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ORIGINAL RESEARCH

A comparative study of ultrasound guided supraclavicular brachial plexus block and ultrasound guided interscalene brachial plexus block for surgery around shoulder joint

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ABSTRACT

Introduction: The ultrasound guided supraclavicular brachial plexus block and ultrasound guided Interscalene brachial plexus block both are used for surgery around shoulder joint. Supraclavicular block has proved to provide the same effect as with interscalene block. Ultrasound guided supraclavicular block has lower incidence of hoarseness of voice or horner`s syndrome. The ultrasound guided interscalene brachial plexus block is seems to be a standard technique for surgery around shoulder joint. However, the interscalene block may cause unilateral diaphragmatic paralysis. If compared to interscalene block, supraclavicular block can provide effective anaesthesia for surgery around shoulder joint, with less side-effects. Thus, we decided to perform a randomized double blind study to compare ultrasound guided supraclavicular brachial plexus block with interscalene brachial plexus block. **Aims and objectives:** In current randomized double blind study we compared ultrasound guided interscalene block and ultrasound guided supraclavicular block for surgery around shoulder joint. **Methods and materials:** In this prospective randomized double blind comparative study, we enrolled 60 ASA grade 1 or 2 patients who were posted for elective or emergency surgeries around shoulder joint under ultrasound guided brachial plexus block into one of the two groups, as shown in computer generated random number table. Group A patients were given ultrasound guided interscalene brachial plexus block and group B patients were given ultrasound guided supraclavicular brachial plexus block**. Result:** No significant difference was noted in demographic parameters between the groups. Time required for performing block was longer in group B when compared to group A which was statistically significant. Incidence of horner's syndrome, phrenic nerve palsy and hoarseness of voice were high in group A when compared to group B which was also statistically significant. **Conclusion:** If summarized, ultrasound guided supraclavicular brachial plexus block is a very effective technique for surgery around shoulder joint with lower incidence of complications. Thus, ultrasound guided supraclavicular brachial plexus block can be used as an alternative method for surgery around shoulder joint.

Keywords: Ultrasound, Supraclavicular block, Interscalene block, Shoulder surgery.

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INTRODUCTION

Both general anesthesia as well as regional anesthesia can be used for shoulder surgeries with risks and benefits of both the techniques.[1] Many surgeries around the shoulder joint such as total shoulder replacement, hemiarthroplasty, shoulder arthroscopy, subacromial decompression, shoulder herbert screwing, rotator cuff repair etc are performed under general anesthesia or brachial plexus block.[2] There are many techniques for blocking the brachial plexus such as supraclavicular, midclavicular, interscalene, axillary and infraclavicular approaches.[3-7] The interscalene approach of brachial plexus block is the gold standard for shoulder anesthesia and the most commonly used procedure for shoulder surgeries.[8] Interscalene approach blocks the brachial plexus nerves at the C5–C6 nerve root or superior trunk level. The approach is very useful for procedures involving the shoulder joint and the fracture of clavicle, neck of humerus etc.[8] The supraclavicular

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approach of brachial plexus block is simply known as the "spinal anesthesia of the upper extremity". The high success rate of this approach is due to its characteristic anatomy. This block is performed at the level of the termination of trunks and initiation of the divisions where the surface area of the brachial plexus is smallest.[9] This compact structure of brachial plexus may explain the reason for the block's effectiveness of providing anesthesia for the whole upper extremity in comparison to other approaches of brachial plexus block. [10]

AIMS AND OBJECTIVES

The aim of this prospective randomized double blind study was to compare both the approaches of brachial plexus block using ultrasound in patients posted for surgeries around the shoulder joint. Primary outcome of the study was the comparison of success rate, whereas secondary outcomes were block performance time, duration of analgesia, complications observed with each technique and heart rate changes during procedure in both approaches.

