Original Research Paper

Volume-8 | Issue-2 | February-2018 | PRINT ISSN No 2249-555X

Anesthesiology

A PROSPECTIVE AND RANDOMISED STUDY COMPARING SUCCESSFULL SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK USING NERVE STIMULATOR AND ULTRASOUND

Dr. C. Senthil M.D.,D.A., Assistant Professor, Department of Anaesthesiology, Thanjavur Medical College And Hospital, Thanjavur.

Dr. G. Malini* M.D.,D.A., Assistant Professor, Department of Anaesthesiology, Government Raja Mirasudhar Hospital, Thanjavur. *Corresponding Author

ABSTRACT Supraclavicular brachial plexus blocks are more predictable regional anesthetic technique than other methods for upper limb surgeries with minimal adverse effects. The nerve blocks were performed initially based on anatomical landmark technique by elicitation of paresthesia with needle. Paresthesia is a subjective response and due to direct contact of the needle with nerve, neuronal damage can occur frequently. In order to minimize these complications with the equal success rate an objective response equipment, Nerve stimulator was introduced in clinical practice. It is also a anatomical landmark oriented technique and may lead to residual neuronal damage. The introduction of Ultrasonogram has generated a yearning of identifying the better technique with more success and least complication rate.. Therefore we conducted a study to compare the usefulness of ultrasound and nerve stimulator for supra clavicular brachial plexus block in upper limb surgeries.

AIMS & OBJECTIVES: To compare the effects of supraclavicular brachial plexus block using nerve stimulator and USG technique in terms of time taken for the procedure (Block execution time) , onset of sensory blockade , onset of motor blockade, success rate incidence of complications , total duration of analgesia

SAMPLE SIZE AND RANDOMIZATION: The sample size was scheduled to be 60 based on the pilot study. They were randomly selected to 30(n=30) in each group and named as Group US (ultrasound) and Group NS (Nerve stimulator).**NS Group**: Supraclavicular brachial plexus block performed withthe guidance of Nerve Stimulator **US Group**: Supraclavicular brachial plexus block performed throughUltrasound guidance.

CONCLUSION: We concluded that Ultrasound guided supraclavicular brachial plexus block for patients undergoing upper limb surgeries provided rapid onset of sensory and motor blockade than NS group and also extends the duration of analgesia with good hemodynamic stability. Block execution time by US group was longer than NS group. Success rate achieved by both methods are similar and occurrence of complications such as vascular puncture and paresthesia was seen more in NS group.

KEYWORDS :

INTRODUCTION :

Supraclavicular brachial plexus blocks are more predictable regional anesthetic technique than other methods for upper limb surgeries with minimal adverse effects. Advantages over general anesthesia are better hemodynamic stability, avoidance of poly pharmacy, preservation of Consciousness and Respiration, reduced neuro-endocrine stress response and postoperative nausea, vomiting, excellent postoperative analgesia.

AIMS & OBJECTIVES :

To compare the effects of supraclavicular brachial plexus block using nerve stimulator and USG technique in terms of:

1. Time taken for the procedure (Block execution time)
2. Onset of sensory blockade
3. Onset of motor blockade.
4. Success rate
5. Incidence of complications
6. Total duration of analgesia

MATERIALS AND METHODS :

This is a prospective, randomized, observer blinded study in Supraclavicular brachial plexus blocks using nerve stimulator and ultrasound guidance to evaluate the effectiveness, safety and to compare different parameters. The study was intended and ethical committee approval was obtained.

(i) **Inclusion criteria:** a) Patients of both sex, aged in the middle of 18 and 60 years b) Patients with ASA-PS Grade I and II physical statusc) Elective upper limb surgeries

ii) **Exclusion criteria:** a) Patients <18 years and >60 years of age. b) Patient refusal c) Patients with significant coagulopathy or peripheral neuropathy d) ASA Grade III and IV patients e) Allergy to local anesthetics.

