



COMPARATIVE EVALUATION OF TWO TECHNIQUES IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK: NERVE STIMULATOR ASSISTED VS ULTRASONOGRAPHY GUIDED

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ABSTRACT

Background The advent of ultrasound guided & nerve stimulator technique has heralded a new era in regional anesthesia. The aim of this study is to compare between nerve stimulator guided and ultrasound guided supraclavicular block in elective upper limb surgeries. **Material & Methods:** This is a parallel group open label randomised controlled trial. 70 ASA grade I & II patients of both sexes between 18-60 years of age posted for elective upper limb surgery were allocated in two groups. Group U patients received supraclavicular brachial plexus block under ultrasound guidance and in Group N patients, nerve stimulator was used. In both the groups, local anesthetic mixture consisting of 0.5% bupivacaine and 2% lignocaine with 1:2,00,000 adrenaline was used according to body weight. In both groups, time of onset of sensory block, time of onset of motor block, block execution time, complications and success rate were noted. Statistical analysis was done with student independent t test to compare mean between two groups and chi-square test for categorical variables. **Results:** The procedure time in group U was 10.03 ± 0.92 min versus 17 ± 1.085 min in group N. The onset time of sensory and motor blocks in group U were 12.14 ± 0.88 min & 19.17 ± 1.10 min, respectively in comparison to 15.34 ± 0.87 min & 23.09 ± 1.314 min, respectively in group N. Success rate in group U and group N was 94.28% and 85.71%, respectively. None of the patients developed complications in group U but in 2.9% patients of group N arterial puncture was reported. **Conclusion:** The USG guided technique has shorter procedure time, faster onset time of sensory and motor block and higher success rate as compared to nerve stimulator technique.

KEYWORDS : USG- Ultrasonography, PNS- Peripheral Nerve Stimulation

INTRODUCTION:

The ability to image the plexus, rib, pleura, and subclavian artery with ultrasound guidance has increased the safety due to better monitoring of anatomy and needle placement. The peripheral nerve stimulator (PNS) allows better localization of the brachial plexus by locating the nerves using a low intensity electric current (upto 2.5mA) for a short duration (0.05-1ms) with an insulated needle to obtain a defined response of muscle twitch and to inject local anesthetic solution in close proximity to the nerve.

AIMS & OBJECTIVES:

The aim of this study is to compare between the two groups on the basis of time of onset of sensory and motor blockade, block execution time, failure rate & complications.

MATERIAL & METHODS:

Study type:

Parallel group open label randomized controlled trial.

Study centre:

This study was carried out in Department of Anesthesiology & Critical Care, Darbhanga Medical College & Hospital.

Sample size:

Total number of patients studied were 70, with 35 patients in each group.

Group U: Patients receiving USG guided block (n=35)

Group N: Patients receiving nerve stimulator assisted block (n=35)

Study period:

15 months from May 2021 to August 2022 after obtaining clearance from Institutional Ethics Committee.

Inclusion criteria:

ASA grade I & II patients aged from 18-60 years of either sex

for any elective surgery on upper extremity below mid humerus level with duration of operation less than 3 hours.

Exclusion criteria:

1. Patient's refusal to participate
2. Infection at proposed site
3. Coagulopathies
4. Allergy to local anesthetics
5. Pre-existing neurological deficit in upper limb

Study Technique:

All patients were randomly allocated into two groups of 35 each. Pre-anesthetic checkup was done. Informed consent was taken after explaining the anesthetic procedure. Preoperatively, fasting of 6 hours was confirmed. In operation theatre intravenous cannula, electrocardiogram, non-invasive blood pressure, pulse oximeter was applied. Patients were positioned supine with head resting on ring and turned slightly to contralateral side, ipsilateral arm adducted, shoulder depressed, a roller pack was placed in between scapula. Under all aseptic precautions local site was prepared. Local anesthetic solution used was a mixture of 0.5% bupivacaine 15ml and 10ml of 2% lignocaine with 1:2,00,000 adrenaline to make a total volume of 25ml.

