To Compare Nerve Stimulator Guided Brachial Plexus Block by Supraclavicular and Infraclavicular Approach for Block Performance Time and its Duration of Action and its Complications

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ABSTRACT

Introduction: Regional nerve blocks should be considered for ease of procedure, good anaesthesia and lesser complications. The supraclavicular brachial plexus block is quite popular with this respect for upper limb surgeries but having considerable complications rate. Infraclavicular brachial plexus blocks have a similar anaesthesia distribution and known to be safer but technically difficult. With nerve stimulator guidance infraclavicular approach could be as easier as supraclavicular approach. This study aimed to compare the supraclavicular and infraclavicular approaches of brachial plexus blocks, guided by nerve stimulator.

Material and methods: A prospective comparative study was carried out for 60 patients undergoing distal upper limb orthopaedic surgery of forearm, wrist and hand. They were randomly divided into two groups. Group 1 with 30 Patients - Supraclavicular block given. Group 2 with 30 Patients - infraclavicular block given. Block performed using nerve stimulator. The two groups were compared with respect to onset of sensory and motor blockade, readiness for surgery, total duration of block and complications.

Results: The onset of sensory block for the infraclavicular group was 9.92min, whereas for supraclavicular group, it was 6.01 min (p value 0.0001).Onset of motor block in infraclavicular group is 10.94 min and that of supraclavicular group is 7.81 min(p value -0.0001).Duration of sensory and motor block is similar in both groups. Incidence of vascular puncture is statistically significant in supraclavicular group.

Conclusion: The onset of sensory and motor blockade faster in supraclavicular group than in infraclavicular group. The quality and duration of sensory and motor blockade is comparable in both groups. The higher respiratory rate seen in group 1 due to phrenic nerve block.

Keywords: Brachial Plexus Block, Supraclavicular Block, Infraclavicular Block, Nerve Stimulator.

INTRODUCTION

Brachial plexus blocks are quite popular with respect to ease of administration, quick onset of action, excellent intraoperative anaesthesia and post operative analgesia, fewer complications with high success rate. Good patient's and surgeon's satisfaction because of excellent operative conditions. Patient remains conscious, avoidance of polypharmacy, haemodynamic stability are additional advantages over general anaesthesia.[1,2] Supraclavicular block mostly satisfy above mentioned qualities except high complications rate; like high incidence of vascular puncture, pneumothorax, phrenic nerve palsy and Horner's syndrome.[3] Infraclavicular block is technically difficult as plexus are situated in deeper plane but major advantage is fewer rates of complications especially with the help of nerve stimulator and ultrasound.[4]Though infraclavicular block is technically difficult blind technique but with help of nerve stimulator, wepostulated that infraclavicular block is equally easy and safe toperform with less complications.

The aim of this study was to compare supraclavicular and infraclavicular approaches to brachial plexus block using nerve stimulationfor block performance time, its duration and complications.

MATERIAL AND METHODS

After approval by the Institutional Ethical Committee, this prospective, randomised study was done on 60 patients undergoing elective upper limb orthopaedic surgeries of the elbow, forearm and hand in a tertiary medical care centre, department of anaesthesia. Inclusion criteria includes patients of the American Society of Anaesthesiologists (ASA) Physical status I or II, weighing 50 to 80 kg and in the age group of 18–60 years; undergoing upper limb orthopaedic surgeries distal to forearm. Exclusion criteria includes pregnancy, clavicle fracture; patients with chronic lung conditions (obstructive/restrictive lung conditions, patients on home cpap/oxygen therapy);patients with skin infection located near the block injection site; patients with allergy to local anaesthetics; patients with coagulopathy (international normalized ratio (INR)>1.4, thrombocytopenia platelet count <100,000), and uncooperative patients.The written informed consent for the study was obtained from each patient. The patients were randomised to receive either supraclavicular (Group 1) or infraclavicular (Group 2) blocks. Patients were premedicated with 2–3 mg IV midazolam. Standard ASA monitoring and supplemental oxygen (mask 40%, 5

