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Randomised Controlled Study of Comparison of two Approaches of Infra Clavicular Brachial Plexus Block Using Nerve Stimulator for Upper Limb Surgeries

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Abstract
The this study was to compare two approaches (coracoid and clavicular) regarding success rate, discomfort during performance of block, tourniquet tolerance and complications. This randomised brachial plexus in infra clavicular region can be blocked by various approaches. Aim of, controlled, prospective study included sixty adult patients of both sexes of ASA status 1 and 2 randomly assigned to receive nerve stimulator guided infra clavicular brachial plexus block either by lateral coracoid approach (group A, n=30) or medial clavicular approach (group B, n=30) with 25-30 ml of 0.5% bupivacaine. Sensory block in the distribution of five main nerves distal to elbow, motor block (Grade 1-4), discomfort during performance of block and tourniquet pain were recorded. The depth of insertion was less with corocoid approach group when compared to clavicular approach group. Time taken to perform block was shorter in corocoid approach group when compared to clavicular approach group. Onset of both sensory and motor blockade were similar in both the groups. Successful block was achieved more with corocoid approach group than with the clavicular approach group. Tourniquet tolerance was found to be better with corocoid approach group than with the clavicular approach group. Complications like vascular puncture was similar in both the study groups. Infra clavicular brachial plexus block using corocoid approach provides an adequate sensory and motor blockade, easy to perform with high success rate, good tourniquet tolerance and less complications when compared to that using clavicular approach.

INTRODUCTION

The merits of regional anaesthesia compared to general anaesthesia are many and have been well demonstrated . These are very good pain relief during the perioperative period (pre-intra and post-operative) which can be maintained in the post operative period also using various continuous techniques of regional anaesthesia 1-5, reducing the occurrence of side-effects caused by the use of opioids[1,2] (especially nausea, vomiting and sedation), reducing the necessity of manipulating the airways, reducing the need for strenuous care during the post operative period, reduces the time required to recover from anaesthesia and also increases patient acceptance. Blockade of the peripheral nerves using local anaesthetics may provide good operating conditions for patients who undergo surgeries in the upper limb. Peripheral nerve blocks are widely in use now because of the presence of well equipped conditions and the wide usage of numerous local anaesthetic drugs which has lesser side effects and has prolonged duration of action[3-5]. Block of the brachial plexus[6] using supra clavicular approach when compared to the infra clavicular approach seems to usually produces dense sensory, motor blockade providing very good operating conditions but with the disadvantage of more chances of causing pneumothorax. The infra clavicular approach of block of brachial plexus has its own merits like decreased incidence of discomfort during the procedure especially during patient positioning and also reduction in the chances of occurrence of pneumothorax. In comparison with the block of brachial plexus using axillary approach, very good tolerance of arm tourniquet with better patient comfort and success rate in the block of musculocutaneous nerve seems to be higher in infra clavicular approach. Techniques of regional anaesthesia targets to find out a nerve or plexus of nerves and deposits local anaesthetic drug surrounding the nerve or the nerve plexus, thereby producing block in the conduction along the nerve fibre. Numerous techniques are followed to produce blockade of nerve fibres. The various modalities widely in practice to identify a nerve or nerve fibers to facilitate the block are elicitation of parenthesis, stimulation of peripheral nerves and ultrasound which is gaining importance in the recent years[7]. Nerve blocks were carried out by using anatomical landmarks to facilitate the insertion of the needle and also by elicitation of paraesthesia. (As soon as the needle used to locate the nerve comes in contact with the nerve, the patient might feel a 'pins and needles' sensation or like 'electric shock). The demerits of elicitation of paresthesia technique were probability of rise in the chances of injury to the nerve when the needle comes in contact with the nerve that may be assessed from the elicitation of paraesthesia. Moreover, eliciting paraesthesia may cause discomfort to the patient and may not be tolerated by certain patients. Stimulators used in peripheral nerve stimulation are provided with an objective aspect which facilitates the identification of a nerve. These stimulators produce a little fraction of direct current (DC) at the needle, when it approaches the nerve, transmission of the current to the nerve will occur. This is then followed by stimulation of the nerve which may then produce a motor response[8]. By getting motor response of the required nerve needed to be blocked, chances of obtaining successful blockade remain high. This study is proposed to compare the two different approaches used for block of the brachial plexus using infra clavicular approach by the use of nerve stimulator in upper limb surgeries.