METHODS AND MATERIALS

After the approval of Institutional Ethical Committee, this prospective, randomized, double blind comparative study was done in Department of Anaesthesiology VAMCRH banthara shahjahanpur, 60 patients of American Society of Anesthesiologists Class I or II posted for elective or emergency surgeries around shoulder joint were randomly allocated into two groups of 30 each, named group A and group B . Group A patients were given 20 ml of 0.5% levobupivacaine in brachial plexus using ultrasound guided interscalene approach and group B patients were given 20 ml of 0.5% levobupivacaine in brachial plexus using ultrasound guided supraclavicular approach. Success rate, block performance time, duration of analgesia, complications and heart rate changes were noted in both the groups. The patients were explained about the procedure and the advantages of postoperative analgesia over general anesthesia, with this technique. Patients with known hypersensitivity to the study drug, patients on anticoagulant drugs or deranged coagulation profile, patients with infection at the site of block and any bony deformity, patients with documented evidence of preoperative diaphragmatic paresis or chronic lung disease, ptosis or preoperative hoarseness of voice were excluded from the study. Written informed consent was obtained from all the patients and local anesthetic sensitivity testing was done. Randomization was done by computer generated random number table and allocation of the cases by the sealed envelope technique. When the patient reached in the operation theater, the numbered envelope was given to an anesthesiologist who was going to administer the block and was not taking part in the study. The anesthesiologist opened the envelope and administered the block to the patients accordingly. Both blocks were performed with 20 ml of 0.5% injection levobupivacaine using a 22 G 5 cm needle. The ultrasound used was Sonosite M-Turbo linear probe. After securing an intravenous line with 18 G cannula in the dorsum of opposite upper limb, monitors were attached and baseline pulse rate, respiratory rate, and blood pressure were recorded.

For supraclavicular brachial plexus block, after strict aseptic precautions, at a point 1.0 to 1.5 cm posterior and cephalad to midpoint of clavicle, subclavian artery pulsation was felt. The skin was anesthetized with local anesthetic agent, just posterior and superior to the pulsations of subclavian artery. After preparing ultrasound machine, a high frequency linear probe was positioned in supraclavicular fossa using clavicle as a landmark and pulsation of the subclavian artery was identified. The area lateral and superficial to subclavian artery, brachial plexus was identified as honey combing structure. The needle was inserted from lateral side of probe and advanced towards the ultrasound beam by in plane technique till the plexus was visualized. [20] Following negative aspiration, 20 ml of 0.5% levobupivacaine was injected.

For interscalene brachial plexus block, anterior and middle scalene muscles were identified. A high frequency linear probe moved towards the head in groove between two scalene muscles until the nerve plexus is visualized in the groove. The needle was inserted in plane from lateral to medial, approached towards the groove and advanced towards nerve root under ultrasound guidance avoiding intraneural injection. After ensuring negative aspiration, 20 ml of 0.5% levobupivacaine was injected to bath the nerve roots in interscalene groove.

Fifteen minutes after giving the block, sensory and motor block was assessed over surgical area of interest.

The onset of sensory block was defined as the time between injection and complete loss of pin prick sensation in C_2 to T_2 dermatome. The time when complete sensory blockade achieved was noted. Sensory blockade was graded as-[0= Sharp pin prick sensation felt, 1= dull pin prick sensation felt, 2=No pin prick sensation felt].[8]

Motor block was assessed by bromage three point score [0 = normal motor function with full flexion and extension of elbow, wrist and fingers, 1= decreased motor strength with ability to move wrist and fingers only, 2= complete motor paralysis with inability to move wrist or fingers]. The time when complete motor paralysis achieved was noted.[8]

Block success was defined by complete paralysis of muscles after which surgery was allowed to proceed. If 30 min after giving the block, the sensory and motor blocks were inadequate, the block was considered to have failed block and general anesthesia was given to complete surgery. Block performance time was defined from entry of needle to the termination of injection. Intraoperatively if patient complaint of pain, it was managed by giving injection

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ketamine 0.5 mg/kg intravenously. Duration of surgery was defined as the time from skin incision till closure of the skin wound. Ten minutes after giving the block, all the patients were evaluated for any complication related to the block. Horner's syndrome was checked by looking for ptosis, miosis and anhidrosis, phrenic nerve palsy was evaluated by looking for bilateral movement of the chest wall, vascular puncture was confirmed if there was visible blood in the syringe or any hematoma at the site of the injection and hoarseness of voice was checked by talking to the patient. The severity of postoperative pain was assessed on the basis of the visual analog scale (0–10), where 0 indicates no pain and 10 indicates worst possible pain.[10] When the visual analog scale assessed >4 rescue analgesia was given in the form of injection tramadol 2mg/kg intramuscularly . The duration of analgesia was calculated from the onset of sensory block till the patient demanded first rescue analgesia.

