

# A study to compare the effects of supraclavicular perivascular technique and infraclavicular brachial plexus blockade for below elbow surgeries

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## Abstract

**Background:** The brachial plexus provides the motor innervations and nearly all the sensory supply of the upper limb. Supraclavicular block is one of the most widely used techniques of brachial plexus block. At the lateral border of the anterior scalene muscles the brachial plexus passes down between the first rib and clavicle to enter the axilla. **Objective:** To compare the efficacy of supraclavicular perivascular technique and vertical infraclavicular brachial plexus block, using nerve locator for below elbow surgeries. **Materials and Methods:** This is a prospective randomized study conducted at Chengalpattu Medical College and Hospital, Chengalpattu. Eighty patients of ASA grade I or II of either sex undergoing below elbow surgeries (mostly orthopedic and plastic surgeries) were randomly allocated into group S and group I. Each group comprises of 40 patients. Surgery was done under vertical infraclavicular approach of Brachial plexus Block in Group I and under supraclavicular perivascular approach of Brachial plexus block in Group S. **Results:** In our study, the mean age of patients in Group S was 33.52 years and in group I it was 32.88 years. The mean weight of patients in both the groups S and I was 58.1 and 58.62 respectively. The total duration of motor Blockade was found to be 464.1 min in Group S and 452.5 in group I. The post-operative analgesia time was also found to be not significant between the two groups with mean time of 429.49 in group S and 414 in group I. **Conclusion:** From our study it is inferred that nerve locator guided infraclavicular block of brachial plexus is similar to nerve locator guided supraclavicular block in the form of ease of technique, onset and duration of sensory and motor blockade and on complication rate.

**Key Words:** Block, brachial plexus, infraclavicular, perivascular

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Received Date: 13/09/2018 Revised Date: 10/10/2018 Accepted Date: 03/11/2018

DOI: <https://doi.org/10.26611/1015821>

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Accessed Date:  
07 November 2018

## INTRODUCTION

The use of peripheral nerve blockade offers several advantages when compared to general anesthesia or local anesthesia. The patient can remain awake and on

spontaneous respiration, thus protecting himself/herself from aspiration of stomach contents into the lungs. Complications of General anesthesia like malignant hyperthermia, severe post-operative nausea and vomiting, known hypersensitivity to agents and excessive sleepiness can be successfully avoided. In peripheral nerve blockade the affected limb's sympathetic nerves are blocked, leading to vasodilation, which improves blood flow to the affected limb and makes microvascular surgical procedures technically simpler. The block was first performed by William Stewart Halsted in 1889. He directly exposed the brachial plexus in the neck to perform the block and used cocaine. Hirschel first described the percutaneous approach to the brachial plexus.<sup>1</sup> Kulenkampff<sup>2</sup> first described the classical supraclavicular approach to the brachial plexus. The

subclavian perivascular block was first described by Winnie and Collins<sup>3,4</sup>. This approach became popular as it was associated with less incidence of pneumothorax than the Kulenkampff approach. The infraclavicular approach was first developed by Raj an Indian anesthesiologist practicing in USA.<sup>5,6,7</sup> The anaesthetized limb can remain numb for several hours after surgery, providing excellent post-operative pain relief. Deep and superficial structures of the limb are similarly anesthetized, permitting extensive surgical exploration and correction. This is in contrast to locally injected local anesthetics, which tend to numb only superficial structures in the immediate vicinity of the injection. Brachial plexus blockade provides excellent intraoperative anesthesia as well as post-operative analgesia, eliminating the need for post-operative opioids, resulting in quicker recovery, shortened hospital. Supraclavicular block is one of the most widely used techniques of brachial plexus block. At the lateral border of the anterior scalene muscles the brachial plexus passes down between the first rib and clavicle to enter the axilla. The trunks are tightly oriented vertically on top of the first rib just posterior to the subclavian artery. As the plexus is so compact here blockade achieves excellent anesthesia of the entire arm including the hand.

## AIMS AND OBJECTIVE

To compare the efficacy of supraclavicular perivascular technique and vertical infraclavicular brachial plexus block, using nerve locator for below elbow surgeries.

