Original Research Article

COMPARISON OF SUPRACLAVICULAR VERSUS INFRACLAVICULAR APPROACH TO BRACHIAL PLEXUS BLOCK USING BOTH ULTRASOUND AND NERVE STIMULATOR TECHNIQUE FOR UPPER LIMB SURGERIES

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ABSTRACT

Background: Brachial plexus block is a widely used regional anaesthetic technique for upper limb surgeries. Ultrasound guidance combined with peripheral nerve stimulation improves the accuracy, success rate, and safety of the block. Among the various approaches, supraclavicular and infraclavicular techniques are commonly employed; however, their comparative efficacy remains a subject of interest.
Materials and Methods: This prospective, randomized, double-blinded study. Patients were randomly allocated into two groups: Group S (supraclavicular approach, n=30) and Group I (infraclavicular approach, n=30). Parameters assessed included block performance time, onset of sensory blockade, onset of complete sensory blockade, onset of motor blockade, onset of complete motor blockade, readiness for surgery, time to rescue analgesia, success rate, and complications.
Results: The mean block performance time was significantly shorter in Group I (10.66 ± 2.75 min) compared to Group S (12.48 ± 2.97 min) (p=0.0167). The onset of complete sensory blockade occurred significantly earlier in Group I (6.57 ± 2.48 min) than in Group S (8.42 ± 2.75 min) (p=0.0080). The onset of complete motor blockade was significantly faster in the infraclavicular group (7.59 ± 2.36 min) compared to the supraclavicular group (9.47 ± 3.23 min) (p=0.0126). The time to rescue analgesia was similar in both groups, Readiness for surgery was achieved significantly earlier in Group I (8.52 ± 2.38 min) than in Group S (10.33 ± 3.22 min) (p=0.0162).
Conclusion: Ultrasound-guided neurostimulation-assisted infraclavicular brachial plexus block provides faster block performance, earlier complete blockade, and earlier readiness for surgery with fewer complications compared with the supraclavicular approach. It represents a safe and effective alternative for upper limb surgeries.
Keywords: Brachial Plexus Block, Ultrasonography, Peripheral Nerve Stimulation, Postoperative Analgesia, Nerve Block.

INTRODUCTION

Regional anaesthesia [nerve blocks] are thought to be better than other forms of anaesthesia because they prevent unwanted polypharmacy and its adverse effect, unwanted stressful laryngoscopy and tracheal intubation.[1] It not only provides stable hemodynamic status, but also a prolonged postoperative pain relief, so suitable for patients with cardio pulmonary comorbidities.[1] Brachial plexus block is a better alternative to general anaesthesia for upper limb surgeries.[2] Brachial plexus block is very popular technique also known as “spinal anaesthesia of upper limb”.[2]

Brachial plexus can be approached through interscalene, supraclavicular, infraclavicular and axillary routes.[3] Our aim is to compare rapid, safe and successful approach of brachial plexus block by using both ultrasound and nerve stimulator. Which helps anaesthesiologist (good hemodynamic stability and increase duration of blockade, avoid polypharmacy) and patient in many ways (unwanted intubation, avoid polypharmacy and also better post-operative analgesia).[1,3]

Supraclavicular approach is a well-known and a very common technique, which gives quick onset and high success rate for upper limb surgeries but complications like vascular puncture, pneumothorax, phrenic nerve palsy, Horner’s syndrome etc were quite common, hence to avoid such complications with more success rate we need an alternative technique or approach to brachial plexus block.[4] After ultrasonogram, it’s rekindled the infraclavicular approach, and by adding nerve stimulator we are trying to improve technique of approach and compare them.[5]

Abhinaya RJ et al. demonstrated that the infraclavicular approach offered shorter block performance time and fewer complications than the supraclavicular approach while maintaining similar success rates.[5] Uday Ambi et al. reported comparable efficacy between perivascular and perineural ultrasound-guided techniques, supporting the versatility of ultrasound-guided brachial plexus blocks.[8] Studies by Suneet Kaur et al. and Patil et al. showed that the addition of dexmedetomidine to ropivacaine hastened the onset and prolonged the duration of sensory and motor blockade, thereby improving postoperative analgesia.[9,10] Singh S et al. demonstrated higher success rates and lower complication rates with ultrasound guidance compared to nerve stimulator-guided techniques alone.[11] Chan VW et al. further established the role of real-time ultrasound imaging in improving nerve localization and enhancing block success while minimizing complications.[6]

Despite these advances, there is still controversy in the best technique of brachial plexus blockade for upper limb surgeries. Hence, the present study was conducted to compare supraclavicular and infraclavicular approaches of brachial plexus block under ultrasound guidance and nerve stimulation, with special emphasis on block performance time, onset of sensory and motor blockade, readiness for surgery, postoperative analgesia, success rate, and procedure-related complications.

