematic when using both ultrasound and nerve stimulator. [3,4]

In this study, brachial plexus blocks for patients having upper limb surgery were evaluated between the supraclavicular and infraclavicular procedures employing neurostimulation in a prospective randomized way.

Material and Methods

In a tertiary medical college hospital, this prospective, randomised, and observer-blinded study was conducted on 80 patients who were having elective surgery on their elbows, forearms, and hands. The study comprised participants who were between the ages of 18 and 60 and who met the physical status I or II criteria of the American Society of Anesthesiologists (ASA) and weighed between 50 and 100 kg. Patients who were unwilling to cooperate, those who had severe lung disease, and those who were allergic to amide local anesthetics were not included in the study. The study excluded women who were pregnant, had clavicle fractures, or had a deformed chest.

A vertical infraclavicular plexus block (group I, n = 40) or supraclavicular plexus block (group II, n = 40) was randomly administered to the patients. The very same anesthesiologist performed all of the blocks. Upon entering the preoperative holding area, routine monitoring was started. All blocks were performed with a 22-gauge 50-mm insulated stimulation short bevel needle attached to a nerve stimulator. The initial settings for the nerve stimulator were 1.5 mA and 0.1 ms for the impulse duration. When the motor response in the hand or wrist was elicited and remained apparent with a maximum current of 0.5 mA, the needle location was deemed to be sufficient. Using intermittent aspiration, 30 ml of 0.5% ropivacaine local anaesthetic was gently delivered.

The supine posture was used for the vertical infraclavicular approach, and the upper arm was placed along the side with the elbow flexed and the hand resting on the lower chest or abdomen. The puncture site was noted halfway between the jugular notch and the most ventral region of the acromion after the features had been identified. The needle was inserted into the horizontal plane with perfect verticality. According to the original method described by Brown et al., the supraclavicular brachial plexus block was carried out.[4] The patient was positioned on their back with their head tilted to the other side. A needle was placed at the specified location where the lateral border of the sternocleidomastoid muscle crosses the superior side of the clavicle in a posterior orientation. A motor response was elicited before the needle was advanced farther. The needle was redirected cephalad in modest stages until a motor response in the hand or wrist was elicited or until it was angled at about 30 degrees if a motor response in the hand or wrist was not obtained during the first insertion or if the first rib was not contacted. The needle was redirected caudad in incremental steps until a motor response was felt or until an angle of 30o caudad was reached if contact with the brachial plexus was still not made.

Immediately following the removal of the needle, block performance-related pain was assessed by having the patient vocally rate their level of discomfort on a scale of 0 to 10, with 0 representing no pain and 10 representing excruciating pain. Throughout the innervation of each neuron, the sensory and motor function was evaluated. A block assessment was carried out every 10 minutes until 50 minutes had passed since the injection.

We used gauze that had been soaked in alcohol to perform the sensory block on each target nerve. The forearm flexion thumb abduction, thumb and second digit pinch, and finger abduction were used to assess the motor block. During the operation, the block's quality was assessed. It was determined how long the sensory and motor block lasted. There were certain difficulties and side effects that were identified, including blood vessel puncture, intravascular injection, overdose, dyspnea, Horner's syndrome, and pneumothorax. After being admitted to the post-anesthesia care facility, the patient's satisfaction with the anaesthetic method was evaluated using a 2-point scale.

Statistical analysis

The collected data was organised, inputted, and exported to the data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA) after being combined and entered into a spreadsheet programme (Microsoft Excel 2007). The level of significance and confidence level for each test were set at 5% and 95%, respectively.

Results

The study comprised participants who had elective surgery on their upper limbs. The demographic characteristics of the two groups were comparable. Additionally, it was discovered that the length of operation and the location of surgeries were comparable, and statistical significance was not observed. No skewed distribution was noted, and all of the data obtained demonstrated a normal distribution. (Table 1)

Group I's block performance took less time (9.40±2.34 min) than Group II's (10.9±83.47) ($P = 0.02$) (Table 2). The success rate was essentially the same between the two groups ($P > 0.05$). One patient in Group II had more than two nerves preserved, and general anaesthesia was given. These four patients' data were not collected for

additional sensory and motor blockade analyses. In contrast to Group II, Group I had a higher satisfaction rating. But patient satisfaction showed no statistically significant difference. (P>0.05). The sensory blocking was discovered to be statistically significant (P 0.05) and occurred earlier in I Group than II Group. In Group I, motor blockade began more quickly than in Group II, although this difference was not statistically significant.

