ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

Original Research Article

Efficacy of Infraclavicular Brachial Plexus Block Versus Supraclavicular Brachial Plexus Block By Using Ultrasound Guided Nerve Stimulation Technique for Elective Upper Limb Surgeries a Randomised Controlled Trial

Dr. Megha Tajne[1], Dr. Priyanka Shinde[2], Dr. Prachi Wankhade[3], Dr. Shrikant Perka[4]

[1]Professor & HOD, Department of Anesthesia, GMC and Trauma care Center, Nagpur, Maharashtra, India.
[2]Senior Resident, Department of Anesthesia, GMC and Trauma care Center, Nagpur, Maharashtra, India.
[3]Assistant Professor, Department of Anesthesia, GMC and Trauma care Center, Nagpur, Maharashtra, India.
[4]Assistant Professor, Department of Plastic Surgery, GMC and Trauma care Center, Nagpur, Maharashtra, India.

Corresponding Author
Dr. Shrikant Perka, Assistant Professor, Department of Plastic Surgery, GMC and Trauma care Center, Nagpur, Maharashtra, India.

ABSTRACT

Background
The supraclavicular and infraclavicular brachial plexus blocks have a similar distribution of anaesthesia, and both can be used effectively for surgeries of the upper limb. The present study aimed to **c**ompare the efficacy of Infraclavicular brachial plexus block and supraclavicular brachial plexus block by using ultrasound guided nerve stimulation technique in elective upper limb surgeries.

Method
A total 40 patients of both sexes and ASA 1 and 2 grades, were undergoing elective upper limb surgeries were enrolled and divided into two groups of 20 patients each. Group I- Patients had infraclavicular block with Inj. ropivacaine 0.5% 15 ml and Inj 2% lignocaine with adrenaline 15 ml using an ultrasonographyguided peripheral nerve stimulator. Group S- Patients had a supraclavicular block with Inj ropivacaine 0.5 % 15 ml and Inj 2 % lignocaine with adrenaline 15 ml using an ultrasonography-guided peripheral nerve stimulator.

Results
Group S took less time to complete a block (9.45±2.982 minutes) than group I (11.15±2.09 minutes), (p=0.07). Onset of sensory and motor block was early in group I as compared to group S with statistically significant difference, (p<0.001). Time to achieve sensory and motor block was significantly longer in group I than group S, (p=0.001). Supraclavicular block required fewer needle pricks (1.45±0.945min), but infraclavicular block required (1.85±0.587min) needle pricks, (p=0.01). Group I had a higher success rate of block (85%) than S group (80%), which was not significant.

Conclusion

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

Both the techniques were safe to perform without any complications. Ultimately the technique to be used depends upon the availability of the instruments, choice of the anaesthetist, understanding and co-operation of the patient.

Keywords: Supraclavicular; Infraclavicular; Brachial plexus blocks; Anaesthesia; Ultrasound; Upper limb surgeries

INTRODUCTION

Brachial plexus block is increasingly being used as the primary mode of anaesthesia for surgical procedures on the upper limb distal to the mid arm. The various approaches to brachial plexus block are interscalene, supraclavicular, infraclavicular and axillary [1]. As we know for upper limb surgeries, supraclavicular or infraclavicular blocks are used, but preferably anaesthesiologists oftenly prefer supraclavicular block over infraclavicular block because of its anatomical location and difficulty in techniques and also blind approach to infraclavicular blocks leading to complications. Both blocks have same distributions of anesthesia [2].

Due to recent invention in use of ultrasonography technique in anaesthesia practice peripheral nerve blocks are easily given due to benefits of direct visualisation of nerves and sonoanatomy, also we are going observe tip of needle till local anaetshestics spread around the plexus. By the use of peripheral nerve stimulator along with ultrasound are responsible for increasing success rate of blocks. Because it gives anaesthetic and analgesia below the shoulder, the supraclavicular block is a magnificent choice for forearm surgery [3]. However, the supraclavicular brachial plexus block is known as -upper limb spinal anaesthesia‖ because of safe, fast acting procedure that provides reliable anaesthetic for upper limb surgery. Supraclavicular technique produces block with a quick start [4].