Group N:

Subclavian artery was palpated 1-1.5 cm above the midclavicular point, immediately lateral to sterno cleidomastoid muscle. The positive electrode from the PNS attached to an ECG lead was placed in the ipsilateral forearm. A 20 G insulated nerve stimulator needle attached to the negative electrode of the nerve stimulator was then inserted through the skin in a backward, inward and downward direction. A current of 1.5-2.5mA at 1Hz frequency and 0.1ms of pulse duration was delivered. The elicited motor response of the fingers obtained at 0.5 mA confirms the proximity of the needle tip to the lower trunk. Local anesthetic solution was injected after negative aspiration for air or blood.

Group U:

A high frequency linear array ultrasound (9-18 MHz) probe was positioned in the supraclavicular fossa just superior to the midpoint of the clavicle. The brachial plexus was identified as a honeycombed hypoechoic structure lateral to the pulsating subclavian artery above the first rib and pleura. A 18G needle was inserted from the lateral side of the probe inside the ultrasound beam by in-plane technique into the sheath of the brachial plexus. Under vision, after hydrodissection with 2ml saline and negative aspiration, the local anesthetic solution was injected into the brachial plexus sheath in at least two different needle positions around the subclavian artery.

Parameters Studied:

Intraoperative: Non-invasive blood pressure, heart rate, electrocardiogram, SpO2.

Block execution time:

Group U: from the time of initial scanning to the removal of the needle. Group N: from the time of insertion of the needle to its removal.

Time of onset of sensory block:

Assessed after removal of block needle by pin prick sensation every 2 minutes till the onset of sensory block, comparing to the same sensory dermatome of the opposite limb. Sensory block in each dermatome was evaluated using the following scale: 2 (normal sensation), 1 (hypoesthesia), 0 (no sensation felt).

Time of onset of motor block:

Assessed every 2 min till the onset of motor blockade through modified bromage score.

0-normal motor function with full extension and flexion of elbow, wrist, and fingers

- 1- ability to flex wrist and fingers
- 2- ability to flex only fingers
- 3- complete motor block

Success:

The block was considered to be successful when the patient had full block of all the sensory dermatomes and no power to move above mentioned joints.

Complications:

Patients were evaluated for 24 hours after the block for complications like hypotension, arrhythmias, convulsion, nausea, vomiting, horner's syndrome, phrenic nerve palsy, pneumothorax, respiratory depression, signs and symptoms of local anesthetic systemic toxicity.

Statistical Analysis:

Statistical analysis were performed using SPSS version 28.0. Data were expressed in mean and standard deviation for continuous variables, numbers and percentage for categorical variables. Student independent t-test was used to compare mean between the two groups and chi square test used for categorical variables. P < 0.05 was considered statistically significant.

RESULTS:

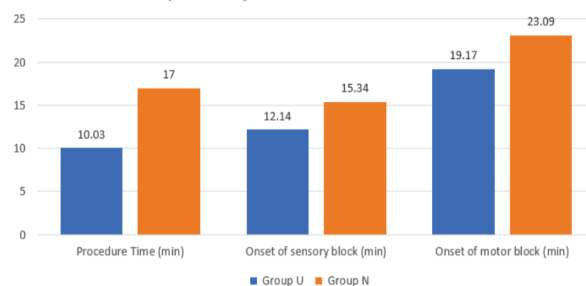
There were no statistically significant differences in the demographic characteristics of the two study groups with respect to age and sex and ASA grade. There were no significant differences in both the groups with respect to hemodynamic changes i.e., blood pressure and heart rate. The block execution time was significantly shorter in group U than in group N (10.03 ± 0.92 min vs 17 ± 1.085 min) which was statistically significant (p < 0.001). The mean onset of sensory block was 12.14 ± 0.88min in group U and 15.34 ± 0.87min in group N, which was statistically significant (p<0.001). The

mean onset of motor block was shorter in group U (19.17 ± 1.10 min) compared to group N (23.09 ± 1.314min) being statistically significant with p value <0.001. Success rates in group U and group N were 94.28% and 85.71% respectively, though this was not statistically significant (p=0.235). Out of 35 patients in each group, 5 patients in group N and 2 patients in group U required analgesic supplementation with intravenous ketamine. None of the patients required conversion to general anesthesia. None of the patients developed complications in group U but in 1 patient of group N arterial puncture was reported. This was not statistically significant (p=1.00).