The amount of time it took for patients to get ready for surgery was not statistically different. During the procedure, the vital signs of heart rate, blood pressure, and oxygen saturation were comparable between the two groups, and there was no statistically significant difference between them. One patient in Group S required the installation of an intercostal drain due to a pneumothorax, and the patient made a full recovery. Compared to none in Group I, four patients in Group II experienced Horner's syndrome. All three instances were handled cautiously and with assurance, and they made a full recovery in under 24 hours. Despite the fact that Group II reported higher issues, they were not statistically significant. (P >0.05).

Discussion

This study evaluated supraclavicular and infraclavicular blocks carried out using ultrasound-guided neurostimulation. It was prospective, randomised, and observer-blinded. Two aliquots of ropivacaine were injected into the brachial plexus sheath at two different places to achieve the supraclavicular block. [5]

Infraclavicular blocks performed their blocks faster than supraclavicular blocks. The needle was targeted at two places in the supraclavicular block, whereas the local anaesthetic was only applied to one point in the infraclavicular block, which may account for the extra time required. One study found a mean block performance time of 5.6 minutes for the supraclavicular group and 5.1 minutes for the infraclavicular group. In terms of safety and efficacy, Chin et al.'s [6] analysis of several brachial plexus surgical procedures employing an infraclavicular approach. They came to the conclusion that infraclavicular block is easy to learn and use, and it effectively delivers anaesthetic for forearm procedures. Desroches et al.'s study [7] came to the conclusion that the infraclavicular technique to brachial plexus block produces substantial sensory blockade for complete anaesthesia for forearm procedures and has good tolerance to arm tourniquet. One study found a success rate of 93% in the infraclavicular group and only 78% in the supraclavicular block under ultrasound guidance. [8] The infraclavicular group started experiencing sensory and motor blockage a little bit earlier. They found that after studying the sensory block of all seven terminal nerves caused by brachial plexus block, supraclavicular block considerably worsened the block of the median and ulnar nerves while improving the block of the axillary nerve. [8]

In the past, brachial plexus surgery under good anaesthesia was accomplished using the supraclavicular route. The supraclavicular approach to the brachial plexus has various advantages over the axillary block, most notably a quicker onset of a dense block with a single injection and less local anaesthesia. [9] However, due to the possibility of inducing a pneumothorax, many anaesthetists avoid employing this approach.

Pneumothorax and ipsilateral diaphragmatic paresis each occurred in one patient in the supraclavicular group in the current trial, but not in the infraclavicular group. The subclavian perivascular and plumb-bob methods were created in part to lower the possibility of pneumothorax. When using the supine plumb-bob approach, the incidence of pneumothorax in tall, thin individuals may be further decreased by first aiming the needle 45 degrees cephalad rather than straight down. Four patients in the supraclavicular group developed Horner's syndrome, and all four patients received conservative management. 20% of patients with supraclavicular block were found to have Horner's syndrome and diaphragmatic paresis in one research. [8] When using more sensitive means of measurement, such as ultrasound, plethysmography, and pulmonary function tests, a 50% incidence of diaphragmatic paresis has been documented in supraclavicular block. In our study, supraclavicular block had a three times higher risk of vascular puncture. In other investigations, the incidence of vascular punctures was observed to range from 2% to 2.5%. [7-9]

The study's limitation was that, despite the fact that all the results favoured infraclavicular block, we were unable to detect a statistically significant difference between the complication rate and surgical preparedness. A considerably larger sample size may be required to detect a statistical difference.

Conclusion

Infraclavicular block was performed faster using the ultrasound-guided neurostimulation approach than supraclavicular block. The infraclavicular technique may be preferred for surgery on the hand, forearm, or elbow, according to these findings. To contrast the supraclavicular block with the infraclavicular block utilising neurostimulation, additional large-scale investigations will be required.

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