SAMPLE SIZE AND RANDOMIZATION:

The sample size was scheduled to be 60 based on the pilot study. They were randomly selected to 30(n=30) in each group and named as Group US (ultrasound) and Group NS (Nerve stimulator). The performer made 60 lots and numbered serially from 1-60. A chart was prepared that selected each number randomly to a group. The observer took a lot and the number was noted in the proforma chart. Then the observer was hided for the block being done. The investigator performed the block and then the observer was allowed to note the outcomes. After the study was completed the proforma chart was revealed.

DESCRIPTION OF PARAMETERS:

1. **Block Execution time US GROUP:** The time duration between the primary scanning to identify the plexus and the withdrawal of the needle at the end of the procedure. **NS GROUP:** The time duration between the subclavian artery landmark palpation to the withdrawal of the needle at the end.
2. **Success** We declared our block to be successful when the patient had a dense block of all the sensory dermatomes and unable to move shoulder, elbow and wrist joints.
3. **Failure** was defined as the presence of sensation in at least one or more dermatomes.

GROUP NS:

1. Sterile sheets and 4"x4" gauze pieces
2. Two 10-mL syringes filled with local anaesthetic drug
3. Surface electrode leads and sterile gloves
4. One 1½" 25-gauge needle to infiltrate skin, povidone iodine.
5. Peripheral nerve stimulator
6. 5cms long, 21G, stimuplex needle (Braun).

GROUP US:

1. Sterile sheets and 4"x4" gauze pads.
2. Two 10-mL syringes with local anaesthetic.
3. Sterile gloves
4. One 1½" 25-G needle for local infiltration.
5. A 38mm long and 7-11 MHz linear probe (SONO RAY)
6. The needle used is 18 G intravenous needle

Drug: 1:1 mixture of 15 ml Inj.Lidocaine (2%) and 15 ml of Inj.Bupivacaine (0.5%) with adrenaline (1:200000) dilution.

PREPARATION OF THE O.T

i. Anesthesia machine check.
ii. Avail resuscitation equipment, laryngoscope, endotracheal tube and Laryngeal mask and oro pharyngeal airways
iii. Keep ready the emergency drugs with preloaded syringes like, Inj. Adrenaline, Inj.Atropine Inj.Midazolam Inj.Thiopentone sodium and general anesthesia drugs.
iv. Ultrasound machine and probe check (Linear array probe (9-18MHZ).
v. Check the monitors (ECG, NIBP,Sp02 and ETCO2).

Informed consent obtained from patient and relatives with adequate documentation of the risk and complications After preoperative assessment of the patient, they were shifted to operation theatre. After arrival in the operating room, intravenous access was gained with 18G intravenous cannula and intravenous premedication was given (midazolam0.03mg/kg). Continuous blood pressure monitoring was done with NIBP with automated cuff, heart rate and Pulse Oximetry during the entire period. Position should allow comfortable placement of patient in supine position in O.T table with arm placed by side. Head is positioned without head rest and head turned 45 degree opposite side.

After proper positioning, skin preparation done with povidone- iodine and draping with sterile sheet, in US group Transducer is placed in coronal plane just above the clavicle at approximately its midpoint.(Land mark: subclavian artery, scalenus muscle, first rib). The probe should be focused acutely down the neck, as if scanning the image deep to the thorax, do not across the neck. Attempts are made to appreciate the subclavian artery: Artery is hypo echoic (black circle), pulsation is visible. The artery lies on the hyper echoic line of pleura or first rib. If difficult to find the artery, slide the probe medially (or) laterally parallel to clavicle. Scanning to be done cautiously, to avoid inadvertently mistaking the carotid artery for subclavian artery Brachial plexus is posterior-lateral to the artery (or) superior to the artery, looks like bunch of grapes, hypo echoic structure encases hyper echoic fascia. Before insertion of needle, change to color Doppler to differentiate blood vessel (either artery or vein) and to know the needle pathway. During In plane technique, needle placed medial to lateral (or) lateral to medial towards and below the transducer. Needle should be advanced at the junction of the artery and rib. To make sure the needle does not cross beyond the hyper echoic line (pleura, rib). After the injection of local anesthetic mixture, the plexus will separate away from the artery and is displaced. Remaining LA injected on the superficial aspect of the plexus after change the needle position