## MATERIALS AND METHODS

This is a prospective randomized study conducted at Chengalpattu Medical College and Hospital, Chengalpattu. Eighty patients of ASA grade I or II of either sex undergoing below elbow surgeries (mostly orthopedic and plastic surgeries) were randomly allocated into group S and group I. Each group comprises of 40 patients. Surgery was done under vertical Infraclavicular approach of Brachial Plexus Block in Group I and under Supraclavicular perivascular approach of Brachial plexus block in Group S.

### Inclusion Criteria

- ASA grade I and II patients of either sex
- Age: 20 – 60 yrs.
- Weight: 50 -70 kg
- Type of surgery: Elective below elbow surgeries (orthopedic and plastic surgeries)

### Exclusion Criteria

- Patient refusal
- Inability to understand the information provided
- Known or anticipated difficult intubation
- Impaired coagulopathy
- Coexisting lung, heart, liver, or kidney disease
- Pregnancy
- Allergy to local anesthetics
- Chest deformities
- Previous clavicle fractures, neurological disorders.

The patients were randomly allocated into two groups – Group S and Group I. All the patients will be premeditated with Tab. Midazolam 7.5mg orally one hour prior to surgery with sips of water. Patients monitored with minimum standards of monitoring. an IV line was secured and Inj.fentanyl 2 microgram/kg iv given to the patient on the table 5 mins prior to giving the block. Nerve plexus will be identified using the nerve stimulator. Surgery will be allowed to start 20 mins after giving the drug.

**Drugs and Equipment:** In Group I (vertical infraclavicular brachial plexus block) 15ml of 2% lignocaine with adrenaline 1 in 2,00,000(5mic/ml) and 15ml of 0.5% bupivacaine. In Group S (supraclavicular perivascular brachial plexus block) 15ml of 2% lignocaine with adrenaline 1 in 2,00,000 (5mic/ml) and 15ml of 0.5% bupivacaine.

**Infraclavicular Block:** The block was performed with the patient lying in supine position with the upper arm to be blocked along the side, but with the elbow flexed and the hand resting on the lower chest or abdomen. After identifying the landmarks, the puncture site was marked half way between the jugular notch and the most ventral part of the acromion, as previously described by yang *et al.*

**Supraclavicular Block:** Patient was placed in supine position with head turned 30° to the opposite side to be injected. The arms were placed at the patient's side with hands pointing towards the knee. The interscalene groove and subclavian pulsations were marked. The pulsation of the subclavian artery against the palpating finger was used as a guide and the stimulating needle was inserted just above the palpating finger (i.e. the inferior most point of interscalene groove) and advanced in a direction which is directly caudal running parallel to sagittal axis. The needle was advanced behind the palpating finger until a motor response below elbow or hand is obtained.

## RESULTS

A total of 80 subjects were analyzed, 40 in group I and 40 in Group S.

**Table 1: Profile of Study Participants**

Profile	Group S		Group I		P value	
	N	%	N	%		
Age group	20-30 Years	20	50	19	47.5	Chi sq. = 3.76; p = 0.28
	-31-40 Years	12	30	13	32.5	
	41-50 Years	5	12.5	8	20	
	>51 Years	3	7.5	0	0	
Gender	Male	27	67.5	26	65	Chi sq. = 0.06; p = 0.8
	Female	13	32.5	14	35	
Weight ( Mean $\pm$ SD)		58.1 $\pm$ 5.47		58.62 $\pm$ 5.27		P=0.66

In our study, the mean age of patients in Group S was 33.52 years and in group I it was 32.88 years. The age of the patients was found to be statistically not significant between the two groups. The male was found to be more in number in both the groups and the association of

Gender was not significant between the groups. The mean weight of patients in both the groups S and I was 58.1 and 58.62 respectively and association was found to be statistically not significant.

**Table 2: Comparison of Surgical Parameters between the both the groups**

	Group S		Group I		P value
	Mean	SD	Mean	SD	
Duration of Surgery ( mins)	127.75	33.24	124.25	30.03	0.6
Time to Perform Block( mins)	4.35	0.89	4.15	0.8	0.29
Time for onset of Motor Blockade( mins)	4.21	0.86	4.05	0.74	0.39
Time for onset of Sensory Blockade( mins)	8.74	1.45	8.45	1.52	0.38
Duration of Motor Blockade time ( mins)	464.1	38.44	452.5	40.11	0.193
Post-Operative Analgesia time ( mins)	429.49	35.02	414	36.71	0.06