MATERIALS AND METHODS

This prospective, randomized, double-blinded clinical study was conducted in a Tertiary care hospital in Tamilnadu, India. The study was conducted after obtaining approval from the Institutional Ethics Committee and written informed consent from all participants. Sixty patients of either sex, aged 18–60 years, weighing 45–65 kg, belonging to American Society of Anesthesiologists (ASA) physical status I and II, and scheduled for elective upper limb surgeries under brachial plexus block were enrolled in the study. Patients were randomly allocated into two groups of 30 each using a random number chart. Group S received ultrasound and nerve stimulator-guided supraclavicular brachial plexus block, while Group I received ultrasound and nerve stimulator-guided infraclavicular brachial plexus block. The observer responsible for data collection was blinded to group allocation and was not present during block performance. Patients with ASA grade III or IV, pregnancy, clavicular fracture, thoracic or upper limb skeletal abnormalities, local site infection, bleeding disorders, known allergy to amide local anaesthetics, pre-existing sensory or motor neuropathy, seizure disorders, or refusal to participate were excluded from the study. All patients received premedication with oral alprazolam 0.5 mg and ranitidine 150 mg on the night before surgery. Standard monitoring including electrocardiography, non-invasive blood pressure and pulse oximetry was instituted in the operating room and intravenous access was obtained using an 18 G cannula. Brachial plexus blocks were performed by an experienced anaesthesiologist under strict aseptic precautions with the use of ultrasound guidance and peripheral nerve stimulation. The brachial plexus was identified with a low-frequency ultrasound probe in the supraclavicular or infraclavicular region. Needle placement was further confirmed with the use of an insulated stimulating needle connected to a peripheral nerve stimulator. Stimulation was started at 2.0 mA and gradually reduced to 0.6 mA after obtaining the desired distal motor response. All patients received 30 mL of 0.5% ropivacaine administered incrementally after negative aspiration. Sensory blockade was assessed using pinprick testing in the distributions of the median, radial, ulnar, musculocutaneous, and medial cutaneous nerves of the forearm. Motor blockade was assessed by evaluating flexion and extension movements against resistance. Sensory and motor blockades were graded using the modified Hollmen sensory scale and Lavoie motor scale. The primary outcome measures included block performance time, onset of sensory blockade, onset of complete sensory blockade, onset of motor blockade, onset of complete motor blockade, and readiness for surgery. Secondary outcomes included success rate of the block, duration of analgesia, time to first rescue analgesic requirement, and complications such as vascular puncture, hematoma, local anaesthetic toxicity, pneumothorax, Horner’s syndrome, diaphragmatic paresis, and nerve injury.

Rescue analgesia was provided with intramuscular diclofenac sodium 50 mg when the Visual Analogue Scale (VAS) score was ≥4. Failed blocks requiring conversion to general anaesthesia were excluded from the final analysis. Data were analysed using SPSS software. Continuous variables were expressed as mean ± standard deviation and compared using the unpaired Student's t-test. Categorical variables were analysed using the Chi-square test. A p-value <0.05 was considered statistically significant.

RESULTS

The results of this comparative study is given below.

Table 1: Baseline data comparison

Variable	Group S (n=30)	Group I (n=30)	p-value
Age (years), Mean ± SD	35.73 ± 12.64	37.83 ± 14.98	0.5596
Weight (kg), Mean ± SD	57.90 ± 7.01	55.80 ± 8.34	0.2954
Sex, n (%)			1.0000
Male	21 (70.0)	21 (70.0)	
Female	9 (30.0)	9 (30.0)	
ASA Physical Status, n (%)			0.2557
ASA I	8 (26.7)	11 (36.7)	
ASA II	22 (73.3)	19 (63.3)	
Duration of Surgery (min), Mean ± SD	101.10 ± 9.97	99.94 ± 10.27	0.6588
Site of Surgery, n (%)			1.0000
Hand & Fingers	7 (23.3)	7 (23.3)	
Forearm	21 (70.0)	21 (70.0)	
Elbow	2 (6.7)	2 (6.7)	

There were no statistically significant differences between the two groups regarding age, weight, sex distribution, ASA physical status, duration of surgery, or site of surgery (p > 0.05), indicating that both groups were comparable at baseline.

