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Original Research Article

COMPARATIVE EVALUATION OF TWO APPROACHES OF BRACHIAL PLEXUS ANESTHESIA

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ABSTRACT

Background: The brachial plexus blockade of is a proven and very effective method for achieving anesthesia for the upper limb which involves shoulder to fingertips. There are multiple theories and various approaches for achieving brachial plexus blockage which are varies on the block indication, procedure of surgery which being performed, specific patient-body habitus, associated medical comorbidities and anatomical individual variations. **Material & Methods:** The present single Centre observational study was conducted in department of anesthesia at our tertiary care hospital. The study was conducted in duration of one year, after seeking approval from the Institutional Ethics Committee. Calculated Sample size of study was 100, and patients who had American society of anesthesiologists (ASA) physical status I to II and in the age group of 18 to 65 years, who were scheduled for surgery of the upper limb under brachial plexus anesthesia, were enrolled for the study. **Results:** The block performance time (min) was 3.8±0.90 in supraclavicular brachial plexus block (group I) and block performance time (min) was 5.4±0.7 in infraclavicular brachial plexus block (group II) (P <0.05). The Onset time for sensory and motor block was 29 and 30 minutes for supraclavicular brachial plexus block (group I) and Onset time for sensory and motor block was 30 and 31 minutes for infraclavicular brachial plexus block (group II) (P >0.05). The most common complication after supraclavicular brachial plexus block was Horner syndrome 31 (62%) and Vascular puncture 3 (6%). Complication after infraclavicular brachial plexus block was Horner syndrome 3 (6%) and Vascular puncture 3 (6%). **Conclusion:** The supraclavicular brachial plexus block was easier to perform compared to the infraclavicular brachial plexus block. Both the approaches of the brachial plexus block have nearly similar duration of onset. The infraclavicular brachial plexus block approach had minimal complications.

Keywords: Brachial plexus block, Supraclavicular block, Infraclavicular block.

INTRODUCTION

The anatomy of brachial plexus is well described and it formed by nerve roots from the C5 to T1. These nerve roots join to form three trunks above the clavicle namely superior trunk (C5, C6), middle trunk (C7), and inferior trunk (C8, T1). These trunks then further descend downwards and pass beneath the clavicle, here they are situated in close proximity to each other and that's why at this level they blocked easily. Further downwards, the brachial plexus divided into the three cords namely lateral (C5-C7), medial (C8, T1) and posterior (C5-T1), they are situated in close proximity of the axillary artery **(1)**. At last, the end nerve branches of the plexus are formed by the cord branches in the axilla. Similarly, the median nerve is form by brachial plexus from the continuation of medial and lateral cords which are situated superficial to the axillary artery. Likewise, ulnar nerve is form by brachial plexus from the continuation of medial cord and it is situated lateral to the axillary artery. Radial nerve is situated lateral and deep to the axillary artery. The musculocutaneous nerve is branches off the lateral cord and pierces by the coracobrachialis muscle located in the proximal axilla **(2)**.

The brachial plexus blockade of is a proven and very effective method for achieving anesthesia for the upper limb which involves shoulder to fingertips. There are multiple theories and various approaches for achieving brachial plexus blockage which are varies on the block indication, procedure of surgery which being performed, specific patient-body habitus, associated medical comorbidities and anatomical individual variations **(3)**. This study was tried to address all the indications and including, probe placement, superior trunk block, ultrasound-guided interscalene block, supraclavicular brachial plexus block, axillary brachial plexus block and infraclavicular brachial plexus block **(4)**. The brachial plexus blockade can be provided at multiple sites for varying wanted effect. It is useful to be study the various approaches of brachial plexus blockade given patients who have varying anatomy and different indications **(5)**. In the present study, we tried to research the two approaches of brachial plexus block, which were supraclavicular block and infraclavicular block approaches and compared them in the terms of the block performance time, onset of motor and sensory block, by using neurostimulation among patients who were undergoing upper limb surgery.

MATERIALS & METHODS

The present single Centre observational study was conducted at our tertiary care hospital. The study was conducted in Department of anesthesia. The study was conducted in duration of one year, after seeking approval from the Institutional Ethics Committee. All protocols of ethical conduct including written and informed consents of the patients enrolled for the study was strictly complied. Calculated Sample size of study was 100, and patients who had American society of anesthesiologists (ASA) physical status I to II and in the age group of 18 to 65 years, who were scheduled for surgery of the upper limb under brachial plexus anesthesia, were enrolled for the study. Detailed socio-demographic data were taken and recorded along with general physical and clinical examination. Patient who had disorders of hemostasis, major systemic illness, localized sepsis, systemic infection, pregnancy, allergy to local anesthetics, previous clavicle fractures, chest deformities, neurological disorders and patients who had chronic pain were excluded from the study.

Patients were randomly divided in two equal groups, who received supraclavicular and infraclavicular brachial plexus block. In both the groups 30 ml of 0.5% ropivacaine was used and injected slowly (over 1 minute) with intermittent aspiration. The block performance time was noted. Block performance which was related to pain was assessed by using a VAS pain score between 0 and 10 (0 -no pain and 10 -excruciating pain). The sensory block was evaluated by alcohol-soaked gauze and graded from 0-2 (0 means no difference from an unblocked area; 1means comparative less cold than unblocked area; 2 means no sensation of cold). The motor block was assessed by; forearm flexion, thumb and second digit pinch, thumb abduction and finger abduction and graded from 0-2 (0 means no loss of force; 1means reduced force compared to other arm; and 2 means inability of movements). The results thus obtained shall be subjected to statistical analysis. The data were analyzed by using software's MS Excel 2010, Epi Info v7 and SPSS v22.