Aims and Objectives of the Study: The aim of the study is to compare two approaches of infra clavicular brachial plexus block-coracoid and clavicular approaches for upper limb surgeries using nerve stimulator.

- To evaluate the success rate of the nerve block.
- Discomfort during performance of block.
- Complications.
- Pain related to tourniquet and tolerance.

MATERIALS AND METHODS

60 patients of ASA 1 and 2 of both sexes posted for upper limb surgeries from March 2022 to August 2023 at Sree mookambika college of medical sciences formed the group.

Inclusion Criteria: Are below the following Age 18-45 years, Patients who undergo upper limb surgery requiring Anaesthesia under ASA Physical Status 1, Weight 45-70 kg, Elective surgery, Any Upper limb surgery below mid humerus, Patients who are willing to give informed written consent.

Exclusion Criteria: Are Hypersensitivity to the drug, Patient refusal, Chest wall deformities, Any distortion of local anatomy, Neck contractors, Local infection, Coagulopathy, Patients who are not willing to give written informed consent, Pneumothorax, Pregnancy. A total of 60 patients who come under the above mentioned inclusion criteria were selected. Patients who were selected were counselled about the risks and benefits involved in performing the block. After getting informed and written consent, patients willing to be included in the study were enrolled and analyzed. Patients were all preoperatively evaluated preoperatively, clinically examined. Proper investigations were done prior to the assessment. Procedures were explained in detail and written consent was obtained. All patients were kept in nil per oral state at least for 8 hours before taking up for the procedure. Local anaesthetic test dose was carried out

using 0.1 ml of Inj. Lignocaine 2%. Intravenous access was obtained with 18G IV cannula. Inj. Ranitidine 50 mg and Inj. Ondansetron 0.1 mg/kg were given intravenously. All patients were pre medicated with Inj. Midazolam (0.02-0.05 milligram/kg) intravenously 10 minutes before the procedure. This study was designed as a prospective, randomized comparative study. The present study comprised of 60 patients, divided randomly into two groups with 30 patients each.

- **Group A:** 30 patients receiving infra clavicular block of brachial plexus using lateral corocoid approach.
- **Group B:** 30 patients receiving infra clavicular block of brachial plexus using medial clavicular approach.

The procedure was performed in the preparation room or in the theatre. Boyle machine, suctioning equipment, laryngoscope handles and blades, Endotracheal tubes, Laryngeal mask airways, Manual resuscitation bag with mask and reservoir were kept ready. Routine monitoring with ECG, Pulse Oximetry, NIBP was done. In 30 patients belonging to group A, infra clavicular block of brachial plexus was carried out using lateral coracoid approach. In this group, the patient's upper limb to be operated was kept in neutral position along the side of the body. Under strict aseptic precautions, identification of the coracoid process was done and a point about 2 cm inferior and 2 cm medial to coracoid process was labelled and about 1-2 ml of 1% lignocaine infiltration was done at the point of insertion of the needle. Insulated stimulating needle was then inserted at right angles to the skin. In 30 patients belonging to group B, infra clavicular block of brachial plexus was performed using medial clavicular approach. Patients were positioned in supine lying position with the arms in neutral position along the side of the body, a point was marked which bisects line connecting the jugular notch and ventral acromial process of scapula and. In fossa axillaris, the point of emergence of axillary artey was marked. In order to carry out the block, upper limb was abducted to 90 degrees and elevated to 30 degrees approximately with a pillow. Then, a point was labelled about 1cm caudal to the inferior border of the clavicle at the mid clavicular line. Infiltration of 1% lignocaine was done with 1-2 ml. The insulated needle was then inserted with 45-60 degrees angulation to the skin directed laterally towards the point of emergence of axillary artery in the axilla, making sure to lie to the lateral border of Pectoralis Major. In both the study groups, the infra clavicular block was given with the guidance of a nerve stimulator which was attached to the proximal point of 50mm, 22 G insulated stimulator needle. Then the needle was proceeded till there was a response from a muscle distal to the deltoid. To start with, the current was kept at 2.0m. A and gradually decreased. The needle was further forwarded until the distal motor response was able to be elicited with 0.5 mA current. Then, slow injection of 25ml-30 ml of 0.5% bupivacaine was done with intermittent aspiration. Patients in whom the block was insufficient, were supplemented with either Inj. Fentanyl (2 µ/kg) or local infiltration at the surgical site or converted to general anaesthesia using Inj. Glycopyrrolate (5µ/kg), Inj. Propofol (2mg/kg), Inj. Atracurium (0.5mg/kg loading dose followed by 0.1mg/kg every 30 minutes) and reversed with Inj. Neostigmine (50µ/kg) and Inj. Glycopyrrolate (5µ/kg) at the end of surgery. Monitoring the patient was carried out throughout the surgery, after deflating the tourniquet and also in the post operative period using continuous pulse oximetry, ECG, Heart rate and NIBP every 10 minutes for first one hour and every 15 minutes thereafter. Data obtained in the study were tabulated manner and the variables were represented by mean value ±SD. The statistical significance in mean difference was calculated using analysis of paired t test. Statistical analysis was done using the statistical package for social sciences (SPSS). Different statistical methods were used as appropriate. Mean±SD was determined for quantitative data and frequency for categorical variables. The independent t-test was performed on all continuous variables. The normal distribution data was checked before any t-test. The Chi-Square test was used to analyze group difference for categorical variables. A p- value <0.05 was considered significant.

