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A COMPARISON OF ULTRASOUND GUIDED SUPRACLAVICULAR BLOCK AND INFRACLAVICULAR BLOCK USING COSTOCLAVICULAR APPROACH FOR UPPER EXTREMITY SURGERY

Anaesthesiology

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ABSTRACT

Brachial plexus block through USG guided Supraclavicular or Infraclavicular approach is a commonly used anesthetic technique for Upper Extremity surgeries. Recently, utilization of costoclavicular space for infraclavicular block has been suggested as a suitable approach for brachial plexus block with various beneficial advantages. **Objective:** The present study is proposed to compare the efficacy of USG guided Supraclavicular and Costoclavicular blocks for upper extremity surgery. **Methodology:** Seventy ASA Grade I/II patients scheduled to undergo upper extremity surgery will be randomised either to ultrasound-guided costoclavicular approach of infraclavicular block (Group A) and supraclavicular block (Group B) respectively. All patients will be assessed for block success, onset time, sensory and motor block scores, duration of block, post-operative pain and need for rescue analgesic. Data will be analyzed using Statistical Package for Social Sciences (SPSS) version 21.0. Independent samples 't'-test, paired 't'-test, Mann-Whitney U test, Wilcoxon signed rank test and chi-square test will be used . **Result:** Onset Time: Group A (6.00 min median) vs. Group B (7.00 min median). Mean onset time (6.23 min vs. 6.63 min) was not significantly different ($p = 0.119$). Block Duration: Group B had slightly longer motor (357.43 min vs. 347.71 min) and sensory (400.86 min vs. 388.57 min) blocks, but differences were not statistically significant. Rescue Analgesia: First dose timing was similar between groups (Group A: 564.00 min vs. Group B: 570.00 min, $p = 0.612$). Pain Scores: At 12 hours, Group B had higher pain scores (2.00 vs. 1.83, $p < 0.05$). Other time points showed no significant differences. Satisfaction: No significant difference in satisfaction, with most patients being satisfied (Group A: 65.7%, Group B: 68.6%). **Conclusion:** No significant differences were found between the groups in terms of block onset, duration, or satisfaction, but Group B had slightly higher pain at 12 hours post-procedure.

KEYWORDS

INTRODUCTION

Regional anesthesia for upper limb surgery offers significant benefits. These benefits include superior intraoperative pain control, attenuation of the surgical stress response, minimal systemic impairment, lower incidence of postoperative nausea and vomiting, excellent localized postoperative analgesia, and decrease hospital discharge time and cost[..].

The regional anesthesia for upper extremity surgeries can be achieved by brachial plexus block above the clavicle (interscalene or root level block and supraclavicular or trunk level block) or below the clavicle (infraclavicular or cord level block and axillary or branch level block).

In the recent years, ultrasound-guided regional blocks have emerged as a choice for regional anaesthesia. The advantages over conventional guidance techniques, such as nerve stimulation and loss-of-resistance procedures, are significant. They have fewer complications such as 'pins and needles' or accidental punctures of blood vessels. Thus, USG guidance shortens the block performance time, reduces the number of needle passes and shortens the block onset time. USG guided blocks may be performed using lower LA doses too[..].

Both supraclavicular and infraclavicular brachial plexus blocks, using ultrasound (US) guidance, have demonstrated their high effectiveness for upper extremity surgery[.....].

Infraclavicular brachial plexus block (ICBPB) is traditionally performed at the lateral infraclavicular fossa (LIF) where the cords of the brachial plexus lie deep to the pectoral muscles and adjacent to the second part of the axillary artery. However, at the LIF, the cords are separated from one another, there is substantial variation in the position of the individual cords relative to the axillary artery[.], and all 3 cords are rarely visualized in a single ultrasound window[xv]. Furthermore, the tip of a catheter, placed at the LIF, is unlikely to lie close to all the cords. Therefore, relatively large volumes of local anesthetic[] and/or multiple injections are used to produce successful brachial plexus blockade[xvi] and secondary catheter failure is not uncommon, even with ultrasound guidance. To overcome these problems, recently, Karmakar and Sala-Blanch (2015) described the use of costoclavicular space for the purpose of infraclavicular block.

The costoclavicular space lies deep and posterior to the midpoint of the clavicle. It is bound anteriorly by the subclavius and clavicular head of the pectoralis major muscle and posteriorly by the anterior chest wall[xix]. The space is continuous cranially with the supraclavicular fossa and caudally with the medial infraclavicular fossa above the superior border of the pectoralis minor muscle[xix]. The axillary vessels and cords of the brachial plexus traverse this space, with the vessels lying medial to the cords. The cephalic vein also passes through the deltopectoral fascia at the deltopectoral groove to join the axillary vein from a lateral to medial direction at the lower part of the costoclavicular space. At the costoclavicular space, and in contrast to that at the LIF, the cords are relatively superficial[19], clustered together[xix,xx] , exhibit a triangular arrangement[xix] and share a consistent relationship with one another[xix,xx]. In the sagittal plane, the lateral cord is located anterior to the posterior and medial cords, the posterior cord is cranial to the medial cord, and all 3 cords are cranial to the axillary artery[xx].In the transverse plane, the cords of the brachial plexus are located lateral to the first part of the axillary artery[xix].