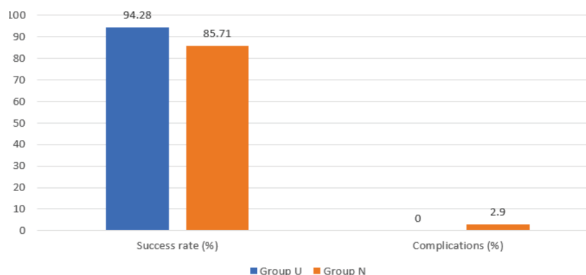
Table 1: Comparison of block parameters

BLOCK PARAMETERS	GROUP U (n = 35)	GROUP N (n = 35)	P VALUE
Procedure time (min)	10.03 ± 0.92	17 ± 1.085	<0.001
Onset of sensory block (min)	12.14 ± 0.88	15.34 ± 0.87	<0.001
Onset of motor block (min)	19.17 ± 1.10	23.09 ± 1.314	<0.001
Success of block (%)	94.28	85.71	0.235
Complications of block (%)	0	2.9	1.00

Graph 1: Comparison of block characteristics



Graph 2: Comparison of Success rate & Complications



DISCUSSION:

The present study was conducted to compare the above two techniques for performing supraclavicular block with respect to efficiency and complication rate.

It was demonstrated that the mean block execution time was significantly shorter in Group U than Group N (10.03 ± 0.92 min vs. 17 ± 1.085 min, respectively).

Singh *et al.* observed that the average time to perform the block was significantly shorter in USG group compared to PNS group for executing supraclavicular block (8.14 vs. 10.63 min, respectively).¹ Similarly, Williams *et al.* and Ratnawat *et al.* found a significantly shorter time to perform the block with USG than the PNS.^{2,3} However, Duncan *et al.* observed a comparable procedural time (7.27 ± 3.88 min in group USG and 8.8 ± 1.73 min in group PNS) with the above two techniques,³ but the time required in this particular study was much shorter than the above studies.

In the present study, the onset of block was faster in the USG group, in all the nerve territories. The onset of the sensory and motor block was found to be significantly shorter in Group U (12.14 ± 0.88 min & 19.17 ± 1.10 min respectively) compared to Group N (15.34 ± 0.87 min & 23.09 ± 1.314 min respectively).

This is similar to the study done by Ratnawat *et al.* in which the mean onset time of sensory and motor block was significantly shorter in USG group (6.46 ± 1.02 min and 8.10 ± 1.02 min, respectively) compared to the PNS group (7.68 ± 1.33 min and 9.94 ± 1.28 min, respectively).³ However, our findings were in contrary to the study done by Duncan *et al.*, in which the onset time of sensory and motor block was comparable between the USG and PNS groups.⁴

The success rate in our study was 94.28% (33 out of 35) in group U compared to 85.71% (30 out of 35) in Group N which was statistically insignificant (p value 0.235). Similarly, Singh *et al* have observed that out of 102 patients, 45 out of 50 (90%) patients had developed successful block with USG, compared to 38 of 52 (73.1%) in group PNS requiring additional nerve blocks (p=0.028). Duncan *et al.* and Williams *et al.* observed a comparable rate of the successful block with both the groups. One of the limitations of this study is the small sample size of only 70 patients. A multicentric study with a large sample size will give a better picture of the success rate and incidence of complications such as arterial puncture and pneumothorax. The number of needle pricks and needle readjustments which will be helpful in assessing patient discomfort and satisfaction were not recorded in our study.

CONCLUSION:

USG guided supraclavicular block is significantly better in terms of procedure time and block characteristics with shorter onset of sensory and motor blockade during upper limb surgeries compared to the nerve stimulator technique. Further studies with large sample size are required to assess and compare the incidence of complications and success rates with these techniques.

Abbreviations:

USG – Ultrasonography

PNS – Peripheral Nerve Stimulation

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