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Original Research Paper

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A COMPARATIVE STUDY OF ULTRASOUND GUIDED SUPRACLAVICULAR AND INFRACLAVICULAR BLOCKS FOR UPPER EXTREMITY SURGERIES

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ABSTRACT

Background: Regional anaesthesia has many benefits over general anaesthesia, including keeping the patient conscious during surgery, improving haemodynamic stability, providing excellent postoperative analgesia, and allowing for faster oral consumption after surgery. These benefits accrue to the anaesthesiologist, surgeon, and patient. While the axillary technique requires a separate block of the musculocutaneous nerve, a brachial plexus block at the level of the clavicle may anaesthetise all four distal upper extremity nerve regions simultaneously. **Aim And Objectives:** The aim of the research was to evaluate and compare the impact of supraclavicular and infraclavicular brachial plexus blocks in terms of the duration of onset, performance, and success rate of the block. **Materials And Methods:** A total of Fifty patients who were scheduled for below-elbow upper limb procedures were randomly assigned to two groups: (1) infraclavicular (Group IC) and (2) supraclavicular (Group SC). Each subject was administered 30ml of 0.5% bupivacaine as the selected local anaesthetic. Observations were made about the block performance time, the time it took for the beginning of sensory and motor blockade, the overall length of the block, and the haemodynamic parameters. The major goals of the study were the performance times of the block and the commencement of the sensory blockade. The secondary outcomes were the length of the block and the haemodynamic parameters. Two two-tailed independent sample t-test was used to compare the variables. **Result:** Mean Block Performance Time (mins) was 15.34 was longer in infraclavicular block than among Supraclavicular block group (11.23). Mean Onset of sensory block (minutes) in Supraclavicular block group was 18.65 longer than in infraclavicular block (13.98). there was a statistically significant difference between two groups in regards to Block performance time and onset and Duration of Sensory block. (p value <0.0001). **Conclusion:** The ultrasound-guided infraclavicular block is a comparatively safer approach than the supraclavicular technique, and it has a speedier onset. Repeated exposure to the procedure may decrease the time required to apply the infraclavicular block.

KEYWORDS : Regional Anaesthesia, Supraclavicular Block, Infraclavicular Block

INTRODUCTION:

Administering comprehensive surgical anaesthesia to the upper extremity using regional block methods is a difficult task. While ultrasound (US)-guided supraclavicular and infraclavicular blocks are often used for upper extremity surgery, patients with short and broad necks have a greater incidence of Horner's syndrome and imaging challenges during US-guided supraclavicular blocks.[1-4] Several investigations have shown that the infraclavicular block has a more rapid start, superior surgical efficacy, and a lower incidence of adverse events when compared to the supraclavicular approach. Performing this approach in trauma patients may be challenging and may lead to partial blockage of the radial nerve.[5,6]

Ultrasonography has made peripheral nerve blocks for regional anaesthesia less difficult. Ultrasound-guided regional anaesthesia (UGRA) provides live imaging of anatomical structures in relation to nerve bundles. With the use of echogenic needles, the tip of the needle and the spread of the drug can be easily seen.[7-9] This makes UGRA a preferred technique over traditional methods. We hypothesised that using the infraclavicular method for brachial plexus block would result in a faster and comparatively safer procedure compared to the supraclavicular approach.[10] Furthermore, we anticipated that performing the block under ultrasound guidance would lead to fewer problems.

OBJECTIVES:

- To compare Block Performance time of supraclavicular and infraclavicular brachial plexus blocks.
- To Compare Onset and duration of sensory and motor clock of supraclavicular and infraclavicular brachial plexus blocks.

MATERIALS AND METHODS:

Study Design: A prospective Randomised Control study

Study Settings: Department of Anaesthesia of tertiary care hospital

Study Population: All Patients who underwent elective below elbow upper limb surgeries were enrolled in the study.

Study Period: 1 year (Feb 2023 to Feb 2024)

Sample Size: During the period of study a total of 50 patients who satisfied inclusion and exclusion criteria were included in the study.

Inclusion Criteria:

- Patients aged 18 to 65 years who underwent elective below elbow upper limb surgeries were enrolled in the study.
- ASA 1 and 2

Exclusion Criteria:

Patients who had contraindications to regional anaesthesia, pregnant females, and informed consent not given were excluded.

Upon receiving permission, the primary investigator informed the attending anaesthesiologist about the method of brachial plexus block, depending on the randomisation sequence. Patients in Group IC were administered an infraclavicular block, whereas those in Group SC got a supraclavicular block. Both groups were administered 30ml of 0.5% bupivacaine as the local anaesthetic for brachial plexus block.