The anatomical arrangement of the cords at the costoclavicular space makes it an attractive site for ultrasound imaging. The local anesthetic can be injected at a single site thus resulting in a very rapid onset of brachial plexus blockade similar to that seen with a supraclavicular approach but without the occasional sparing of the nerves of the lower trunk[xviii]. The costoclavicular space also acts as a useful site for brachial plexus catheter placement. Moreover, because the distal end of the catheter is wedged in an "intermuscular tunnel," between the subclavius and serratus anterior muscle, this may help secure the catheter in situ and reduce the risk of dislodgement that is common with supraclavicular catheters[xviii]

Considering these reported advantages USG guided infraclavicular block using costoclavicular approach seems to be an attractive choice for brachial plexus block for upper extremity surgeries. However, being a relatively newer approach there is limited clinical evidence evaluating the usefulness of this approach and its relative superiority to USG guided supraclavicular block.

Hence, the present study was planned with an aim to evaluate the USG guided supraclavicular block with USG guided infraclavicular block using costoclavicular approach for their usefulness in upper extremity

surgeries.

MATERIAL AND METHODS

The randomised control trial was conducted at Dr. K.N.S Memorial Institute of Medical Sciences, Barabanki, Uttar Pradesh patients with physical status ASA I or ASA II were randomized into 2 groups containing 35 patients in each group. Group A: patients undergoing surgery using USG guided infraclavicular block using costoclavicular approach. Group B: patients undergoing surgery using USG guided supraclavicular block using costoclavicular apprproach.

The Sensory assessments were performed every 10 min after needle removal for 30 min. The sensory score for each nerve was documented as: anaesthesia – 2 points, analgesia – 1 point and pain – 0 point. In case of doubt, the other arm was pinched for comparison. Motor block was only assessed at 30 min as: complete – a limp hand and elbow, or incomplete/ poor – partial/normal movements. After 30 min, the unblocked median, radial, ulnar and musculocutaneous nerves were imaged either at the elbow or midhumerally and supplemented. In the immediate post-operative period, patients were asked about the occurrence and the intensity of surgical and/or tourniquet pain. The time for first analgesic request and supplemental analgesic requirements over 24 h was recorded after surgery, the patients were asked to rate on a three-point scale about their satisfaction with pain management 1 - highly satisfied, 2 - satisfied, 3 - dissatisfied.

Statistical Analysis:

The data was entered in an MS-Excel 2013 worksheet. Data analysis was performed using IBM SPSS Stats 21.0 version. Chi-square test and Independent samples 't'-test were used to compare the data. A 'p' value less than 0.05 was considered as statistically significant.

RESULTS

Patients were randomly divided into two equal groups with the help of Computer generated random number tables. Out of the total 70 patients enrolled in the study, a total of 35 (50%) patients underwent USG guided infraclavicular block using costoclavicular approach comprised Group A of the study while remaining 35 (50%) patients underwent USG guided supraclavicular block comprised Group B of the study.

Time of onset among patients of Group A ranged between 4.00 & 8.00 minutes (median 6.00) while that in Group B was 5.00 & 9.00 (median 7.00). Though mean onset time of patients of Group B (6.63±1.09 min) was found to be higher than that of Group A (6.23±1.03 min) but this difference was not found to be statistically significant (p=0.119) as depicted in Table 1 and Fig 1.

Table 1: Between Group Comparison of Onset Time (Minutes)

Group	No. of patients	Min.	Max.	Median	Mean	S.D.
Group A	35	4.00	8.00	6.00	6.23	1.03
Group B	35	5.00	9.00	7.00	6.63	1.09
Total	70	4.00	9.00	7.00	6.43	1.07

't'=1.579; p=0.119

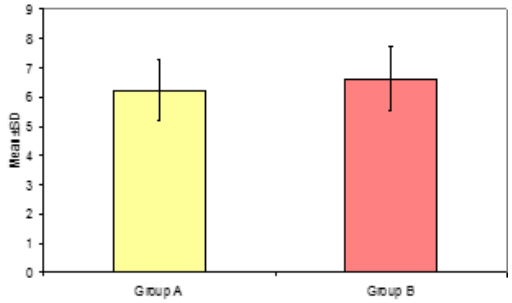

Fig 1: Between Group Comparison of Onset Time (minutes)

Mean duration of motor block among patients of Group B (357.43±27.05 minutes) was longer as compared to Group A (347.71±24.63 minutes) but this difference was not found to be statistically significant. Similarly mean duration of sensory block among patients of Group B (400.86±31.00 minutes) was longer as compared to Group A (388.57±26.14 minutes) but this difference was not found to be statistically significant.) as depicted in Fig 2.