In all patients an infraclavicular approach should be possible. This has its own advantages than supraclavicular and axillary approach. The infraclavicular block is advantageous because in this approach we are targeting individual cords. Trauma to vital blood vessels and nerves and pleural puncture risk is less in this group [3]. However, problems such as pleural puncture, pneumothorax, nerve palsies are more common with supraclavicular than infraclavicular block [3, 5]. Hence present study proposes comparison of efficacy of infraclavicular and supraclavicular block using ultrasound guided nerve stimulation technique in elective upper limb surgeries.

MATERIALS AND METHODS

After obtaining Institutional Ethical Committee approval and written informed consent from all the patients, this randomised controlled double-blind trial was conducted in the Department of Anaesthesia at Tertiary health care center during a period of 2 years from November 2019 to October 2021. Original sample size was 80 but due to covid restrictions sample collected was 40. Hence a total 40 patients of both sexes and ASA 1 and 2 grades, were undergoing elective upper limb surgeries were enrolled and divided into two groups of 20 patients each. Group I- Patients had infraclavicular block with Inj. ropivacaine 0.5% 15 ml and Inj 2% lignocaine with adrenaline 15 ml using an ultrasonographyguided peripheral nerve stimulator. Group S- Patients had a supraclavicular block with Inj ropivacaine 0.5 % 15 ml and Inj 2 % lignocaine with adrenaline 15 ml using an ultrasonography-guided peripheral nerve stimulator.

Operational Definitions

Block performance time

The duration of time from placement of the ultrasound probe on the skin to needle removal.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

Block success is defined as diminished sensation to pinprick in each of the radial, ulnar, median, and musculocutaneous nerve distributions when measured 20 min after block performance.

Onset of sensory block
The time from the removal of block needle to loss of pin prick sensation (2 on the three-point score)
Onset of motor block
The time from the removal of block needle to reduced power (2 on the three-point score).
Rescue analgesia
Administration of a pre-decided systemic analgesic to supplement the block.
Readiness for surgery
No requirement for supplemental nerve block, skin infiltration, or general anaesthesia.
Motor deficit
Partial or total loss of function of the limb
Need of supplemental nerve block
Requirement of another nerve block to supplement the parent block for the execution of surgery.
Failure of block
Block not achieved more than 30 min or more than one nerves are spared [3].
Hypotension
Systolic blood pressure less than 90 millimeters of mercury or diastolic blood pressure less than 60 millimeters of mercury [6].
Hypertension
Rise in systolic blood pressure more than 20% of baseline [7]
Vascular puncture
Continuous aspiration of blood in the syringe after insertion of needle for block [1].
Pneumothorax
Abnormal collection of air or any gas in the space between the lung and the chest wall leading to collapse of the lung [8].
Phrenic nerve palsy
Phrenic nerve is the primary motor supply to diaphragm, damage to which presents as unexplained shortness of breath, recurrent pneumonia, anxiety, insomnia, morning headache, daytime somnolence, orthopnea, fatigue, and difficulty weaning from mechanical ventilation. Diagnostic tools are Ultrasound, Electromyography or Fluroscopy [9].
Horner's Syndrome
Combination of symptoms arising due to damage of cervical sympathetic chain characterised by miosis partial ptosis, anhidrosis, enophthalmos and loss of ciliospinal reflex [10].

RESULTS

A total 40 patients of both sexes and ASA grade 1 and 2, who were undergoing elective upper limb surgeries were enrolled and divided into two groups of 20 patients each. Both the groups were comparable and found no significant difference with respect to demographic profile of the patients as shown in table 1.

Demographic data	Group I	Group S	P value
Mean age (years)	28.6±10.68	29.1±10.64	0.45
Weight (kgs)	64.95±5.81	66.0±7.77	0.62

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

Height (cm)		168.25±5.49	166.25±4.19	0.95
BMI Kg/cm^2		23.2±2.23	23.99±2.63	0.58
Gender	Female	02	03	0.66
	Male	18	17	
ASA PS	1	16	19	0.34
	2	04	01	

Table 1: Demographic profile of the patients

Group S took less time to complete a block than group I, but statistically not significant difference, (p = 0.07). Onset of sensory and motor block was early in group I as compared to group S with statistically significant difference, (p<0.001). Time to achieve sensory and motor block was significantly longer in group I than group S with p value of 0.001. Supraclavicular block required fewer needle pricks (1.45±0.945min), but infraclavicular block required (1.85±0.587 min) needle pricks, difference was statistically significant, (p=0.01), (Table 2).

