



## Comparative Study of Supraclavicular Brachial Plexus Block Using Nerve Stimulator Vs Ultrasound Guided Method

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### Abstract

**Background:** *Brachial plexus block is a common technique to provide anaesthesia for surgery of arm, forearm and hand. It can be obtained by conventional method by eliciting paraesthesia, use of a peripheral nerve stimulator or use of ultrasound scanning device. The aim of this study is to compare the efficacy of supraclavicular brachial plexus block by using nerve stimulator method and USG guided method. The procedure time, volume of drug and adverse effects in upper limb orthopaedic surgeries performed under supraclavicular brachial plexus blockade using ropivacaine as local anaesthetic*

**Methods:** *After ethical committee approval and informed consent from patients, a comparative observational study was performed on patients scheduled for upper limb orthopaedic surgeries under supraclavicular plexus block.*

*This study was done among two group of patients belonging to ASA 1 and 2, of age 30-70yrs Both the groups of patients were comparable with regard to age, sex and weight. They were allocated into two groups using computer generated randomization. Group 1 received 15mL of 0.5 % ropivacaine brachial plexus block using ultrasound guided and Group 2 received 25ml of 0.5 % ropivacaine in brachial plexus block using nerve stimulator.*

**Results;** *Datas were analysed using spss software using the student 't test And chi square test and  $p < 0.05$  was considered as significant. Observation were represented both graphically and numerically*

**Conclusion;** *Observation of this study shows that supraclavicular brachial plexus block using ultrasound guided method is an improved nerve block technique due to visualization of nerves with more success, decreased complication rate, and less time consuming, smaller volume of local anaesthetic agent required, as compared to nerve stimulator*

**Keywords:** *supraclavicular brachial plexus block, ultrasound, nerve stimulator, ropivacaine.*

### BACKGROUND

The international association for the study of pain (IASP) defines pain as an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage. Factors influencing post operative pain are site of surgery, nature and duration of

surgery, the type and extent of incision and nature of trauma, the physiological & psychological makeup of the patient. The degree of pain an individual can tolerate shows wide variability. Brachial plexus block is a common technique to provide anaesthesia for surgery of, arm, forearm and hand<sup>[1]</sup> To

achieve an optimal block the tip of the needle should be close to or in contact with a nerve and at that time patient may experience a paresthesia (a sudden tingling sensation, often described as feeling like 'Pins and Needles' or like an electric shock) in the arm, forearm, hand or fingers. Injecting local anaesthetic drug close to this point may result in a successful block. It can be obtained by conventional method by eliciting paraesthesia, use of a peripheral nerve stimulator or use of ultrasound scanning device. A nerve stimulator connected to an appropriate needle allows emission of electric current from needle tip close to or contacts motor nerve with characteristic contraction of innervated muscle. Ultrasound guided peripheral nerve block is an advanced technique in which there is non-invasive visualization of internal structures, including nerves to be blocked, under an image produced by ultrasound which required essential skill for the performance of block. Accurate position of needle under USG guidance delivers local anaesthetic drug in correct place near the nerves.

Observation of spread of drug surrounding the nerves is predictive of successful block. Peripheral nerves have a variable monographic echo texture that is affected by the surrounding tissue. Classically, nerve fascicles itself appear hypo-echoic embedded within a more hyperechoic and homogenous perineurium and endoneurium. When grouped together and viewed in a transverse plane, this gives peripheral nerves their classic 'honeycomb' appearance.<sup>2,3</sup> The overall confirmation of a peripheral nerve depends on its course and surrounding tissue.

Ropivacaine is a long acting amide local anaesthetic. It is a pure S enantiomer developed for the purpose of reducing potential cardiovascular and central nervous system toxicity associated with bupivacaine and improving the relative sensory and motor block profiles<sup>(13)(14)</sup>. It was introduced into clinical use in the year 1996<sup>(15)</sup>. Ropivacaine is advantageous as it

provides differential block with lower systemic toxicity<sup>(13)</sup>.

Local anaesthetics produce anaesthesia by inhibiting excitation of nerve endings or by blocking conduction in peripheral nerves. This is achieved by anaesthetics reversibly binding to and inactivating sodium channels.<sup>(11)(12)</sup>,

## MATERIALS AND METHODS

After obtaining approval from the institutional ethics committee and informed consent from patients, this study was conducted in 72 patients with ASA grade 1 and 2, aged from 20 to 70, of either sex satisfying selection criteria, undergoing elective upper limb extremity below mid humerus level with duration of operation less than 3 hours were selected. Patients were randomly allocated into two groups as follows;

1. Group A; Brachial plexus block using ultrasound guided
2. Group B; Brachial plexus block using nerve stimulator

**Exclusion Criteria** Were Patient refusal for consent or regional anaesthesia, Pregnancy, Pre-existing neuropathy involving the surgical limb, Systemic use of corticosteroids for  $\geq 2$  weeks within 6 months of surgery, History of allergy to drugs including local anaesthetics, Psychologically ill or mentally retarded patients, Infection at the site of injection. Significant uncontrolled systemic illness, Patients with ASA grade 3 and above and coagulopathies.

