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EVALUATION OF DIFFERENT APPROACHES FOR ULTRASOUND GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK

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ABSTRACT

BACKGROUND: Brachial plexus blockade is a time tested technique for the upper limb surgeries.Ultrasound for supraclavicular brachial plexus block has improved the success rate of block with excellent localization as well as improved safety margin. **OBJECTIVE:** We performed this study to evaluate safety and clinical usefulness of ultrasound technology for different approaches for supraclavicular block. **METHOD:** We included 60 adult patients of either sex undergoing elective upper limb surgeries. Patients were divided randomly in two groups. In one group, conventional approach was used while in another group parasagittal approach was used. SCB was performed under ultrasound guidance. All patients received injection bupivacaine 0.5% 20 ml. (dose of bupivacaine will not exceed 2 mg/kg) **RESULT:** There was no significant difference between patients groups with regard to demographic data. The time taken for the block procedure was less in parasagittal approach as compared to conventional approach. The time of onset of sensory and motor block was equal in both groups. Success of the block and complications are comparable in both the groups. **CONCLUSION:** Ultrasound guidance is clinically very useful for supraclavicular brachial plexus block. Block performance time of ultrasound guided supraclavicular block via parasagittal approach was less as compared to ultrasound guided conventional approach.

KEYWORDS

Supracavicular brachial plexus block, ultrasound, upper limb surgeries, parasagittal approach.

INTRODUCTION:

Supraclavicular nerve block is ideal for procedures of upper arm, from midhumeral level down to hand. Brachial plexus is most compact at the level of trunks formed by C5-T1 nerve roots, so blockade here has greatest likelihood of blocking all of the branches of brachial plexus. But the proximity of the brachial plexus at this location to pleura has resulted in unacceptable high incidences of pneumothorax which has been of concern to many practitioners.[4]

Ultrasound guided regional anaesthesia is a growing area of both clinical and research interest.11 Ultrasound in regional anaesthesia offers a new standard in nerve location and identification, allows real time imaging of nerves and direct needle guidance.10 The first description of ultrasound guided blocks were in the supraclavicular region.

Ultrasound provides an opportunity to visualize individual typical and atypical anatomy. This technology is applicable to most patients requiring regional anesthesia and may be particularly useful in patients with obscure anatomic landmarks, coagulopathy, neural pathology, and severe extremity trauma.11 Ultrasound location offers the opportunity to improve success, reduce complications, and enhance teaching of regional anaesthesia.[10]

Among the various approaches for ultrasound guided supraclavicular brachial plexus block we compared conventional versus parasagittal approach. A conventional supraclavicular approach with probe resting parallel and posterior to clavicle, provides very stable location but has the disadvantage of looking across the first rib, with the apex of the lung visualize close to the brachial plexus. Parasagittal approach had advantages like easy to perform, less chances of pneumothorax and reduction in requirement of local anaesthetic volume. The use of ultrasound in regional anaesthesia makes its future bright by converting it from blind procedure to under vision and making it safer.

MATERIALAND METHOD:

After approval by the institutional review board, total 60 adult patients who satisfied the inclusion and exclusion criteria, undergoing surgeries for upper limb were selected for the studies. Written informed consent obtained from each patient.

Patients of either sex, aged between 18 to 60 years, with the American society of anaesthesiologist (ASA) classes I and II posted for elective upper limb surgeries were included in the study.

A patient who refuses, age >18 years and <60 years of age, with significant coagulopathy, peripheral neuropathy, ASA III and IV patients, allergy to local anaesthetics, emergency surgical procedures were excluded from study.

Patients were divided randomly into two groups. Each group included 30 patients. In Group A (n=30) USG guided supraclavicular block performed via conventional approach and group B (n=30) USG guided supraclavicular block performed via parasagittal approach.

All patients were undergo routine pre-anaesthetic check up and necessary investigations done. All the patients were fasted for 6 hours before surgery. In the operation theatre, patients were monitored with pulse oximetry, non invasive blood pressure, and electrocardiogram. No other sedation was given till the evaluation of block was completed. The respective equipement was kept ready, and the drugs were loaded maintaining sterility. The drugs used was injection bupivacaine 0.5% 20 ml. The amount of local anaesthetic injected was calculated according to body weight and not crossing the upper limit of the toxic dosage. The patients were positioned supine with the arms by the side, and head turned to the opposite side by 45 degree. The proposed site of the block was aseptically prepared and draped.

In Group A patients ultrasound guided supraclavicular block was given with conventional approach (probe position is parallel and posterior to clavicle) and group B patients were given ultrasound guided supraclavicular block by parasagittal approach (probe position was vertical or perpendicular to clavicle). Block was performed after real time visualization of vessel, nerve and bone. Using 10 ml syringe containing LA was injected and the drug distribution was noted. This procedure was done using sonosite HM ultrasound machine available with high frequency linear 38/6- 13 MHz transducer and 38 mm linear array probe using 1.5 inch 22 gauge block needle.

Time taken for the procedure, onset of sensory blockade, onset of motor blockade, success of block and complications like blood aspiration, pnemothorax, pain while injecting drug at initiation of block procedure were noted and compared between two groups.

Grading of sensory blockadge:
1. Normal sensation of pinprick
2. Pinprick felt as sharp pointed but weaker compared with same area in upper limb

3. Pinprick recognized as touch with blunt object
4. No perception of pinprick

Grading of motor blockadge:
1. Normal muscle function
2. Slight weakness in function
3. Very weak muscular function
4. Complete loss of muscle action

Success of block was defined as grade 4 sensory and motor blockadge.

Statistical analysis: For statistical analysis SPSS version 20 was used. Results were analysed using chi square and fisher's exact tests.