Variables	Group I	Group S	P value
Block performance time (min)	11.15±2.09	9.45±2.98	0.07
Onset of motor block (min)	2.25±1.44	4.40±1.53	<0.001
Onset of sensory block (min)	2.10±0.78	3.25±0.91	<0.001
Time to achieve sensory block (min)	12.50±2.56	8.70±2.08	<0.001
Time to achieve motor block (min)	16.05±3.62	11.45±2.28	<0.001
No of pricks	1.85±0.58	1.45±0.94	0.01

Table 2: Comparison of block characteristics

In total, 20 patients were studied in each group, with 3 patients in I group requiring additional blocks. The patient in S group 4 required additional block. These were equivalent in both groups (p-0.5) and not statistically significant.

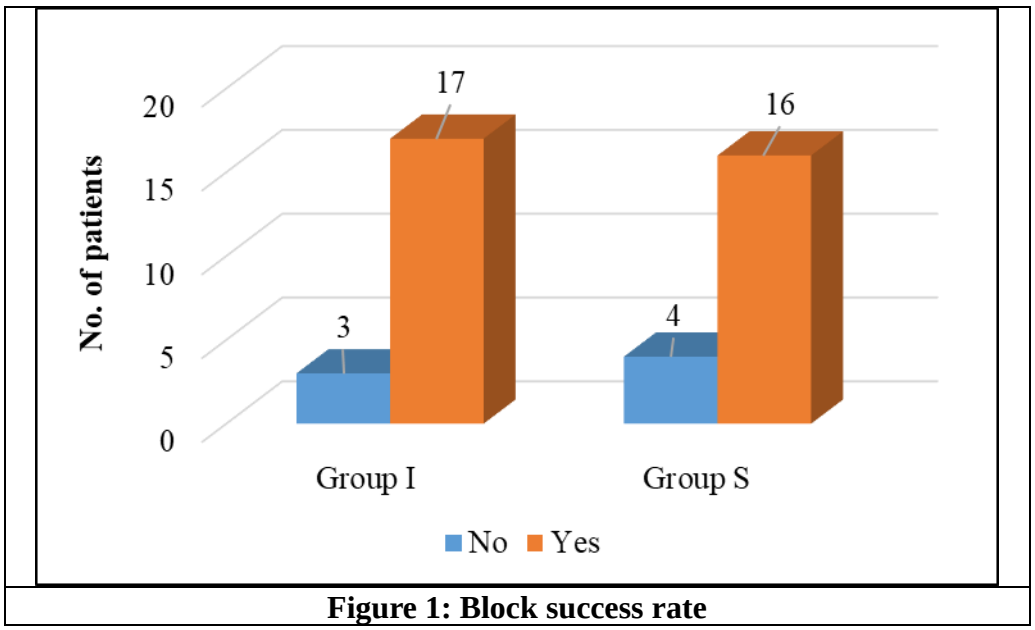

Figure 1: Block success rate

Throughout the study, haemodynamic measures such as SBP, DBP, RR and SPO2 were equivalent in both groups, (Figure 2). There were no problems at the injection site, such as vascular puncture, pneumothorax, nerve palsies, hematomaformation.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