36 patients were given block with USG guided block (GROUP A) and another 36 patients were given with nerve stimulator. (GROUP B). A routine preoperative assessment of all the patients were done and after explaining the anaesthetic procedure informed consent were taken.

Preoperatively adequate fasting of 6 hrs were confirmed. In operation theatre Intravenous cannula were placed. Electrocardiogram, noninvasive blood pressure, pulse oximeter were applied. On operation table, under aseptic precaution patient were given the position for

brachial plexus block via supraclavicular approach, supine position with head resting on ring, ipsilateral arm adducted, shoulder depressed, roller pack placed in between scapula and head turned slightly to contralateral side. Under all aseptic and antiseptic precaution local site is prepared. Subclavian artery is palpated 1-1.5 cm above the mid clavicular point, immediately lateral to Sternocleidomastoid muscle and is pushed medially by the thumb.

In patients where the nerve stimulator using was connected to the stimulating needle and set to deliver a 0.5 to 1.0 mA current at 1 Hz frequency and 0.1 ms of pulse duration. The needle is inserted posterior, medially and caudally. The needle is slowly advanced under the palpating finger to elicit contraction of innervated muscle. Once the elicited motor response of the fingers was obtained at 0.5 mA, the injection of 25 ml of 0.5% ropivacaine was carried out after gentle aspiration.

In patients where the ultrasound machine is using were prepared and checked, a high frequency linear array ultrasound (9-18 MHz) is used. Clavicle is proper landmark which is easily felt in most of the patients. The probe was positioned in supraclavicular fossa just superior to the clavicle at mid point. The probe was moved

medially and laterally and also in rocking fashion in order to locate pulsating subclavian artery. The area lateral and superficial to subclavian artery were explored. The needle was inserted from lateral side of the probe first perpendicular to the skin to penetrate the skin and then at a shallow angle under the probe.

The needle was advanced inside ultrasound beam by inplane technique till the plexus is seen with characteristic honey comb appearance. The subclavian vein is medial and superficial to artery. Color Doppler can be used to confirm the vascular nature of vessels. Under USG view the pulsating subclavian artery was readily apparent, whereas the parietal pleura and first rib can be seen as linear hyper echoic structure lateral and deep to it respectively. The brachial plexus can be seen as a bundle of hypo echoic round nodules (grapes) just lateral and superficial to the artery. At this point injection of 15 ml of 0.5% ropivacaine were done following gentle aspiration and spread of drug and bulging of plexus were seen. During this volume of local anaesthetic agent (V), procedure time (Td) were noted. All patients were monitored for side effects like hypotension, bradycardia, nausea, vomiting, respiratory distress

Fig showing structures surrounding brachial plexus in supraclavicular approach<sup>4</sup>

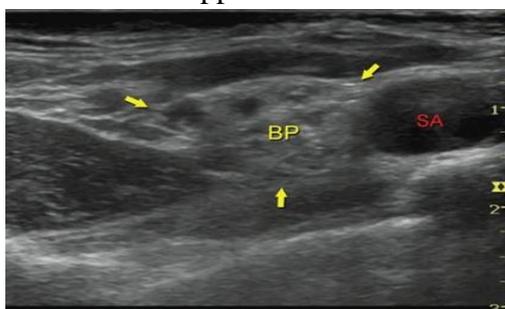


Fig showing nerve bundle, position of needle, and spread of drug.<sup>5</sup>



Motor power of block was assessed by asking patient to flex the forearm and hand against gravity and to abduct the shoulder

Data were analysed using computer software, statistical package for social sciences (SPSS)

version 10. Data are expressed in its frequency and percentage as well as mean and standard deviation. For all statistical evaluation, a two tailed probability of value  $< 0.05$  was considered

significant. Observations were represented both graphically and numerically

**RESULTS**

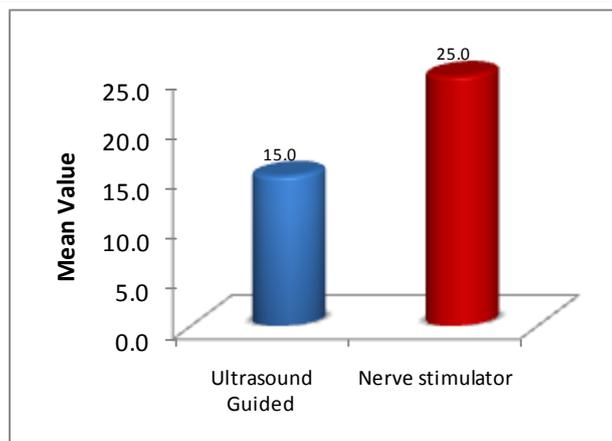
The two groups were comparable in terms of age, heart rate, spo2, side effects, volume of drug, procedure time.