All research participants were administered premedication and had to fast for a duration of eight hours in accordance with the institutional anaesthesia procedure. The patients were transferred to the operating room and standard monitors, such as ECG, peripheral oxygen saturation (SPO2), and non-invasive blood pressure (NIBP), were connected to them according to the basic monitoring guidelines specified

by the American Society of Anaesthesiologists (ASA). A skilled anaesthesiologist gave the brachial plexus blocks using a linear ultrasound probe (SonoSite® 7-12 MHz linear array transducer; Fujifilm, Bothell, Washington, United States). The supraclavicular brachial plexus block included positioning the ultrasound probe in the frontal plane above the collarbone to provide a short axis view of the subclavian artery. The needle was thereafter moved forward in a straight line, using direct observation from the side, until the needle's tip was positioned in closer proximity to the subclavian artery.
The duration and intensity of sensory and motor block were evaluated at five-minute intervals for a total of 30 minutes until full blockage was attained. If a patient still experienced discomfort and did not attain full sensory blocking even after 30 minutes, it was considered a failure of the block. If just one nerve was left unaffected, a rescue block was administered at the appropriate level. If many nerves were spared, it was decided that general anaesthesia would be provided. Sensory block was evaluated by assessing the response to a pinprick. The specific sites innervated by the median, radial, ulnar, musculocutaneous, and medial cutaneous nerves of the forearm were evaluated and recorded. The sensory block was assessed using the scoring method derived from Koscielniak-Nielsen et al, where a score of 0 represents acute pain, a score of 1 indicates touch feeling only, and a score of 2 indicates no sensation. The commencement of sensory blockage was determined when a score of 2 was reached.

The motor blockage was evaluated concurrently using the modified Lovett scale in four specific nerve regions: radial nerve for thumb abduction, ulnar nerve for thumb adduction, median nerve for thumb opposition, and musculocutaneous nerve for elbow flexion. The moment at which the automobile blockage began and the time at which regular mobility resumed were recorded. The duration of the motor blockade was measured from the beginning of the blockage until regular mobility was restored. The duration between the placement of an ultrasonic probe and the extraction of the needle after the administration of the local anaesthetic was recorded as the block performance time. The time when the patient had no sensation to pinprick was recorded as the duration of total sensory blockage. The time when there was no movement of the upper limb below the elbow was recorded as the duration of full motor blockade.

Data Analysis:
The data collected was entered in Microsoft Excel 2019 Spreadsheet and analyzed using IBM SPSS 21.0 version. The data on categorical variables was presented as frequency and percentages and the data of continuous variables was presented as mean and standard deviation. The comparison of the distribution of continuous variables was done using the student T-test. P value less than 0.05 was considered statistically significant. The data was analyzed and interpreted. Charts like bar diagram, pie chart was depicted wherever necessarily.

RESULTS:
Among infraclavicular block group, 12(48%) were aged 46 to 65 years, 8(32%) were aged 31 to 45 years and 5(20%) were aged 18 to 30 years.16(64%) were males and 9(36%) were females. Among Supraclavicular block group, 10(40%) were aged 46 to 65 years, 9(36%) were aged 31 to 45 years and 6(24%) were aged 18 to 30 years.13(52%) were males and 12(48%) were females. There was no significant difference between two groups in regards to Age and Gender.

Among infraclavicular block group, Mean Block Performance Time (mins) was 15.34 with a SD of 1.98, Mean Onset of sensory block (minutes) was 13.98 with a SD of 2.98, Mean Duration of sensory block (min) was 657.54 with a SD of 68.5, Mean Onset of motor block (minutes) was 19.4 with a SD of 2.57, Mean Duration of motor block (minutes) was 547.56 with a SD of 49.87.

Among Supraclavicular block group, Mean Block Performance Time (mins) was 11.23 with a SD of 1.68, Mean Onset of sensory block (minutes) was 18.65 with a SD of 3.21, Mean Duration of sensory block (min) was 579.32 with a SD of 66.87, Mean Onset of motor block (minutes) was 19.7 with a SD of 2.43, Mean Duration of motor block (minutes) was 551.34 with a SD of 52.76.

There was a statistically significant difference between two groups in regards to Block performance time and onset and Duration of Sensory block. (p value <0.0001) and there was no statistically significant difference between two groups in regards to onset and Duration of Motor block.

DISCUSSION:
The block performance time of the supraclavicular block was shorter in comparison to the infraclavicular block. In contrast to the research done by Abhinaya RJ et al[11], Nielsen ZJ et al[12], and Gurkan Y et al[13], this data indicates that the time taken to accomplish the block was shorter for the infraclavicular block compared to the supraclavicular block. Nevertheless, a research done by Sarkar S et al[14] yielded comparable results to our own investigation.

