

Comparative study of ultrasound and ultrasound with peripheral nerve stimulator guided techniques for brachial plexus block in upper limb surgeries

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Abstract

Background: Interscalene brachial plexus block (ISBPB) is a well-established technique in anaesthetic practice with high success rate. Conventional methods include electric stimulation and patient-reported paraesthesia which rely on surface landmark identification in a semi-blind manner. Aim of the current study is to compare ultrasound alone versus ultrasound with peripheral nerve stimulator guided techniques for brachial plexus block in upper limb surgeries at a tertiary hospital. **Material and Methods:** Present study was single-center, prospective, comparative study, conducted in 18-60 years age patients of either gender, ASA grade 1/2, Mallampati grades 1 and 2, posted for elective upper limb surgeries. 100 patients were randomly allocated to one of the two groups of fifty patients in each. Group (U)- For ultrasound guided interscalene block and Group (UN) – For USG with nerve stimulator guided interscalene block. **Results:** There were no clinical or statistically significant differences in the age, weight and gender distribution of patients in either group and difference was not significant statistically. The mean time taken for the procedure to administer a block in group U was 7.63 min, whereas in group UN, the time required for the same was 8.2 min. This was clinically and statistically insignificant. Onset of block was within 4.5±1.5 min in group U and 4.2 ±1.4 min in B group. This was not clinically or statistically significant. The block was successful in 96% of patients in group U compared to 92% in group U+N. No Total failure of block occurred in both group was 4% in group U and 8% in group U+N. These were comparable both clinically and statistically. This was not statistically significant. There were no vessel puncture, nerve injury, hematoma, hemothorax happened in both the groups. **Conclusion:** The peripheral nerve block, when given with ultrasound with nerve stimulator, time and man power required more than block given with ultrasound alone. Even though time required more in ultrasound with nerve stimulator, this technique should be used in medical colleges for teaching purpose to master them regional block techniques. **Keywords:** peripheral nerve block, ultrasound, nerve stimulator, upper limb surgeries

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INTRODUCTION

An ever increasing demand for regional anaesthesia from patients and surgeons matches the growing realization that regional anaesthesia can provide superior pain management and perhaps improve patient outcomes to meet evolving expectations for ambulatory, cost-effective surgery.¹ The ideal in the practice of regional anaesthesia would be the ability to precisely deliver to the target nerve exactly the right dose of local anaesthetic without incurring any risk of damage to the nerve or its related structures taking in consideration that nerves are not blocked by the

needle but by the local anaesthetic around.² The introduction around 30 years ago of electric stimulation (ES) as an objective means for identifying needle- nerve proximity was an integral step towards transforming regional anesthesia into a ‘science’.³ Interscalene brachial plexus block (ISBPB) is a well-established technique in anaesthetic practice with high success rate. Different technical modalities are being used for identifying and locating the brachial plexus in the interscalene area. Conventional methods include electric stimulation and patient-reported paraesthesia which rely on surface landmark identification in a semi-blind manner.^{4,5} Apart from individual and anatomical variations, the success rate here is dependent on equipment accuracy. Ultrasound has also been used to visualize the spread of local anaesthetic from a catheter and to validate currently used landmarks.⁶ While electrostimulation-guided ISBPB is a well-established and well accepted procedure in routine daily clinical practice, the aim of the current study is to compare ultrasound alone versus ultrasound with peripheral nerve stimulator guided techniques for brachial plexus block in upper limb surgeries at a tertiary hospital.

MATERIAL AND METHODS

Present study was single-center, prospective, comparative study, conducted in department of anaesthesiology, at Dr. V M Government Medical College Solapur, India. Study duration was of 2 years (Sept 2018 to Sept 2020). Study was approved by institutional ethical committee.

Inclusion criteria: Age 18-60 years, of either gender, ASA grade 1/2, Mallampati grades 1 and 2, posted for elective upper limb surgeries.

Exclusion criteria: ASA grades 3 and more. History of serious pulmonary, coronary artery, or cervical spine disease and patients with bleeding diathesis with abnormal coagulation profile. Patient with h/o drug abuse with local skin site infections. Patients with pheochromocytoma, patients on b blocker, antidepressants, anticonvulsants, antipsychotics.

100 Patients were randomly allocated to one of the two groups of 50 patients in each. Group (U)- For ultrasound guided interscalene block and Group (UN) – For USG with nerve stimulator guided interscalene block.

Patients underwent routine pre-anaesthetic evaluation. Study was explained and informed / written consent was obtained from patients. Routine NPO protocols were followed. Intravenous line is secured on the opposite side of the limb undergoing surgery. Blocks were performed under standard monitoring with pulse oximetry, noninvasive blood pressure measurement, heart rate, ECG. With all aseptic precautions brachial plexus block was performed using 30ml of 0.33% bupivacaine plain anaesthetic drug by either of the approaches. Time taken to perform the block, Onset and duration of Sensory/ Motor neural blockade and need for supplementation of anesthesia and adverse effects if any were noted. Data was collected every 1 min for first 15mins. Next every 5 mins for 15mins and after the completion of surgery sensory and motor blockade was assessed every 30 mins till the complete recovery of blockade. Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. Difference of proportions between qualitative variables were tested using chi- square test or Fisher exact test as applicable. P value less than 0.5 was considered as statistically significant.