Results:
There were no significant difference in both the groups with respect to demographic data as shown table 1.

TABLE 1: DEMOGRAPHIC DATA

Variable	Classical approach	Parasagittal approach
Sex (M:F)	16:14	12:18
ASA (I:II)	24:6	26:4
Age (years)	31.0±9.70	30.9±7.99
Weight (kg)	59.56± 8.18	58.4±7.076

TABLE : 2 TIME TAKEN FOR THE BLOCK PROCEDURE

Approach	Time taken to perform block (minute)		p Value
	Mean	SD	
Classical	8	0.93	p <0.0001
Parasagital	6	1.04	

Time to perform block in classical approach was 8±0.93 minute and in parasagittal approach was 6±1.04 minute, on comparing both groups, the difference was statistically significant (p<0.0001) as shown in table 2.

Table 3: TIME FOR ONSET OF SENSORY AND MOTOR BLOCK

Parameter	Time for onset of block(min)		p Value
	Classical	Parasagital	
Sensory	11±1.0	11±0.9	p =1.000
Motor	14±1.51	14±1.25	p =1.000

Time for onset of sensory block in classical approach was 11±1.0 minute and in parasagittal approach was 11±0.9 minutes. There was no significant difference in both the group.

Time for onset of motor block in classical approach was 14±1.51 minute and in parasagittal approach was 14±1.25 minute. There was no significant difference in both the group.

There was no complications noted in both the group. Failed block requiring general anaesthesia was nil in either group.

DISCUSSION:
The supraclavicular block has the most wide spread extent of sensory blockade among all the brachial plexus approaches, but the potential risk of pneumothorax has decreased its popularity, particularly with the increased development of ambulatory surgery. The improved safety afforded by ultrasound location and in particular the visualization of pleura and needle position has been the turning point in the increased use of this approach. The block is ideal in providing a dense, rapid onset, and efficient anaesthesia and analgesia for procedures from mid humerus proximally, to those performed on the hand distally. The plexus is usually easily visualized with ultrasound at this position lying in close proximity to the subclavian artery.[12]

In classical approach probe resting parallel and posterior to clavicle, provides a stable location but had the disadvantage of "looking" across the first rib with the apex of the lung is visualized close to the brachial plexus as compared to parasagittal approach. The results of this prospective study suggest that the parasagittal approach for supraclavicular brachial plexus block is a clinically useful and safe technique for accurate nerve localization. This approach improves the speed of execution and quality of supraclavicuar block.

There have been various ultrasound guided approaches described for supraclavicular brachial plexus blockade. Kapral et al[7] imaged the plexus 3 cm superior to the midpoint of the clavicle in the sagittal plane. The needle orientation relative to the ultrasound probe was not described. De Andres et al[1] utilized an out of plane approach to the plexus in the sagittal plane. The disadvantages with the out of plane approach include difficulty in visualizing the needle tip with the resultant increased risk of inadvertent arterial or pleural puncture. Perlas and Chan et al[5] utilized a coronal oblique plane with the ultrasound probe placed parallel and immediately posterior to the clavicle. The needle was advanced in plane from either medial to lateral or lateral to median direction after visualising a short axis view of the brachial plexus and the subclavian artery. The medial to lateral approach was associated with risk of arterial puncture in the region of 0.4%.

The parasagittal approach described here enables the operator to locate the arc of the first rib and the apex of the pleural dome. Most supraclavicular approaches rely, upon the first rib for safety. Visulisation of the arc of the first rib in the plane of the ultrasound beam and needle creates a secure deep safety feature. At this anatomical point, the subclavian vein is well separated from the brachial plexus and the subclavian artery, with the plexus positioned posterior to the artery. There are therefore no major structures of concern in the needle path before the needle approaches the brachial plexus. An in plane approach helps in visualising the needle shaft and more importantely, the needle tip. By approaching the plexus in a nearly horizontal plane to the ultrasound beam except in very deep cases, the reflection back to the probe is maximized, giving a clear image of the needle. This technique ensures that the needle tip does not trespass the first rib or the pleural dome thereby theoretically eliminating the risk of pneumothorax. Adrian Searle et al[9] studied usg guided parasagittal approach for brachial plexus block.

Time taken for block procedure in our study was 8±0.93 in classical and 6±1.04 in parasagittal approach. Results were similar to Kiran et al[3] Studied. 9.96 min for block procedure in USG classical apporch. Adrian et al[9] observed. 4 ± 1.5 min taken for block procedure by Parasagittal approach.

In present study onset of sensory block and motor block was not statistically significant. Stephan r Williams et al[2] found similar results that the onset of motor blockade paralleled that of sensory blockade.In the present study both the group did not have any of the mentioned complications because usg provides direct visualization of vessels around the plexus and also needle path. Similar results were found to Stephan kapral et[7] al in their study. Yuan jian min et al[8] studied complications of usg and pns guided brachial plexus block and he found that usg decreases risk of complete hemidiaphragmatic paresis or vascular puncture and improves success rate of block.

In our study, success rate of block procedure was 100% and patients required general anaesthesia was nil in either group. Chan et al[8] in their study in 40 patients also reported 95% success rate using ultrasonic guidance for supraclavicular block. Hopkins PM[6] demonstrated an improved success rate using ultrasound guidance for any regional anesthesia technique.

In conclusion, parasagittal approach to the supraclavicular plexus described here enhances visualization of the structures in the supraclavicular fossa, is associated with a rapid onset time using a smaller volume of local anaesthetic agent, no need for nerve stimulation, and an excellent success rate with theoretically minimal risk of pnemothorax.

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