The initiation of motor block was comparable in both groups, whereas the initiation of sensory blockade occurred sooner in the infraclavicular block (13.98 vs 18.65 minutes) compared to the supraclavicular block, and this difference was determined to be statistically significant ($p<0.0001$). Abhinaya RJ et al[11] and Nielsen ZJ et al[12] did a research that produced the same data, showing that the sensory blockade start was quicker in the infraclavicular block.

In the architecture of the upper limb's nervous system, the neurones that provide innervation to the furthest section of the upper limb are situated more centrally inside the nerve, as opposed to the nerves that supply the closer parts. In the brachial plexus anatomy, the block level in the supraclavicular approach is rather high. As a result, there is a delay in the spread of local anaesthetic to the neurones that feed the area below the elbow. The findings were comparable to the research conducted by Yang et al. Nevertheless, there was no disparity in the length of the blockade, including both motor and sensory blockade, which aligns with the findings of previous investigations done by Abhinaya RJ et al[11], Satani TR et al[15], Bharti N et al[16], and Roussel J et al[17].

The study's main benefit is that, as far as we know, it is the first of its sort in this region to use adequate randomisation of participants, thereby minimising the potential for selection bias. The research is limited by the small sample size. Increasing the sample size would have enhanced the statistical power of the research, hence strengthening its findings. However, due to time limitations, it was not feasible to get a bigger sample.

CONCLUSION:
Assisted by ultrasound imaging the infraclavicular block is a comparatively safer method for anaesthetising upper limb procedures. The progression of motor and sensory inhibition was superior in the infraclavicular block as opposed to the supraclavicular block. The duration of the supraclavicular approach for the brachial plexus block was shorter compared to the infraclavicular method for the same block. To avoid the temporal delay that occurs during the administration of the infraclavicular block, one may regularly use the infraclavicular method of brachial plexus block for procedures involving the upper limb.

Tables And Figures
Table 1: Frequency Distribution Of Study Participants

According To Sociodemographic Variables

Variable		Type of Block		P value
		Infraclavicular Block	Supraclavicular Block	
Age (Years)	18- 30	5(20%)	6(24%)	0.847
	31-45	8(32%)	9(36%)	
	46-65	12(48%)	10(40%)	
Gender	Male	16(64%)	13(52%)	0.39
	Female	9(36%)	12(48%)	

P Value <0.05 Is Considered Statistically Significant

Table 2: Distribution Of Various Block Parameters Among Infraclavicular Block Group And Supraclavicular Block Group

Variable		Type of Block		P value
		Infraclavicular Block	Supraclavicular Block	
Block Performance Time (mins)	Mean	15.34	11.23	<0.0001
	SD	1.98	1.68	
Onset of sensory block (minutes)	Mean	13.98	18.65	<0.0001
	SD	2.98	3.21	
Duration of sensory block (min)	Mean	657.54	579.32	0.0002
	SD	68.5	66.87	
Rescue analgesia (minutes)	Mean	657.54	579.32	0.0002
	SD	68.5	66.87	
Onset of motor block (minutes)	Mean	19.4	19.7	0.67
	SD	2.57	2.43	
Duration of motor block (minutes)	Mean	547.56	551.34	0.79
	SD	49.87	52.76	

P value <0.05 is considered statistically significant

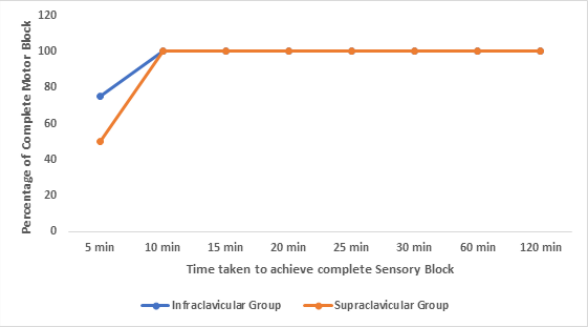

Figure 1: Distribution Of Time Taken To Achieve Complete Motor Block In Four Nerves Between The Groups In Terms Of Proportions

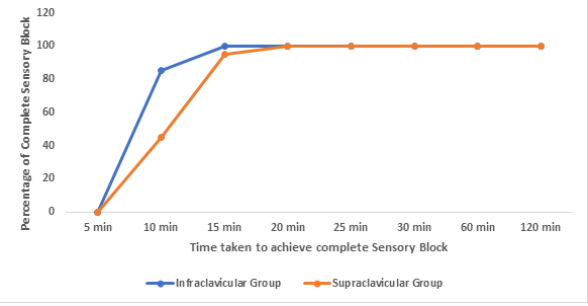

Figure 2: Distribution of Time taken to achieve complete Sensory block in four nerves between the groups in terms of proportions

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