Table 2: Variables comparison between supraclavicular and infraclavicular block

Variables (in minutes)	Group S	Group I	P value
Block Performance Time	12.48 ± 2.97	10.66 ± 2.75	0.0167
Onset of Sensory Blockade	3.32 ± 0.71	3.08 ± 0.88	0.2438
Onset of Complete Sensory Blockade	8.42 ± 2.75	6.57 ± 2.48	0.0080
Onset of Motor Blockade	3.88 ± 0.76	3.86 ± 0.69	0.9303
Onset of Complete Motor Blockade	9.47 ± 3.23	7.59 ± 2.36	0.0126
Time of rescue analgesia	365.15 ± 53.98	366.17 ± 53.10	0.9412
Readiness For Surgery	10.33 ± 3.22	8.52 ± 2.38	0.0162

The mean block performance time was significantly shorter in Group I (10.66 ± 2.75 min) compared to Group S (12.48 ± 2.97 min) (p=0.0167). The onset of sensory blockade was comparable between the groups, with no statistically significant difference (p=0.2438). However, the onset of complete sensory blockade occurred significantly earlier in Group I (6.57 ± 2.48 min) than in Group S (8.42 ± 2.75 min) (p=0.0080). Similarly, the onset of motor blockade was comparable in both groups (p=0.9303), whereas the onset of complete motor blockade was significantly faster in the infraclavicular group (7.59 ± 2.36 min) compared to the supraclavicular group (9.47 ± 3.23 min) (p=0.0126). The time to rescue analgesia was similar in both groups, with no statistically significant difference (365.15 ± 53.98 min in Group S vs. 366.17 ± 53.10 min in Group I; p=0.9412). Readiness for surgery was achieved significantly earlier in Group I (8.52 ± 2.38 min) than in Group S (10.33 ± 3.22 min) (p=0.0162).

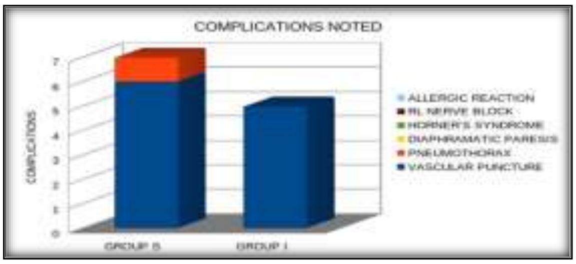

Figure 1: Comparison of complications

In our study, one of the patient developed minimal pneumothorax, six cases of vascular puncture in group S, and five cases of vascular puncture and nil other complication in group I, but they were statistically insignificant.

DISCUSSION

Brachial plexus block has emerged as an effective alternative to general anaesthesia for upper limb surgeries. It is often referred to as the "spinal anaesthesia of the upper limb" because it provides dense surgical anaesthesia while avoiding the adverse effects associated with general anaesthesia, including polypharmacy, laryngoscopy, and tracheal intubation.[1,2]

In the present study, ropivacaine was used as the local anaesthetic agent. Ropivacaine is a long-acting amide local anaesthetic with a lower potential for cardiotoxicity and neurotoxicity compared to bupivacaine while maintaining comparable anaesthetic efficacy.[16] This makes it a preferred agent for peripheral nerve blocks.

In the supraclavicular approach, blockade is performed at the level of the distal trunks and proximal divisions where the brachial plexus is compactly arranged. Consequently, even small volumes of local anaesthetic can produce a rapid, dense, and reliable block.[4] In the infraclavicular (coracoid) approach, blockade is performed at the level of the cords of the brachial plexus. This approach provides reliable blockade of the musculocutaneous and axillary nerves and is associated with a lower risk of complications such as pneumothorax because of its greater distance from the pleura.[14,15]

All demographic variables including age, weight, sex distribution, ASA physical status, duration of surgery, and site of surgery were comparable between Group S and Group I, indicating homogeneity between the study groups. In the present study, the mean block performance time was significantly shorter in Group I (10.66 ± 2.75 min) than in Group S (12.48 ± 2.97 min) (p=0.0167). This finding is consistent with the observations of Abhinaya RJ et al,[5] who reported a significantly shorter block performance time with the infraclavicular approach. Similar findings were reported by Koscielniak-Nielsen et al,[12] who demonstrated that ultrasound-guided infraclavicular block provided faster onset and superior surgical anaesthesia. However, our findings differ from those of Yang et al,[13] and Arcand et al,[17] who found no significant difference in block performance time between supraclavicular and infraclavicular approaches.

The present study demonstrated a significantly earlier onset of complete sensory blockade, complete motor blockade, and readiness for surgery in the infraclavicular group compared with the supraclavicular group. These findings are in agreement with those reported by Abhinaya RJ et al.[5] In contrast, Yang et al,[13] and Arcand et al,[17] reported no significant difference in onset time, block quality, or duration of sensory and motor blockade between the two approaches. Although the onset of sensory and motor blockade was earlier in Group I in our study, the differences were not statistically significant. Similarly, the duration of analgesia and time to rescue analgesia were comparable between the groups.