Group NS Under all aseptic precaution local site was prepared. The Positive electrode of the nerve stimulator was connected to an ECG lead and fixed on the ipsilateral arm. The subclavian artery was then palpated 1-1.5 cm above the mid clavicular point, immediately lateral to the sternomastoid muscle and was pushed medially by the thumb and an intradermal wheal was raised with 1% lignocaine (2 mL) using a 24 G needle. A 20 G insulated needle attached to the negative electrode of the NS was then pierced through the skin wheal in a posterior, medially, and caudally. NS was set to deliver a current of 1.5 current at 1Hz frequency and0.1ms of pulse duration. After finger flexion was obtained with stimulation, the current was reduced in to 0.2 mA till the presence of a muscle twitch with 0.6mA was observed and no twitch with a current of 0.2 mA was observed. This ensures the proximity of the needle tip to the nerve and the drug was injected after negative aspiration of air or blood

Sensory block was evaluated every 5 minutes until 30 minutes after the last local anaesthetic injection by the observer blinded to technique The Sensory blockade is defined as the loss of pinprick pain over the medial and lateral aspect of arm, forearm and the hand. Sensory onset time is the time interval between the last drug injected to loss of pinprick pain sensation. It is scored as follows:

Normal-Intact touch and pain sensation,
Incomplete block-Touch sensation is present with no pain
Complete block-No sensation

When the surgery could not be completed in patients with incomplete block without discomfort, requiring more than 100 mcg fentanylwe administered general anaesthesia (GA) with endotracheal tube and was noted as a failed block. When the patient experienced pain on pinprick by 30 minutes after block completion suitable alternate anaesthesia was provided, declaring the block failed.

After the sensory block, motor block was assessed every 5 minutes to rule out any painful restriction by the same observer blinded to technique The onset of motor blockade was evaluated every 2 min till the onset of motor block. It is the time of withdrawal of the block needle to the time when the patient had weakness of any of the three joints Shoulder, elbow, or wrist, upon trying to achieve active movements. **No block:** full power **Incomplete block:** able to move active movements **Complete block:** No power

OBSERVATION AND RESULTS This is study comparing the nerve stimulator and ultrasound on the duration of block execution time ,time taken for sensory and motor onset, success rate and complications in supraclavicular brachial plexus blocks. After performing the study, the results were compiled and analysed. For analysing comparison among groups Chi square test was used. Student t test helped to quantify the variables. The p value of less than 0.05 was declared as statistically significant. The statistical analysis was carried out using statistical software package SPSS 20

TABLE:1COMPARISON OF GENDER BETWEEN GROUP NS AND US

SEX	US	NS	Statistical inference
MALE	22	21	X2=.082 Df=1 774>0.05 Not Significant
	73.3	70	
FEMALE	8	9	
	26.7	30	
TOTAL	30	30	
	100%	100%	

The distribution of gender among both Group NS and Group US were analyzed and there is no significance difference between the two groups hence they are comparable.(P>0.05)

Table 2: COMPARISON OF MEAN AGE BETWEEN GROUP NS AND GROUP US

Age	Mean	S.D	Statistical inference
US (n=30)	46.70	13.455	T=.751 Df=58 .456>0.05 Not Significant
NS (n=30)	44.10	13.361	

Table 3: COMPARISON OF MEAN WEIGHT BETWEEN GROUP NS AND GROUP US

Weight (kg)	Mean	S.D	Statistical inference
US (n=30)	59.00	8.317	T=.898 Df=58 373>0.05 Not Significant
NS (n=30)	57.20	7.175	

On analysing the data statistically, the p value was calculated as p=.456, p=.373 for age and weight respectively. For both variables P value>0.05 value which is statistically insignificant and comparable

TABLE 4COMPARISON OF "BLOCK EXECUTION TIME" IN GROUP NS AND GROUP US

Block execution time(min)	Mean	SD	Statistical inference
US (n=30)	9.63	2.470	T=5.606 Df=58 .000<0.05 Significant
NS(n=30)	6.67	1.516	