36 cases of supraclavicular brachial plexus block was done with ultrasound guided method (group A) and 36 cases was done with nerve stimulator method (group B).

There was no significant difference between both groups as regard age, heart rate, spo2, and side effects.

Data are expressed as Mean ± SD. Table shows mean duration of procedure time in group A was lower than group B . As regard time of procedure in group A ,it was 5.1± 0.5 min and in group B it was 10.8 ± 1.7., there was a significant decrease in group A( shorter time) as compared to group B (P<0.05)

**Fig.1** Comparison of procedure time by using nerve stimulator based on group



**Table 1** Comparison of procedure time by using nerve stimulator based on group

Group	Mean	SD	N	t	P
Ultrasound Guided	5.1	0.5	36	19.13**	0.000
Nerve stimulator	10.8	1.7	36		

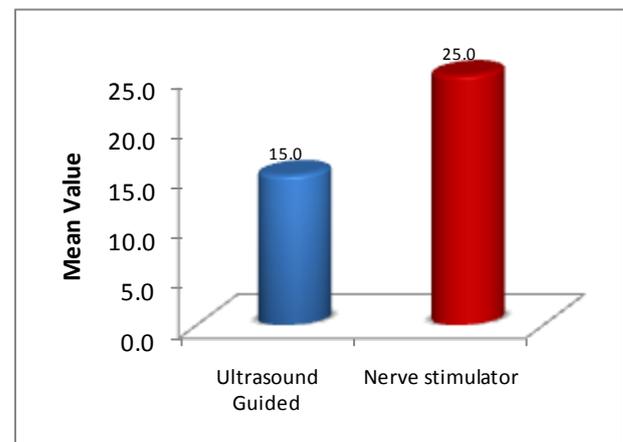
\*\*:- Significant at 0.01 level

Comparison of volume of drug between group A and group B shows that 15 ml drug was required for successful block in group A as compared 25 ml drug for group B, there was significant decrease in group A (ultrasound guided method) as compared to group B (nerve stimulator method)

**Table 2** Comparison of volume of drug based on group

Group	Mean	SD	N	t	P
Ultrasound Guided	15.0	0.0	36	-	-
Nerve stimulator	25.0	0.0	36		

**Fig. 2** Comparison of volume of drug based on group



**DISCUSSION**

In this study the efficacy and safety of two methods of supraclavicular brachial plexus block was assessed. In my study I found that using real time ultrasound could increase safety and efficacy of block. Ultrasound guidance permits a dynamic vision of nerves, vessels, muscles, needle movements, and allows the volume distribution to be controlled while with nerve stimulator a large volume to be injected is needed for effective and successful block. Mean time for performance of block and volume of drug are less with ultrasound guided method. Ultrasound guided block technique is safe as compared to nerve stimulator. Ahamed a. el daba et al studied ultrasonic guided supraclavicular brachial plexus block versus nerve stimulation technique<sup>10</sup> concluded that brachial plexus block with ultrasonography required shorter

duration of time, higher success rate with no complication. also support my study.

The data from other studies was consistent with my findings and suggestive of an improvement in block success rates with ultrasound nerve guidance,<sup>6,8</sup> also the lesser rate of complication within the ultrasound guided group is supported by other studies<sup>9</sup>.

In nerve stimulator technique drug is injected by seeing muscle twitches which is innervated by the nerve in which small and distal nerve may escape from the effect of the drug resulting in inadequate block.

### CONCLUSION

Supraclavicular brachial plexus block using ultrasound guided method is an improved nerve block technique due to visualization of nerves with more success, decreased complication rate, and less time consuming as compared to stimulator method., but requires thorough understanding of sonography and skill in operating ultrasound machine.

### ACKNOWLEDGEMENT

I am greatly thankful to our beloved Professor and Head of the Department Dr. Rajashekar for his valuable help and guidance he had offered during my endeavor to do this study.

I am also thankful to Dr. Muhammed Asharaf, Professor and Head of the Department of Orthopaedics for his valuable support.

It is with immense gratefulness, I am thanking my beloved teacher Dr.Latha.J., Associate Professor, Dr.Arun (Assistant professor) and Dr Jasmine.(PG student,) for their informal guidance and suggestions, which helped me in making this study in the right direction.

I express my sincere gratitude to Mr. ummen for the statistical works.

I owe a lot to Dr SinuSankar.M(my wife) LakshmiHari(my daughter) SuryaDev Hari(my son) for their manual/technical help provided throughout my study.

I express my sincere thankfulness to all the recovery room nurses, operation room technicians as well as all others whose help have been invaluable to me.

Last but not the least I thank all the patients who have willingly co-operated with me during this study.

Finally, but most importantly, I acknowledge my gratefulness to the God almighty and my mother for the constant presence and blessing that made all these efforts fruitful.

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