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litres per minute) were applied throughout the block.All the blocks were performed by the experienced anaesthesiologist using nerve stimulator. Drugs used were Sensoricaine 0.5%- 1.5 mg /kg and Lignocaine 2%- 4 mg /kg (with adrenalin 1:200000) and Distilled water added to make volume 40 cc. A peripheral nerve stimulator with 5 cm short bevelled, hypodermic, insulated needle was used for the blocks. All blocks were performed with the patient in supine position (figure 4,5) and the head tilted to the opposite side in case of supraclavicular blocks. The skin was disinfected and draped. As the needle entered the brachial plexus, a current intensity of 1 mA was given using the peripheral nerve stimulator. Motor response obtained as wrist palmer flexion (median nerve), wrist dorsiflexion (radial nerve), interphalangial joint flexion and metacarpophalangial joint extension (ulnar nerve).The current intensity was then lowered to 0.5 mA at which lowest twitch response was elicited. Sensory and motor block was assessed 30 minutes after the end of the procedure. Loss of sensation was assessed using the pinprick test. The onset of sensory block was defined as the time from injection of drug to complete loss of pinprick sensation, whereas onset of motor blockade was defined as the time from injection of drug to complete motor block. Student's *t*-test was used to compare means between the groups and Chi-square test was used to compare proportions. $p< 0.05$ was considered to be statistically significant.

RESULTS

Variables of 60 patients were included and analysed statistically**.** There was no statistically significant difference among the groups in the demographic data, proportion M: F, the duration of the operation (Table 1).

Onset of sensorimotor block is quicker in group 1 i.e. supraclavicular block group. The sensory blockade was achieved in mean time of 6.01 ± 2.61 min in 1 Group and 9.92± 2.87 minin group 2 and difference was found to be statistically significant ($P = 0.0001$) (table 2). The onset of motor blockade was faster in Group 1(7.81 ± 2.90 min) than Group 2 (10.94 ± 3.50 min) with a $P = 0.001$ which was significant statistically. There was no statistically significant difference in duration of sensory and motor block. Group 1 patients'mean duration of sensory and motor block were 5.43

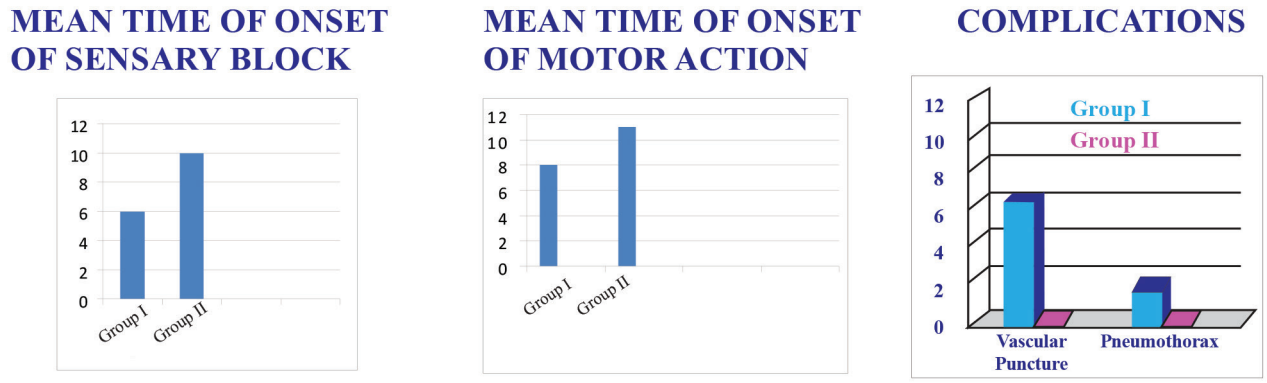

Figure-1:

Total	Group I	Group II	P Value	Significance
60	30	30		
Age	60.60±9.78	60.23±9.24	0.88	NS
Weight	61.93±7.41	62.93±6.49	0.58	NS
Height	156.13±6.73	157.27±6.60	0.51	NS
BMI	25.47±3.26	25.50±2.79	0.96	NS
Male	23 (76.66%)	24(80%)	0.754	NS
Female	7(23.33%)	6(20%)		
Duration of surgery (min)	96.41±8.23	99.52±4.84	0.079	NS

Table-1:

Results			
Observations	**Group 1**	**Group 2**	**P value**
Onset of sensory block	6.01 mins.	9.92 mins	0.0001(significant)
Onset of motor block	7.81mins.	10.94 mins	0.0001(significant)
Duration of sensory block	5.43 hrs	5.76 hrs	0.98(not significant)
Duration of motor block	5.98	5.32	0.836(not significant)
Vascular puncture	6	1	0.01(significant)
Pneumothorax	1	0	>0.05(not significant)
Respiratory rate	17.24	15.36	<0.05(significant)

Table-2:

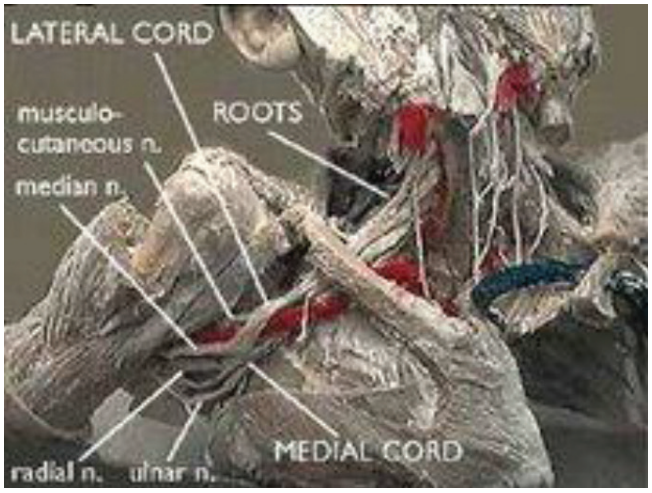

Figure-2: Brachial plexus anatomy

Figure-3: Peripheral nerve stimulator


Figure-4: Supraclavicular approch

hrs and 5.76hrs respectively whereas that in Group 2 patients' were 5.98 hrs and 5.76 hrs respectively. Rate of vascular puncture is statistically significant in supraclavicular block. (6 vs 1). Respiratory rate is higher in group 1 than group 2 which is statistically significant due to phrenic nerve palsy. The vital parameters heart rate, blood pressure and oxygen saturation were comparable between two groups during the surgery and there was no statistically significant difference between them.


Figure-5: Infraclavicular approch

DISCUSSION

In year 1889, William Halsted (1852–1922) performed the first brachial plexus block with cocaine with direct exposure in neck (figure 2).[5] Brachial plexus block can be given by interscalene, supraclavicular,infraclavicular, axillaryapproach, With the introduction of ultrasound Arcand g.,William Sr in 2005 compare USG guided supraclavicular and infraclavicular approach.[4] Few studies are there to compare supraclavicular and infraclavicular approach with the help of nerve stimulator.[1,2]

Electrical nerve stimulation (figure 3) in regional anaesthesia is the use of low-intensity (up to 5 mA) and short-duration (0.05 to 1 ms) electrical stimulus (at 1- to 2-Hz repetition rate) given to nerve to get motor response in muscles innervated by that desired nerve or plexus. Anatomical landmarks are used to locate the desired nerve or plexus with the help of insulated needle which delivers electrical stimulus before injecting local anaesthetic agent. Lesser the threshold current more accurate nerve will be located. Theuse of nerve stimulation can recognize intrafascicular or within the sheath needle placement which prevent further needle advancement intraneurally and help reduce the risk of nerve injury.

In our study, both blocks are given with the help of nervestimulator. The onset of action of infraclavicular block was delayed as compared to supraclavicular block, probably because of nerves are more spread out anatomically as plexus moves distally (figure2). So local anaesthetics need more time to spread and penetrate the nerves. On contrary similar study using both nerve stimulator and ultrasonography showed onset of block action is quicker in infraclavicular approach.[7,8] Duration of block is similar in both groups as shown in other studies.[6,7] In our study, patient with supraclavicular grouphave increased respiratory rate than infraclavicular approach group owing to increased incidence of ipsilateral diaphragmatic paresis occurred in patient with supraclavicular group. Diaphragmatic paresis were reported in 20% of patients with supraclavicular block in one study.[8] A 3% incidence of diaphragmatic paresis in supraclavicular block on the basis of clinical diagnosis with breathing difficulties and chest X-ray was reported in one study.[9] Six patients had vascular puncture in supraclavicular

group compared to one patient in infraclavicular group (figure 1). Thevascular puncture incidence was reported from 2%[8] to 2.5%.[10] One case of pneumothorax was seen in Group 1 which was statistically not significant but was clinically significant.(figure1)

Limitations of our study were

1) as infraclavicular block is technically difficult to perform, time required to locate the plexus in both approaches should have been noted so as to compare all the parameters of each block as done in several other studies.
2) Quality of block is not objectively assessed such as comparing visual analog scale score by patients in both approaches.[6,7]
3) Instead of relying on clinical parameters only i.e. respiratory rate and pulse-oxymetry, fluoroscopy could have been done to get objective evidence of ipsilateral diaphragmatic paralysis.
4) Availability of ultrasound is need of an hour for accurate and safe conduction of procedure in addition to nerve stimulation for regional anaesthesia and pain management.

CONCLUSION

Our study has shown the onset of sensory and motor blockade was faster in supraclavicular group than in infraclavicular group. The quality and duration of sensory and motor blockade is comparable in both groups. The higher respiratory rate seen in Group 1 is due to phrenic nerve palsy. Supraclavicular block is easy technique due to superficial location but complication rate is more. Infraclavicular block is safer technique but expertise is needed.

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