RESULTS AND DISCUSSIONS

Table 1: Time Taken to Perform Block

Parameter	Time taken to perform block (in minutes)	
	Corocoid approach Group A	Clavicular approach Group B
Range	3- 8	6-11
Mean	5.13	8.53
SD	1.279	1.137
'p'	0.000	
	Significant	

Time taken to perform block ranges from 3-8 minutes in group A with mean of 5.13 and standard deviation of 1.279 whereas in group B, it ranges from 6-11 minutes with mean 8.53 and standard deviation 1.137. The 'p'-value was found to be 0.000 (p value <0.05). Hence, the difference observed among the two study groups was found to be statistically significant.

Table 2: Time Taken for the Onset of Sensory Blockade

Parameter	Time taken for the onset of sensory blockade (in minutes)	
	Corocoid approach Group A	Clavicular approach Group B
Range	3-7	3-7
Mean	4.73	4.67
SD	1.048	1.093
'p'	0.810	
	Not significant	

The onset of sensory blockade was found to be ranging from 3-7 minutes in group A, with mean 4.73 and standard deviation 1.048 whereas in group B, the

range was 3-7 minutes with mean 4.67 and standard deviation 1.093. The 'p'-value was found to be 0.810 (p value >0.05). Hence, the difference observed among the two study groups was found to be statistically not significant.

Table 3: Time Taken for the Onset of Motor Blockade

Parameter	Time taken for the onset of motor blockade (in minutes)	
	Corocoid approach Group A	Clavicular approach Group B
Range	5-10	6-11
Mean	7.83	8.20
SD	1.206	1.297
'p'	0.261	
	Not significant	

The onset of motor blockade was found to be ranging from 5-10 minutes in group A, with mean 7.83 and standard deviation 1.206 whereas in group B, the range was 6-11 minutes with mean 8.20 and standard deviation 1.297. The 'p'-value was found to be 0.261 (p value >0.05). Hence, the difference observed among the two study groups was found to be statistically not significant.

Table 4: Discomfort During Blockade

Discomfort during blockade	Corocoid approach group A		Clavicular approach group B	
	No	%	No	%
0- Nil	11	36.7	4	13.3
1- Mild	13	43.3	10	33.3
2- Moderate	4	13.3	11	36.7
3- Severe	2	6.7	5	16.7
'p' value	0.042 Significant			

No discomfort was observed in 11(36.7%) patients belonging to group A compared to 4(13.3%) patients in group B.Mild discomfort was observed in 13(43.3%) patients belonging to group A compared to 10(33.3%) patients in group B. Moderate discomfort was observed in 4(13.3%) patients belonging to group A compared to 11(36.7%) patients in group B. Severe discomfort was observed in 2(6.7%) patients belonging to group A compared to 5(16.7%) patients in group B. The 'p'-value was observed to be 0.042 (p value <0.05). Hence, the difference observed among the two study groups was found to be statistically significant.

Table 5: Supplementation Needed

Supplementation needed	Corocoid approach Group A		Clavicular approach Group B	
	No	%	No	%
Nil	27	90	22	73.3
LA/IV	2	6.7	6	20
GA	1	3.3	2	6,7
'p' value	0.241 Not significant			

There was no need for supplementation in 27(90%) patients in group A and 22(73.3%) patients in group B. Supplementation with LA/IV fentanyl was needed in 2(6.7%) patients, compared to 6(20%) patients in group B. Conversion to general anaesthesia was needed in1(3.3%) patient, compared to 2(6.7%) patients belonging to group B. The 'p' value was 0.241 and the difference among the two study groups was found to be statistically not significant.