T-Test

The duration of technique in Group US=9.63 min and Group NS=6.67 min The calculated p value=.000 which is <0.05, hence the difference is statistically significant. Therefore the time taken to execute the block in Group NS is significantly lesser than the Group US

Table 5: COMPARISON OF ONSET OF SENSORY BLOCKADE BETWEEN GROUP NS AND GROUP US

Sensory onset (min)	Mean	S.D	Statistical inference
US (n=30)	4.87	3.256	T=-3.416 Df=58 .001<0.05 Significant
NS (n=30)	8.23	4.305	

The onset of sensory blockade in Group NS=8.23 minutes Group US=4.87 minutes, whose p value is **0.001**, which is statistically significant. Therefore the onset of the sensory blockade is significantly faster in Group US than Group NS

Table 6: COMPARISON OF ONSET OF MOTOR BLOCKADE BETWEEN GROUP NS AND GROUP US

Motor onset (min)	Mean	S.D	Statistical inference
US (n=30)	8.47	5.501	T=-2.863 Df=58
NS (n=30)	12.67	5.857	.006<0.05 Significant

The onset of motor blockade in Group NS=12.67 minutes and Group US=8.47 minutes, whose p value is **0.006**, which is statistically significant. Therefore the onset of the motor blockade is significantly faster in Group US than Group NS

Table 7: COMPARISON OF SUCCESS RATE OF GROUP NS AND GROUP US

	SUCCESS	FAILURE	TOTAL	Statistical inference
GROUP NS	25(83.33%)	5(16.67%)	30	X_2=1.456 Df=1 .228>0.05 Not Significant
GROUP US	28(93.33%)	2(6.67%)	30	

The success rate in Group NS =83.33% and Group US =93.33% providing a numerical difference. But on statistical analysis, the calculated P value=.228 i.e. (p>0.05)

Table 8: COMPLICATIONS OCCURED AMONG GROUP NS AND GROUP US

Complications	US	NS	Statistical inference
Failure	**2**	**3**	X_2=6.089 Df=3 .107>0.05 Not Significant
	6.7%	16.67	
Par aesthesia	**2**	**6**	
	6.7%	20.0%	
Vascular puncture	**0**	**3**	
	0	**10%**	

Analyzing above values showed complications observed in both groups, US group shows less adverse effects compared to NS group which is statistically insignificant p value .107(>0.05) though appears numerical difference

Table 9: MEAN DURATION OF ANALGESIA BETWEEN GROUP NS AND GROUP US

Analgesic duration (hours)	Mean	S.D	Statistical inference
US (n=30)	6.47	1.299	T=4.539 Df=58
NS (n=30)	4.95	1.289	.000<0.05 Significant

The mean duration of analgesia increased in US group (6.47 hours) compared to NS group which is (4.95 hours).The p value .000(<0.05) is highly significant.

DISCUSSION

In our study, supraclavicular brachial plexus block was done under both ultrasound guidance and nerve stimulator. Most of the patients had successful brachial plexus block and hence satisfactory surgical anesthesia.

The real time ultrasound imaging showed better visualization of the brachial plexus, accurate position of the needle placement and spread of local anesthetic around the brachial plexus. Identification of the adjacent structures like blood vessels (Subclavian artery and vein), first rib and pleura was useful to avoid procedure related complications.

We observed that 15 ml of Inj. Lignocaine (2%) and Inj. Bupivacaine (0.5%) with Adrenaline(1:200000), resulted in excellent quality of supraclavicular brachial plexus block for upper limb surgeries.

In our study, we observed that block execution time was significantly decreased in NS group when compared to US group. The mean duration of block performance in NS group was 6.67 min and in US group 9.63 min. is statistically significant. Singh G Saleem MY et al. showed the mean time required to administer a block was 5.43 min in NS group, whereas using ultrasound, the time needed for the same was 10.1 min. They suggested that the use of ultrasound in brachial plexus block requires good knowledge about sono anatomy and skills by anesthesiolgists.