The overall success rate in our study was 93.3%, which is comparable to the success rates reported by Abhinaya RJ et al,[5] Ambi et al,[8] Singh et al,[11] Chan et al,[6] and other studies evaluating ultrasound-guided brachial plexus blockade.[7,9,10] Only one case of pneumothorax was observed in the supraclavicular group, while vascular puncture occurred in both groups. No cases of Horner's syndrome, diaphragmatic paresis, local anaesthetic toxicity, or nerve injury were observed. These findings partially correlate with Abhinaya RJ et al,[5] who reported pneumothorax, Horner's syndrome, and diaphragmatic paresis in the supraclavicular group. However, our findings differ from those of Yang et al,[13] and Arcand et al,[17] who documented a higher incidence of such complications.

The present study observed fewer complications with the infraclavicular approach than with the supraclavicular approach. This finding contrasts with the report by Perlas et al,[18] who demonstrated that ultrasound-guided supraclavicular block is associated with a high success rate and a very low incidence of complications, including an absence of pneumothorax in a series of 510 consecutive patients.

CONCLUSION

Overall, our study demonstrates that ultrasound-guided neurostimulation-assisted infraclavicular brachial plexus block provides faster block performance, earlier onset of complete sensory and motor blockade, earlier readiness for surgery, and fewer complications compared with the supraclavicular approach. Although both techniques provide comparable success rates and postoperative analgesia, the infraclavicular approach appears to offer distinct clinical advantages. However, the technique requires familiarity with sonoanatomy and needle manipulation, and further large-scale studies are needed to validate these findings.

REFERENCES

1. Miller RD, Eriksson LI, Fleisher LA, Wiener-Kronish JP, Cohen NH, Young WL. *Miller's Anesthesia*. 8th ed. Philadelphia: Elsevier; 2015.
2. Hadzic A. Textbook of Regional Anesthesia and Acute Pain Management. 2nd ed. New York: McGraw-Hill Education; 2017.
3. Brown DL. Atlas of Regional Anesthesia. 4th ed. Philadelphia: Elsevier Saunders; 2010.
4. Neal JM, Gerancher JC, Hebl JR, Ilfeld BM, McCartney CJL, Franco CD, et al. Upper extremity regional anesthesia: Essentials of our current understanding. Reg Anesth Pain Med. 2009;34(2):134-70.
5. Abhinaya RJ, Venkatraman R, Matheswaran P, Sivarajan G. A randomized comparative study between supraclavicular and infraclavicular approaches to brachial plexus block using ultrasound and nerve stimulation guidance for upper limb surgeries. Indian J Anaesth. 2017;61(7):581-6.
6. Chan VW, Perlas A, Rawson R, Odukoya O. Ultrasound-guided supraclavicular brachial plexus block. Anesth Analg. 2003;97(5):1514-7.
7. Marhofer P, Greher M, Kapral S. Ultrasound guidance in regional anaesthesia. Br J Anaesth. 2005;94(1):7-17.
8. Ambi U, Dhiraj S, Jagannath S, Hosagoudar P. Comparison of perivascular and perineural techniques of ultrasound-guided axillary brachial plexus block using levobupivacaine. Indian J Anaesth. 2015;59(10):658-63.
9. Kaur S, Attri JP, Kaur G, Kaur H, Kaur M. Evaluation of dexmedetomidine as an adjuvant to ropivacaine in supraclavicular brachial plexus block. Anesth Essays Res. 2015;9(2):227-32.

10. Patil KN, Singh ND. Comparative study of ropivacaine alone versus ropivacaine with dexmedetomidine in supraclavicular brachial plexus block. Int J Sci Stud. 2016;4(3):36-40.
11. Singh S, Aggarwal A. A comparative evaluation of ultrasound-guided versus nerve stimulator-guided brachial plexus block. J Anaesthesiol Clin Pharmacol. 2010;26(4):481-5.
12. Koscielniak-Nielsen ZJ. Ultrasound-guided peripheral nerve blocks: What are the benefits? Acta Anaesthesiol Scand. 2008;52(6):727-37.
13. Winnie AP. Plexus Anesthesia: Perivascular Techniques of Brachial Plexus Block. Philadelphia: WB Saunders; 1993.
14. Franco CD, Vieira ZE. One hundred consecutive infraclavicular brachial plexus blocks. Reg Anesth Pain Med. 2000;25(1):41-6.
15. Klaastad Ø, Smith HJ, Smedby O, Winther-Larssen EH, Fasting S. A comparison of infraclavicular and supraclavicular brachial plexus blocks. Acta Anaesthesiol Scand. 2004;48(4):470-5.
16. McClure JH. Ropivacaine. Br J Anaesth. 1996;76(2):300-7.
17. Arcand G, Williams SR, Chouinard P, Boudreault D, Harris P, Ruel M, et al. Ultrasound-guided infraclavicular versus supraclavicular block. Reg Anesth Pain Med. 2005;30(6):557-62.
18. Perlas A, Lobo G, Lo N, Brull R, Chan VW, Karkhanis R. Ultrasound-guided supraclavicular block: Outcome of 510 consecutive cases. Reg Anesth Pain Med. 2009;34(2):171-6.