Table 6: Degree of Motor Blockade

Tourniquet tolerance	Corocoid approach Group A		Clavicular approach Group B	
	No	%	No	%
Grade 1	1	3.3	4	13.3
Grade 2	2	6.7	5	16.7
Grade 3	3	10	5	16.7
Grade 4	24	80	16	53.3
'p' value	0.159 Not significant			

Degree of motor blockade was found to be grade 1 in 1(3.3%) patient in group A and in 4(13.3%) patients in group B, grade 2 in 2(6.7%) patients in group A and in 5(16.7%) patients in group B grade 3 in 3(10%) patients in group A and in 5(16.7%) patients in group B. grade 4 in 24(80%) patients in group A and in 16(53.3%) patients in group B. The 'p' value was 0.159 and the difference between the two study groups was found to be statistically not significant.

Table 7: Complications

Complications	Corocoid approach group A		Clavicular approach group B	
	No	%	No	%
Present vascular puncture	1	3.3	3	10
Absent	29	96.7	27	90
'p'	0.301 Significant			

Complications like vascular puncture occurred in 1(3.3%) patient in group A, compared to3(10%) patients in group B. complications didn't occur in 29(96%) patients in group A, compared to 27 (90%) in group B. The 'p' value was 0.301 and the difference between the two study groups was found to be statistically not significant.

Brachial plexus block, like other regional anaesthetic techniques, offers specific advantage compared to general anaesthesia to the patients, surgeon, anaesthesiologist. The use of brachial plexus block may minimize development of central nervous system hyper excitability during a surgical procedure carried out during general anesthesia. Patients who present for surgery with an upper extremity at risk of vascular compromise may improve soon after the pain is relieved and also by the vasodilatation produced by the block. The present study comprised of 60 patients, divided randomly into two groups with 30 patients each. Data obtained were subjected to statistical analysis and the results were interpreted as follows: Vikas Trehan *et al.* in their study reported that the age distribution among the study groups was about 33±10.02 in corocoid group where as in clavicular group, it was 36±13.08 with the 'p' value 0.9459 which was statistically not significant[8-10]. In the present study, age distribution among the study groups was about 31.8±6.8 in group A where as in group B, it was 33.11± 7.8 with the 'p' value 0.826 which was