In our study, we observed that onset time of sensory blockade was significantly decreased in US group when compared to NS group. The mean onset time of sensory blockade in US group was 5.27 min and in NS group 8.23 min. Danelli et al showed the mean onset time for sensory block with the use of ultrasound was 10.86 min and 11.60 min for conventional paresthesia eliciting techniques. This is almost same to the study performed by Marhofer et al. The real time imaging of ultrasound give better visualization of brachial plexus, underlying structures and deposition of local anesthetic in the appropriate place could minimize the sensory onset time in ultrasound guided blocks

The mean onset time of motor blockade in US group was 8.47 min. as compared to NS group 12.67 min which was statistically significant. Duncan et al .showed the mean onset time of motor blockade in group US was 10.83±2.94 min and in NS group was 11.60 ± 3.48 min.The reason for early onset of motor blockade in our study would have been due to accuracy of needle placements close to the plexus, higher volume of local anesthetic (30ml) . Williams et al(2003) found that the motor onset paralleled that of onset of sensory blockade.

The duration of analgesia was significantly prolonged in US group than NS group which was statistically highly significant.The mean duration of analgesia in US group is 6.47 hours as compared to NS group 4.95 hours (p<.000) Singh S et al Showed that Group US the mean duration of analgesia was prolonged 286.22 ± 42.339 compared to 204.37 ± 28.54 min in Group NS (P< 0.05). The prolonged duration of analgesia was due tosynergistic effect of lignocaine and bupivacaine and decreased absorption oflocal anesthetic due to vaso constrictive effect of adrenaline .In US group the drug was injected under direct visualization and equal distribution around the brachial plexus assured, may be the reason for extended duration of block than NS group. Even though proximity ensured in NS group the even drug distribution is doubtful Kapral et al studied that there was no complications such as vessel puncture, paresthesia or pneumothorax in his study of ultrasound guided brachial plexus block through supraclavicular approach. In our study we found that there was no incidence of pneumothorax or vascular puncture during ultrasound guided block. In 3 patients (10%)we had accidental vascular puncture when we followed the NS technique. Three patients in both the groups , the block was „patchy" or inadequate , which was considered as „Block failure"(6.7%). Incidence of accidental paresthesia was higher - 20% (6 patients) in NS group compared to US group 6.7 %. though this was not statistically insignificant.

CONCLUSION

We concluded that Ultrasound guided supraclavicular brachial plexusblock for patients undergoing upper limb surgeries provided rapid onset of sensory and motor blockade than NS group and also extends the duration of analgesia with good hemodynamic stability. Block execution time by US group was longer than NS group. Success rate achieved by both methods are similar and occurrence of complications such as vascular puncture and paresthesia was seen more in NS group

REFERENCE

1. Duncan M, Shetti AN, Tripathy DK, Roshansingh D, Krishnaveni N.A comparative study of nerve stimulator versus ultrasound-guided supraclavicular brachial plexus block. Anesth Essays Res 2013;7:359-64.
2. Singh G.Saleem MY.Comparision Between Conventional technique andUltrasound Guided Supraclavicular Brachial Plexus Block inUpper Limb Surgeries. Int J Sci Stud 2014;2(8):169-176
3. Raghove P, Singh K, Taxak S, Ahlawat M, Hooda S.Comparison of Ultrasound Guided Technique with Conventional Landmark Technique for Supraclavicular Brachial Plexus Nerve Block in Patients Undergoing Upper Limb Surgery. Int J Pharmacol and Clin Sci. 2016;5(1):1-4
4. Ahmed A. El Daba Ultrasonic Guided Supra clavicular Brachial Plexus Block versus Nerve Stimulation Technique Tanta Medical Sciences Journal Vol. (5), No. (2), April 2010: PP 70-73.
5. Williams SR, Arcand G. ultrasound gidance speeds the execution and impoves the quality of supraclavicular block. Anesth analg 2003; 97:1518-23.