STATISTICAL ANALYSIS

The data obtained from this study was systematically collected, compiled and statistically analyzed. Descriptive and inferential statistical analysis were derived from data on continuous measurements, presented as mean ± SD while data on categorical measurements were presented in numbers. Student t test was used to find the significance of the study parameters on a continuous scale between 2 groups.

The *p* value was determined to evaluate the level of significance, $p<0.05$ was considered as significant at 5% significance level, while $p<0.01$, significant at 1% was considered as highly significant. Chi Square test or Fisher's exact test was used to find the significance of the study parameters on the categorical scale where ever applicable between two groups.

The statistical data analysis was done by Microsoft Excel 2024 and Microsoft Word 2024 it was used to generate graphs, charts and tables.

The data were entered on a Microsoft Excel spread sheet and imported into Statistical Package for Social Sciences version 23 for statistical analysis.

OBSERVATIONS AND RESULTS

In this study group A and group B were comparable in terms of age, sex distribution, body weight, ASA grade and duration of surgery. There was no statistically significant difference was observed between two groups ($p>0.05$). (Table no. 1)

In this study there was no statistically significant difference was found among two groups in respect to success rate, procedure time, sedation requirement and duration of analgesia ($p>0.05$).(Table no. 2)

In this study the incidence of complications like Horner's syndrome, hoarseness of voice and respiratory distress was significantly higher in group A in comparison of group B ($p<0.01$). (Table no. 3)

In our study the pulse rate was within normal limits preoperatively, intraoperatively and postoperatively and it was comparable in both the groups ($p>0.05$). (Figure 1)

Table 1: Demographic Profile

Parameters	Group A (n=30)	Group B (n=30)	*p*-value
Age (Years)	39.16±9.47	38.8±11.28	0.863
Weight(Kg)	63.78±13.8	65.23±12.6	0.657
Gender (M/F)	11/39	10/40	0.486
ASA (I/II)	41/09	40/10	0.783
Duration of surgery (Min.)	71.64±26.8	72.86±27.6	0.823

Table 2: Efficacy

Parameters	Group A (n=30)	Group B (n=30)	*p*-value
Success rate	29/30	28/30	0.863
Procedure time (min)	5±1	4±1	0.657
Sedation requirement	11/29	16/28	0.486
Duration of analgesia (hours)	12±2	14±3	0.823

Table 3: Complications

Parameters	Group A (n=30)	Group B (n=30)	*p*-value
Hoarseness of voice	7/29	0/28	0.01
Respiratory distress	6/29	5/28	0.01
Horner`s syndrome	8/29	0/28	0.01

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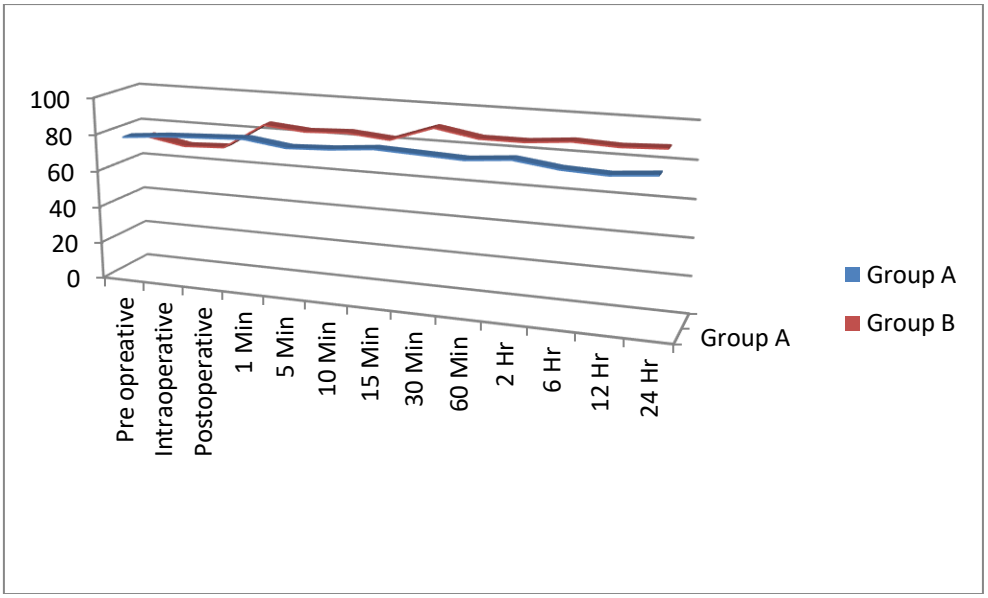