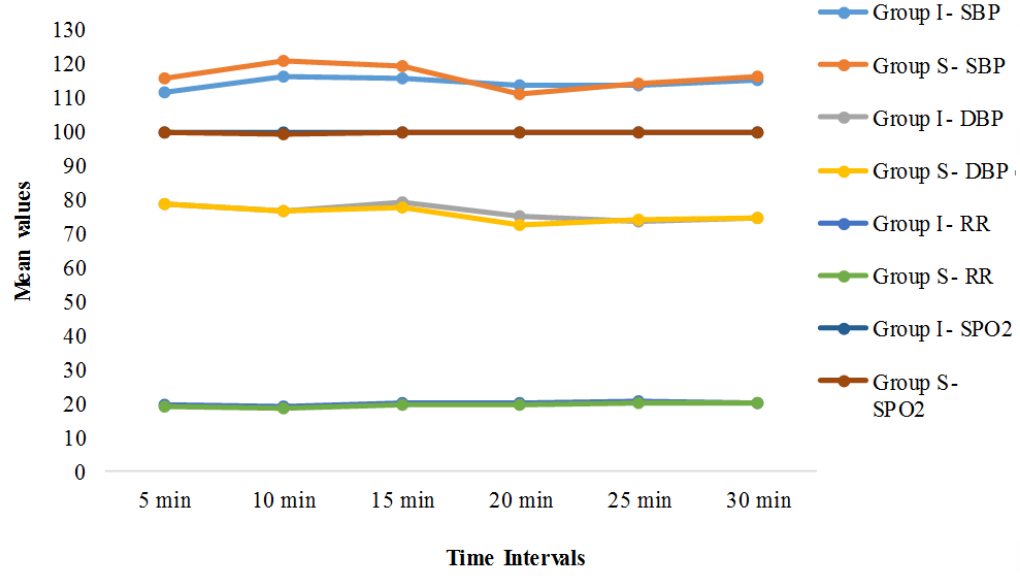

Figure 2: Haemodynamic parameters

The infraclavicular group had a higher mean number of attempts (pricks) than the supraclavicular group with statistically significant difference (p-value = 0.01), (Table 3).

No. of pricks	Group I	Group S	Total	P value
1	05	14	19	0.01
2	13	05	18	
3	02	00	02	
5	00	01	01	

Table 3: Comparison of no of pricks between two groups

DISCUSSION

Upper extremity surgeries are very common, and regional anaesthesia provides dual advantages of avoiding general anaesthesia and its complications, and providing excellent postoperative pain relief [11, 12]. Use of ultrasound guidance in performing brachial plexus blocks has increased the success rate and safety of this procedure. In the present study, Group I had a longer block performance time than S group it was statistically not significant difference. It could be due to variables including unfamiliarity with the procedure and lack of experience doing infraclavicular brachial plexus blocks. Furthermore, our institution did not use the infraclavicular brachial plexus block on a regular basis. However, as the trial went, Group I's block performance time improved. Except for Abhinaya RJ et al [3].

Between the two groups, there was a statistically significant difference in the start of sensory and motor block. Sensory block onset was 2.10±0.78 min in I group and 3.25±0.91 min in Group S. (P =0.001), was statistically significant difference. Motor block onset was reduced in Group I (2.25±1.46 min) than in S group (4.40±1.5 min) where difference was statistically significant. (p=<0.001). These findings are similar to those of Sarkar et al [1] and Abhinaya RJ et al [3] but not to those of Bharati et al [13] which may be due to differences in technique and local anaesthetics utilised. While the time to achieve sensory block was 12.05±2.65 minutes in I group and 8.70±2.08 minutes in Group S (p=0.001.) time needed for motor blockade was 16.05±3.620 minutes in I group and 11.45±2.282 minutes in Group S (p=0.001). The two parameters less in I group than the S group, however statistically

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

significant difference seen. In the I group, 3 patient had to be given supplemental block and in S group 4 patients were given supplemental block. Our block success rate in group I was 85% and in group S it was 80% findings are co relating with Abhinaya RJ et al [3] and Bharti et al [13].

The mean number of needle pricks needed for performing supraclavicular block was less (1.45± 0.945) while it was 1.85±0.587 in infraclavicular block with statistically significant difference (p=0.01). Our investigation, we employed a fixed volume of 30 ml of local anaesthetic for all patients in both groups; however, some studies estimated the amount of local anaesthetic based on body weight. The kind, concentration, and additives used in the local anaesthetic employed for the study also varies, resulting in significant differences in parameters such as sensory and motor block onset. These pharmacological variations, on the other hand, have no effect on the process for conducting the block, hence there is no bias in the block performance time.