RESULTS

Total 100 patients were enrolled for the study. Out of them 50 participants were selected from patients who had given supraclavicular brachial plexus block (group I) and 50 participants were selected from patients who had given infraclavicular brachial plexus block (group II). Both the groups were demographically nearly similar in characteristics. Likewise, both the groups had nearly similar characteristics on ASA evaluation. Similarly, both the groups showed comparative characteristics on evaluation of surgical profile. (Table 1)

Table 1: Distribution of study participants according to study parameters

Parameters		Group I (n = 50)	Group II (n = 50)
Demographic distribution	Age (years)	44±8	45±7
	Sex (M/F)	32/18	35/15
	Weight (kg)	63±4	61±6
	Height (cm)	165±14	162±18
ASA (I/II)		29/11	30/11
Distribution according to surgery	Hand	17	15
	Wrist	10	12
	Forearm	11	9
	Elbow	12	14
	Surgery duration (min)	70±26	68±24

In the present study the block performance time (min) was 3.8±0.90 in supraclavicular brachial

plexus block (group I) and block performance time (min) was 5.4±0.7 in infraclavicular brachial plexus block (group II). It was found statistically highly significant by applying Chi square test (P <0.05). The Onset time for sensory and motor block was 29 and 30 minutes for supraclavicular brachial plexus block (group I) and Onset time for sensory and motor block was 30 and 31 minutes for infraclavicular brachial plexus block (group II). It was found statistically non-significant by applying Chi square test (P >0.05). (Table 2)

In the present study, the most common complication after supraclavicular brachial plexus block was Horner syndrome 31 (62%) which was followed by Vascular puncture 3 (6%). The most common complication after infraclavicular brachial plexus block was Horner syndrome 3 (6%) and Vascular puncture 3 (6%). (Table 3)

Table 2: Distribution of study participants according to block

Parameters	Group I (n = 50)	Group II (n = 50)	P value
Block performance time (min)	3.8±0.90	5.4±0.7	**< 0.05**
Onset time for sensory block (min)	29	30	> 0.05
Onset time for motor block (min)	30	31	> 0.05

Table 3: Distribution of study participants according to complications

Complications	Group I (n = 50)	Group II (n = 50)
Horner syndrome	31 (62%)	3 (6%)
Dyspnea	0	0
Pneumothorax	0	0
Vascular puncture	3 (6%)	3 (6%)

DISCUSSION

In the present study, two approaches of the brachial plexus block were studied, namely supraclavicular block and infraclavicular block approach. We evaluate results by using the neurostimulation and it was found that there was significant difference in the block performance time and there was similar duration of onset of sensory and motor blockade. In the present study the block performance time (min) was 3.8±0.90 in supraclavicular brachial plexus block (group I) and block performance time (min) was 5.4±0.7 in infraclavicular brachial plexus block (group II). It was found statistically highly significant by applying Chi square test (P <0.05). The Onset time for sensory and motor block was 29 and 30 minutes for supraclavicular brachial plexus block (group I) and Onset time for sensory and motor block was 30 and 31 minutes for infraclavicular brachial plexus block (group II). It was found statistically non-significant by applying Chi square test (P >0.05).

In the present study, higher incidence of complication namely Horner's syndrome was reported specialy with supraclavicular block. The most common complication after supraclavicular brachial plexus block was Horner syndrome 31 (62%) which was followed by Vascular puncture 3 (6%). The most common complication after infraclavicular brachial plexus block was Horner syndrome 3 (6%) and Vascular puncture 3 (6%). We applied peripheral nerve stimulation technique in present study for brachial plexus block because there was limited data available on researches among Indian population on the comparison of supraclavicular with infraclavicular brachial plexus block **(6)**. In comparative studies of brachial plexus block for axillary approach and supraclavicular approach it was reported in previous studies that to provide adequate anaesthesia for upper-limb surgeries, with the gain of faster onset & denser block after a single injection of local anesthetic **(7)**.

In previous studies it was reported that incidence of iatrogenic pneumothorax following the Kulenkampf technique for supraclavicular brachial plexus block, makes this technique less preferable among anesthesiologists. The reported prevalence of pneumothorax after a supraclavicular brachial plexus block was 1% to 6.1% **(8)**. However, in the present study there was not a single incidence of iatrogenic pneumothorax was reported. The prevalence of vascular puncture in both the groups of supraclavicular or infraclavicular brachial plexus block in present study was equal and didn't result in any haematoma or intravascular injection. Similarly, in the present study there was not a single incidence of dyspnea was reported. We reported a 100% success rate for supraclavicular block and infraclavicular block in present study.

A study done by Kilka et al on brachial plexus block reported that 95% success rate for vertical infraclavicular approach which was achieved using 40 ml of (1.5%) Prilocaine and 10 ml of (0.5%) Bupivacaine; block assessment time was 30 minutes **(9)**. A study conducted by Franco et al on brachial plexus block reported that 97.2% success rate was achieved with the supraclavicular brachial plexus block using perivascular technique among one thousand patients **(10)**. The main reasons behind the lower success rates of brachial plexus block reported in above mentioned two studies was mainly because of operator inexperience, different local anesthetic used in above studies different than used in present study, the definition used for a successful block and fewer number of study participants studied in present study.

CONCLUSION

We concluded from the present study that the supraclavicular brachial plexus block was easier to perform compared to the infraclavicular brachial plexus block. Both the approaches of the brachial plexus block have nearly similar duration of onset. The infraclavicular brachial plexus block approach had minimal complications. However large population based studies are needed for further evaluation.

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