RESULTS

100 patients aged between 15 to 70 years posted for upper limb surgeries to compare the Ultrasound guided (Group U) and Ultrasound guided with peripheral nerve stimulator (Group U+N), interscalene block in terms of time taken for the procedure, success rate, completeness of block and complications. There were no clinical or statistically significant differences in the age, weight and gender distribution of patients in either group and difference was not significant statistically.

Table 1: Comparison of age and weight distribution between the two groups

Characteristics (Mean ± SD)	Group U	Group UN	P Value
AGE (years)	33.61 ± 12.82	35.35 ± 13.73	0.514
WEIGHT (in kgs)	62.33 ± 13.79	63.43 ± 13.82	0.6912
Gender			0.8199
Male	36	38	
Female	14	12	

The mean time taken for the procedure to administer a block in group U was 7.63 min, whereas in group UN, the time required for the same was 8.2 min. This was clinically and statistically insignificant. Onset of block was within 4.5±1.5 min in group U and 4.2 ±1.4 min in B group. This was not clinically or statistically significant

Table 2: General Characteristics

Characteristics (Mean ± SD)	Group U	Group UN	P Value
Time taken for the procedure (min)	7.63 ± 1.68	8.2 ± 1.92	0.117
Onset of sensory/motor blockade (min)	4.5 ± 1.5	4.2 ± 1.4	0.303

The block was successful in 96% of patients in group U compared to 92 % in group U+N. No Total failure of block occurred in both group was 4 % in group U and 8 % in group U+N. These were comparable both clinically and statistically. This was not statistically significant.

Table 3: Success rate and completeness

Characteristics	Group U	Group UN	P value
Success rate			
Totally Effective	48	46	P = 0.579 (Chi square test)
Partially Effective	2	3	
Completeness			
Totally Effective	44	42	0.5655 (Chi square test)
Partially Effective	6	8	

There were no vessel puncture, nerve injury, hematoma, hemothorax happened in both the groups.

DISCUSSION

Regional anaesthesia makes simple demand that the right dose of the right drug is to be given in the right place. Regional anesthesia techniques provide important advantages as compared to general anesthesia, including excellent pain control, reduced side effects, and shortened hospital stay after surgery.^{4,5} Brachial plexus block is an easy and relatively safe procedure for upper limb surgeries. The real time ultrasound guidance has been used to localize the peripheral nerve or plexus, accurate needle placement and verification of local anaesthetic spread in the appropriate tissue planes.^{4,5} Similar to present study, Bridenbaugh LD *et al.*,⁷ conducted upper limb block in 61 patients, mean age group was 31.23 and mean weight was 65.5. Capdevila X,⁸ performed peripheral nerve blocks in hospital wards after orthopedic surgery, noted that mean age was 33.3 years. Both studies are comparable to the present study. Present study shows that, 36 males and 14 females in group U, 38 males and 12 females in group UN. Both had male predominance. Chan VW.,⁵ study had 45 males and 35 females. Similarly Choyce A .,⁹ shows that in USG group 66 males and 55 females Present study shows that mean time taken to perform block under USG guidance is 7.63 minutes and under USG+NS guidance is 8.2 minutes. Comparison is done using t test and is statistically insignificant. ($p > 0.05$) (35) Similarly Mohamed Hamed Salem *et al.*,¹⁰ studied interscalene block comparing USG guided and nerve stimulator guided shows the mean time to for performing block is 7.8 min by USG and 8.88 min by NS. Likewise Sinha SK *et al.*,¹¹ interscalene block using USG shows that mean time to perm block is 8.88 min. Both study values are comparable to the present study This study shows that mean onset of block action in group U is 4.5 and group UN is 4.2. Both groups compared using test which is statistically not significant. Ting PL *et al.*,¹² in ultrasonographic Study of the spread of local anaesthetic during block showed onset

time is 6.6 min. which comparable this study. Present study shows that success rate under USG alone is 96% and USG with NS is 92%. Both are compared using chi square test and not significant statistically Similarly Mohamed Hamed Salem *et al.*,¹⁰ noted that success rate was 100 % in USG group. Soeding PE *et al.*,¹³ studied ultrasound guidance brachial plexus anaesthesia in upper limb surgery shows that success rate using USG is 98and. Both study results are comparable the present study. Present study shows that block is complete without any rescue analgesia, 88% in group U and 84% in group UN. Both are statistically insignificant. Hopkins PM *et al.*,¹⁴ noted that ultrasound guidance as gold standard in regional anaesthesia shows that completeness is 95% and which is comparable the present study. There was no nerve injury, vessel puncture happened in the both groups. (35)Hamed Salem *et al.*,¹⁰ study of interscalene block comparing USG guided and nerve stimulator guided shows there were no complications using USG guidance block. Ultrasound guidance has improved the success and decreased the complication rate in regional anaesthesia in general. The use of two-dimensional ultrasonic imaging to localize the brachial plexus has been highly successful in several approaches. Modern ultrasound machines are capable of imaging individual roots to their cords in the infraclavicular region. The sonographic image can be used to guide the injection needle while minimizing the risk of injury of adjacent structures.¹⁵

CONCLUSION

The peripheral nerve block, when given with ultrasound with nerve stimulator, time and man power required more than block given with ultrasound alone. Even though time required more in ultrasound with nerve stimulator, this technique should be used in medical colleges for teaching purpose in students to master them regional block techniques.

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