After the block, haemodynamic measures such as SBP, DBP, RR and SPO2 were measured every 5 minutes and were comparable in both groups throughout the trial. Patient satisfaction throughout procedure was satisfactory in both the groups. There was no incidence of complications like vascular puncture, pneumothorax, nerve palsies, hematoma formation and infection at the site of injection.

LIMITATION

The present study was conducted on ASA I and II patients with Body Mass Index <35kg /m2 because of these results obtained from our study is not applicable to greater body mass index >35 kg /m2 and ASA 3 & 4.

CONCLUSION

Out of summary we can say the infraclavicular brachial plexus block proceed towards to reliable and total anaesthesia for upper limb surgeries. Infraclavicular block performance time was slightly more than supraclavicular block for forearm surgeries. Infraclavicular block is distinguished by the plexus's compact anatomical distribution, which allows to give single local anaesthetics injection and to decrease risk of pneumothorax. However, it perhaps linked to patient soreness and technical difficulties while doing the procedure. Both the techniques were safe to perform without any complications. At the end, it is worth mentioning that ultimately the technique to be used depends upon the availability of the instruments, choice of the anaesthetist, understanding and co-operation of the patient.

REFERENCES

1. Sarkar S, Doshi SM. A comparative study between supraclavicular brachial plexus block and Infraclavicular brachial plexus block for upper limb orthopedic surgeries: A prospective, randomized, double-blind study. Bali journal of Anesthesiology (BJOA) 2019;3(1):82-87.
2. Williams LM, Singh K, Dua A, et al. Infraclavicular Nerve Block. [Updated 2023 Jan 26]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK537016/
3. Abhinaya RJ, Venkatraman R, Matheswaran P, Sivarajan G.Department of Anaesthesiology, SRM Medical College Hospital and Research Centre, Chennai, Tamil Nadu, India August 4, 2019: 157.33.225.171.
4. Sreelal P, Singam AP, Gantasala BV. Comparison between Supraclavicular and Infraclavicular Brachial Plexus Block in Patients Undergoing Forearm Surgeries. Journal of Evolution of Medical and Dental Sciences. 2020;9(26):1912-6.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

5. Satani TR, Shah SS, Rathod KB, Shandilya N, Barot L. A comparison of infraclavicular and supraclavicular approaches to the brachial plexus. Medical Science. 2013;2(12).
6. Levine DJ,SakoEY,Peters J (2008). Fishman‘s Pulmonary Diseasesand Disorders (4th Edition). McGraw-Hill. P. 1520.
7. Abdelnasser, B. Abdelhamid, A. Elsonbaty, A. Hasanin, and A. Rady, Predicting successful supraclavicular brachial plexus block using pulse oximeter perfusion index A. British Journal of Anaesthesia, 2017;119 (2): 276–280.
8. Thorn GW, Harrison TR. Harrison‘s Principles of Internal Medicine. McGraw-Hill companies. 19th edition. Volume2. Pg1977.
9. Mayo Clinic Staff (May 23,2009). ―Low blood pressure – Definition‖. MayoClinic.Com. Mayo Foundation for Medical Education and Research.
10. Franco CD, Domashevich V, Voronov G, Rafizad AB, Jelev TJ. The supraclavicular block with a nerve stimulator: to decrease or not to decrease, that is the question. Anesth Analg. 2004;98(4):1167-71.
11. Jones MR, Novitch MB, Sen S, Hernandez N, De Haan JB, Budish RA, et al. Upper extremity regional anaesthesia techniques: A comprehensive review for clinical anaesthesiologists. Best Pract Res Clin Anaesthesiol. 2020;34(1):e13-29.
12. Ardon AE, Prasad A, McClain RL, Melton MS, Nielsen KC, Greengrass R. Regional anaesthesia for ambulatory anaesthesiologists. Anaesthesiol Clin. 2019;37(2):265- 87.
13. Bharti N, Bhardawaj N, Wig J. Comparison of ultrasound-guided supraclavicular, infraclavicular and below-C6 interscalene brachial plexus block for upper limb surgery: a randomised, observer-blinded study. Anaesthesia and intensive care. 2015 Jul;43(4):468-72.