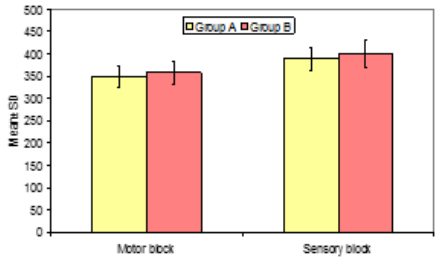

Fig 2: Comparison of Duration of Motor Block and Sensory Block (minutes) between the two groups

It was observed that minimum time of first dose of rescue analgesia among patients of Group A and Group B were 480 minutes and 380 minutes. Median duration of time of first dose of rescue analgesia was 560 minutes in both the groups. Difference in mean time of first dose of rescue analgesia among patients of Group A (564.00±39.87 minutes) and Group B (570.00±57.24 minutes) was not found to be statistically significant (p=0.612).as depicted in Table 2 and Fig 3.

Table 2: Between Group Comparison of Time of First dose of Rescue Analgesia

Group	No. of patients	Min.	Max.	Median	Mean	S.D.
Group A	35	480	640	560.00	564.00	39.87
Group B	35	380	640	560.00	570.00	57.24
Total	70	380	640	560.00	567.00	49.06

't'=0.509; p=0.612

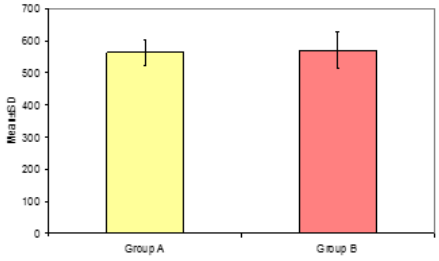

Fig 3: Between Group Comparison of Time of First dose of Rescue Analgesia

Order of block related pain (VAS score) among patients of Group B (median 6; 5.77±1.40) was significantly lower as compared to Group A (median 8; 7.69±1.55).

Order of sensory score at 10 min of patients of Group B (median 2.0; 1.69±0.47) was higher as compared to Group A (median 1.00; 1.43±0.50 minutes) but this difference was not found to be statistically significant. Sensory score at 20 min, 30 min, 45 min and 60 min of all the patients enrolled in the study was 2, sensory scores of both the groups at above time periods were similar.

In both the groups of patients no post-operative pain was reported by any of the patients during first 1 hour.

At 4 h median pain among patients of both the groups was 0.00 and mean pain score of patients of Group B (0.25±0.44) was higher as compared to Group A (0.15±0.36) but this difference was not found to be statistically significant.

At 8 h median pain among patients of both the groups was 1.00 and mean pain score of patients of Group B (1.18±0.39) was higher as compared to Group A (1.10±0.30).

At 12 h median pain among patients of both the groups was 2.00 but mean pain score of patients of Group B (2.00±0.00) was significantly higher as compared to that of Group A (1.83±0.39).

At 24 h pain score of all the patients irrespective of any group was 2 i.e. similar in both the groups.

Majority of patients of Group A (65.7%) and Group B (68.6%) were satisfied, only 2.9% patients of Group A were dissatisfied and rest

31.4% of Group A and Group B patients were highly satisfied. Difference in level of satisfaction among patients of Group A and Group B was not found to be statistically significant.

DISCUSSION

The presents study compared USG guided infraclavicular block using costoclavicular approach with USG guided supraclavicular block for their efficacy among patients undergoing upper extremity surgery. For this purpose a prospective randomized-controlled study was carried out in which a total of 70 patients falling in sampling frame were enrolled and were randomly allocated to infraclavicular group (n=35) or supraclavicular group (n=35) respectively. Following were the characteristics and findings of the study:

Onset time of block ranged from 4 to 9 minutes. Mean onset time was 6.23+1.08 minutes in infraclavicular and 6.63+1.09 minutes in supraclavicular groups

Mean duration of motor and sensory block was 347.71+24.63 and 388.57+26.14 minutes respectively in infraclavicular and 357.43+27.05 and 400.86+31.00 minutes respectively in supraclavicular groups. Statistically, there was no significant difference between two groups with respect to onset time and duration of motor and sensory blocks.

Mean time taken for first rescue analgesic need was 564.00+39.87 minutes in infraclavicular as compared to 570.00+57.24 minutes in supraclavicular groups. Statistically, this difference was not significant.

Mean block related pain scores were significantly higher in infraclavicular (7.69+1.55) as compared to supraclavicular (5.77+1.40) group.

No significant difference between two groups was observed for sensory scores at different time intervals except at 10 minutes when these scores were significantly higher in supraclavicular as compared to infraclavicular group.

No significant difference in post-operative pain scores was observed except for 12 hrs when mean pain scores were significantly lower in infraclavicular as compared to supraclavicular group.

Majority of patients were satisfied (67.1%) followed by those highly satisfied (31.4%). There was only 1 (1.4%) patient who was dissatisfied. Statistically, there was no significant difference between two groups with respect to level of patient satisfaction.

CONCLUSION

The findings of the study, in general showed a comparable profile of both infraclavicular as well as supraclavicular blocks. Despite some occasional differences, the two blocks performed similarly. Thus the study finds the performance of two blocks and related complication rate to be similar. Further studies to explore the differences must be carried out on a larger sample size.

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