Figure 1: Comparison of heart rate.

DISCUSSION

Both general anesthesia and regional anesthesia are used for shoulder surgeries with risks and benefits of both the techniques.[1] Many studies have demonstrated the effectiveness of brachial plexus block for shoulder surgeries.[11-13] Supraclavicular brachial plexus block is indicated in the surgeries below the shoulder, as it is performed at more caudal level than interscalene brachial plexus block. The proximal nerve roots including the suprascapular nerve and the cervical plexus which supply the shoulder joint tend to be spared in supraclavicular block.[14] The probable explanation for adequate surgical analgesia provided by the supraclavicular brachial plexus block for shoulder surgeries is the cephalad migration of the drug between the anterior and middle scalene muscle due to the "chimney effect."[18] Abdelhaq et al in their study compared 20 ml, 15 ml and 10 ml local anesthetic solution in ultrasound guided interscalene block and supraclavicular block and found that the onset of sensory and motor block as well as duration of analgesia and motor block were maximum with 20 ml drug. [19] In our study, the success rate of the blocks was comparable in both the groups which corresponds to the study conducted by Kim et al.[20] Procedural time was found to be more in supraclavicular group in the study conducted by Ryu et al,[21] which is similar to our findings. In our study the duration of analgesia was not statistically different between the groups, with results of 12.32 ± 2.27 hours for the group A versus 14.19 ± 3.13 hours for the group B, which is in accordance with previous studies. [15-18] Kim et al.[20] ,Ryu T et al.[21], Wiesmann et al [22], Singh R et al.[23] and Auyong DB et al.[24] also compared the supraclavicular block and the interscalene block regarding analgesic quality for shoulder surgery and concluded that both the blocks provided comparable pain relief during the first 24 h after surgery. In our study, the incidence of Horner's syndrome was significantly higher in group A as compared to group B. Our findings were verified by the results of the various studies conducted by other researchers .[25-30]

In our study the incidence of respiratory distress due to accidental unilateral phrenic nerve block after supraclavicular block was reported to be lower than after interscalene block which was statistically significant and was explained by previous study by Koh et al. [31] and KessLer J et al.[32]

The phrenic nerve is situated in close relations to the brachial plexus at the cricoid cartilage level and separates more anteriorly, while moving away from the brachial plexus as it travels caudally.[32] In our study, the incidence of hoarseness of voice was more in group A, when compared to group B which was statistically significant and it coincides with the results obtained in the previous study by Liu et al.[33] There was no incidence of vascular puncture in both groups. Like other studies this study also has various limitations. firstly, using various adjuvants to levobupivacaine could have helped us to increase the duration of analgesia as observed by krishan G et al. [7,25-30] Secondly, pulmonary function test may have helped us to select type of anesthesia and to exclude the patients from study to avoid undue complications of brachial plexus block.

CONCLUSION

Once general anesthesia was the choice for shoulder surgery but now a days knowledge of regional anesthesia has changed the myth.Ultrasound guided interscalene brachial plexus block is the choice of most anesthetists but our study shows that ultrasound guided supraclavicular brachial plexus block is equally effective and provides similar operative conditions and duration of analgesia without known side effects of ultrasound guided Interscalene

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brachial plexus block for shoulder surgeries. Thus ultrasound guided supraclavicular brachial plexus block can be used as a safer alternative to general anesthesia or ultrasound guided interscalene brachial plexus block for shoulder surgeries.

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