statistically not significant. not significant. Hence, the duration of surgery was comparable in both study groups. In the present study, 20 patients were males (66.7%) and 10 patients were females (33.3%) in group A where as in group B, 21 patients were males (70%) and 9 patients were females(30%), with the 'p' value 0.781 (p>0.05). Hence, it was statistically not significant and there was no significant difference in sex distribution among the two groups. Vika Trehan *et al.* in their study demonstrated that weight distribution among the study groups was about 64±3.97 in corocoid group where as in clavicular group, it was 62±4.60 with the 'p' value 0.2976 which was statistically not significant. In the present study, weight distribution among the study groups was about 61.2±2.32 in group A where as in group B, it was 61±2.43 with the 'p' value 0.787 which was statistically not significant. From the data analyzed it was interpreted that the distribution of demographic profile like age, sex, weight seems to be equal and comparable among the two study groups. Vikas Trehan[12] in their study, proposed that the duration of surgery lasted for 43±14.53 minutes in corocoid group and 40.3±13.3 minutes in clavicular group with 'p' value 0.956 which was statistically not significant. In the present study, the duration of surgery lasted for 86±6.25 minutes in corocoid group and 85±6.14 minutes in clavicular group with 'p' value 0.605 which was statistically. Vikas Trehan[12] in their study, demonstrated that the depth of insertion was about 3.1±0.24 cms in corocoid group and 3.6±0.19 in clavicular group with 'p' value 0.001 which was statistically significant. In the present study, the depth of insertion was about 3.0±0.14 cms in corocoid group and 3.5±0.12 in clavicular group with 'p' value 0.000. There was a statistically significant difference in the depth of insertion between the two study groups. Hence, the depth of insertion was observed to be significantly less in corocoid approach than in clavicular approach[11]. The time taken to perform the block was found to be 5.1±1.3 minutes in group A whereas in group B, it was about 8.5±1.1 minutes with 'p' value 0.000 (p<0.05) which was found to be statistically significant. The time taken to perform infra clavicular block using corocoid approach seemed shorter than clavicular approach. In the present study, onset of sensory blockade was found to be 4.7±1.05 minutes in group A where as in group B, it was about 4.67±1.09 minutes with 'p' value 0.810 which was found to be statistically not significant. Hence, the onset of sensory blockade was similar and comparable in both the study groups. In the present study, onset of motor blockade was found to be 7.8±1.2 minutes in group A where as in group B, it was about 8.2±1.3 minutes with 'p' value 0.261 which was found to be statistically not significant. Hence, the onset of motor blockade was similar and comparable in both the study groups. Discomfort during blockade mainly occurs during positioning of the limb. Vikas Trehan[12] in their study reported that most patients in group A had nil discomfort or had only mild discomfort while performing the block (22 vs. 16) whereas more patients had moderate to severe discomfort while performing block in clavicular approach, comparing the other (14 vs. 8).But the difference was not significant (P=0.337). In the present study also, most of the patients in group A had nil discomfort or had only mild discomfort while performing the block (24 vs. 14) whereas more patients had moderate to severe discomfort while performing block in clavicular approach, comparing the other (16 vs. 6).The 'p'-value was found to be 0.042 (p<0.05) and the difference between the two study groups was found to be statistically significant. Hence, coracoid approach seems to be better since positioning of the limb to be operated was relatively painless and also easy to approach[13,14]. In the study done by Vikas Trehan *et al*, Success rate was defined as carrying out the surgery without any need for supplementation was 87% in the coracoid approach (group A) and 73% in clavicular approach (group B), but there was no statistically significant difference (P>0.05). Borgeat[15,16] demonstrated a clinical success rate of 44% when a proximal response was taken for local anesthetic injection, compared to 97% when a distal response was taken. In the present study, block was sufficient for surgery in about 90% in corocoid approach (group A) and 70% in clavicular approach (group B) and the difference was found to be statistically significant (p=0.05). Hence, the successful block was achieved more with corocoid approach group than with the clavicular approach group. Vikas Trehan[12] in their study demonstrated that 2 patients in group A and 5 patients in group B needed infiltration of the surgical site by the surgeon and 2 patients in group A and 3 patients in group B needed GA. In the present study, supplementation with LA/IV fentanyl needed in 2 (6.7%) and 6(20%) patients in groups A and B respectively. Conversion to GA was needed in 1 (3%) and 2(6.7%) patients in groups A and B respectively. The 'p' value was 0.241 and there was no statistically significant difference between the two groups. Hence, the requirement for supplementation was comparable among the study groups. Vikas Trehan[12] in their study of 30 patients each in two groups proposed that tolerance to tourniquet was better in most patients without any need for infiltration. No tourniquet sensation was present in 17 and 14 patients in corocoid approach and clavicular approach groups respectively. In the present study, there was no tourniquet sensation in 27(90%) patients in group A compared to 22(73%) of patients in group B. Tourniquet sensation was felt but no pain in 2 (6.7%) patients in group A compared to 5(16.7%) patients in group B. Tourniquet pain was felt in 1(3.3%)patient in

group A compared to 3(10%) patients in group B.The 'p' value was 0.0247 and the difference between the two study groups was found to be statistically significant. Hence, tourniquet tolerance has been found to be better with coracoid approach than with clavicular approach group. Vikas Trehan[12] in their study, reported that the degree of motor blockade was equal in both groups with (P=0.26) 22 (73.33%) grade 1 in 1(3.3%) patient in group A and in 4(13.3%) patients in group B, grade 2 in 2(6.7%) patients in group A and in 5(16.7%) patients in group B grade 3 in 3(10%) patients in group A and in 5(16.7%) patients in group B. grade 4 in 24(80%) patients in group A and in 16(53.3%) patients in group B. The 'p' value was 0.159 and the difference between the two study groups was found to be statistically not significant. Vikas *et al.* in their study, proposed that the incidence of complications related to block was very low in both approaches. They reported one case of venous puncture in either groups. In the present study, complications like vascular puncture occurred in 1(3.3%) patient in group A, compared to 3(10%) patients in group B. There was no incidence of pneumothorax or vascular puncture in both the groups. The 'p' value was 0.301 and the difference between the two study groups was found to be statistically not significant.

CONCLUSION

Infra clavicular brachial plexus block using corocoid approach provides an adequate sensory and motor blockade, easy to perform with high success rate, good tourniquet tolerance and less complications when compared to that using clavicular approach.

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