The Mean duration of Surgery in group S was 127.75mins, and the standard deviation of 33.24, and in Group-I meanduration of surgery was 124.25mins, and the standard deviation of 30.03. p value was found to be statistically insignificant. In the group S the mean time to perform Block was 4.35, and the standard deviation of 0.89, and in Group-I was 4.15min, and the standard deviation of 0.8. The 'value was not significant. The Mean time of onset of Motor Blockade was seen in Group S was 4.21min and the standard deviation was 0.86 and in Group-I the mean time was 4.05 and the standard deviation of 0.749 min with P value being insignificant between the groups. The Mean time of onset of Sensory Blockade was seen in Group S was 8.74min and the standard deviation was 1.45 and in Group-I the mean time was 8.45 and the standard deviation of 1.52 min with P value being insignificant between the groups. The total duration of motor Blockade was found to be 464.1 min in Group S and 452.5 in group I and the association was not significant. The post-operative analgesia time was also found to be not significant between the two groups with mean time of 429.49 in group S and 414 in group I. Quality of block, that is involvement of four terminal nerves: In Group-S, 3 out of four nerves were blocked in 2 patients (5 %), all four nerves were blocked in 37

patients (92.5 %) and complete failure in 1(2.5%) patient. In group I 3 out of four nerves were blocked in 2 patients (5 %) and all four nerves were blocked in 38 patients (95%). Applying Chi square tests, it was found to be statistically insignificant. The 'p' value of 0.6 was statistically insignificant. The number of vessel punctures in Group S was 3(6.7%) and there were no vessel punctures in Group I (0%). There were 2 cases of Horner's syndrome in group S and no such complication in group I. Though seemingly significant clinically, applying Chi square tests, the 'p' value was 0.06 which is statistically insignificant. No other complications were noted in either group. P value insignificant.

## DISCUSSION

In our study, the supraclavicular and infraclavicular approach to the brachial plexus block using neurostimulation was compared; it was found that the two approaches did not show any significant differences. The age, Gender, weight of the Patients and Duration of Surgery was found to be non-Significant in our study. Time to perform block in Group-S ranges from minimum of 3 minutes to the maximum of 7 minutes, with the mean of 4.35, and the standard deviation of 0.89, In Group-I, the time to perform the block ranges from 3min, to the

maximum of 6min, with the mean of 4.15min, and the standard deviation of 0.8, with a p value of 0.29, which is not significant. ( $p > 0.05$ )- Comparable with the study of Genevieve Arcand, Stephen Williams, *et al*<sup>8</sup>. Mean onset of sensory block in Group S was 8.74 min mean and in Group I it was 8.45min. The difference between the two groups was statistically not significant with a p value of 0.38 ( $p > 0.05$ ), again comparable with the study of Genevieve Arcand, Stephen Williams, *et al*.<sup>8</sup> The mean duration of post-operative analgesia till the requirement of first dose of post op analgesia in Group S was 429.49 mins and in Group I it was 414 minutes. The difference between the two groups was not statistically significant with a p value of 0.06 ( $p > 0.05$ ). Thus the quality of blockade was not statistically significant between the two groups which is comparable with the study of Yang, *et al*.<sup>9</sup> Satisfactory block, that is involvement of four terminal nerves. In Group-S, 3 out of four nerves were blocked in 2 patients (5 %), all four nerves were blocked in 37 patients (92.5 %) and complete failure in 1(2.5%) patient. In Group I 3 out of four nerves was blocked in 2 patients (5 %) and all four nerves were blocked in 38 patients (95 %). One patient in Group S underwent general anesthesia. Applying Chi square tests, it was found to be statistically insignificant. ('p' vaule 0.6)- similar to study of Chun Woo Yang *et al*<sup>9</sup> in which in Group S complete failure is 2%, unsatisfactory block is 12% and satisfactory block is 86%. In Group I unsatisfactory block is 12% and satisfactory block is 88%. The increased incidence of sparing can be explained by the fact that although the cords of the brachial plexus are compactly arranged around the axillary artery, the posterior cord is deeper from the point of needle entry which may explain the sparing of the radial nerve in the infraclavicular group.

## CONCLUSION

From our study it is inferred that nerve locator guided Infraclavicular block of brachial plexus is similar to nerve locator guided supraclavicular block in the form of ease of technique, onset and duration of sensory and motor blockade and on complication rate.

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Source of Support: None Declared  
Conflict of Interest: None Declared