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Research Article

A Comparative Study of Interscalene and Supraclavicular Approach of Brachial Plexus Block on Upper Limb Surgeries

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Abstract

Introduction: There are different methods to perform brachial plexus block. Interscalene and supraclavicular approaches are the most frequently used technique during upper limb surgeries.The aims of this study were to compare the onset and duration of sensory and motor block, hemodynamic parameters, sparing of analgesia in any dermatome and to observe any adverse effect during lower arm, elbow and forearm surgeries. Materials and methods: After approval from the ethics committee and written informed consent, 70 patients were randomly allocated into two equal groups. Interscalene and supraclavicular block were administered with 30 ml of levobupivacaine in group ISB and group SCB patients respectively using the nerve stimulator for lower arm, elbow and forearm surgeries. The onset and duration of sensory block, hemodynamic parameters and any adverse effect were noted. Results: The demographic data, duration of surgery, baseline and intraoperative heart rate, mean arterial pressure and oxygen saturation were comparable in both groups. The onset of sensory and motor block was earlier in the supraclavicular group than the interscalene group but there was no sparing of any dermatome in the interscalene group. The duration of sensory block was significantly prolonged in the supraclavicular group but there was no difference regarding the duration of motor block among the two groups. Incidence of vessel puncture and Horner's syndrome were more in supraclavicular and interscalene group respectively.

Conclusion: Interscalene block was equally effective like supraclavicular block for lower arm, elbow and forearm surgery with minimum complications.

Keywords: *Interscalene Block; Levobupivacine; Supraclavicular Block*

Introduction

Upper limb surgeries are mostly performed under the brachial plexus block (BPB) [1]. The brachial plexus is responsible for cutaneous and muscular innervations of the entire upper limb except the trapezius muscle and an area of the skin near the axilla which are innervated by the spinal accessory nerve and the inter costo brachial nerve respectively. BPB can be performed by various methods like: supraclavicular, inter scalene, axillary, infra clavicular approaches [2,3]. Achievement of the adequate block not only depends on the type and the volume of the local anesthetic agent, but also on the methods of BPB. [4] In this study the interscalene block (ISB) and supraclavicular block (SCB) was compared for the onset and duration of sensory and motor block, hemodynamic parameters, sparing of analgesia in any dermatome and to observe any adverse effect during lower arm, elbow and forearm surgeries.

Materials and methods

After obtaining ethics committee approval and written informed consent, this prospective, randomized, comparative study was carried out at a tertiary hospital from January to December 2014 among 70 American Society of Anesthesiologists Physical Status (ASA-PS) I patients of both sex between the age of 25-50 years undergoing elective surgeries of lower arm, elbow and forearm. Patients with known

hypersensitivity to the study drug, infection at the site of block, patients with psychiatric or neurological disorders or severe systemic illness, patients on anticoagulant drugs or with altered coagulation profiles, extremes of age, obstetrics population, uncooperative patients, those with anticipated difficult airway and surgery in the upper part of the arm, shoulder and hand were excluded from this study.

The patients were randomly allocated into two equal groups (Gr: ISB and Gr: SCB) comprising of 35 patients in each group. Group ISB patients were given interscalene brachial plexus block and Group SCB patients were given supraclavicular brachial plexus block. In the operating room venous cannulation was done with 18 G cannula, Ringer Lactate solution was administered at a rate of 10 ml/kg and multichannel monitor was attached. Intravenous midazolam 0.05 mg / kg was given before administration of block. All patients received moist oxygen inhalation at the rate of 5 lit/min via face mask.

In ISB group, block was performed in supine position with the head turned away from the side to be blocked. The border of the sternocleidomastoid muscle was readily palpated by asking the patient to lift the head .The inter scalene groove was identified by rolling the fingers postero- laterally from this border over the belly of anterior scalene muscle. A line extended laterally from the cricoid cartilage intersecting the interscalene groove indicates the level of the transverse process of the sixth cervical (C6) vertebrae. A skin wheal was raised with 1ml of 1% injection of lignocaine at the needle insertion site aseptically. Utilizing a nerve stimulator, a 22-gauge, 5cm insulated stimulating needle was inserted perpendicular to the skin with a 45-degree caudate and slightly posterior angle and appropriate muscle twitches in hand were sought. The end point was taken when hand twitches were elicited at a current of 0.5mA. Then the needle was stabilized and 30ml of 0.5% of levo bupivacaine solution was injected after repeated aspiration [5].

In Group SCB, block was performed by placing the patient in supine position with the head turned towards the opposite side and ipsilateral arm was adducted, and the hand was extended along the side. The midpoint of the clavicle was identified and marked. The posterior border of the sternocleidomastoid was palpated when the patient was asked to raise the head. The interscalene groove and pulsation of the subclavian artery were identified. At a point 1-2cm above and posterior to the arterial pulsation, a skin wheal was raised with 1ml of 1% of lignocaine aseptically. Utilizing a nerve stimulator, a 22-gauge, 5cm insulated stimulating needle was inserted in a backward, slightly medial, and posterior direction and appropriate muscle twitches in the hand were sought. The end point was taken when hand twitches were elicited at a current of 0.5mA. After the appropriate motor response was obtained, 30ml of 0.5% of levo- bupivacaine solution was injected after repeated aspiration [5].

After injection, patients were assessed for onset of sensory blockade by using pin-prick method. Assessment of sensory block was done every 1 min after completion of drug administration in the dermatomes corresponding to the median, radial and ulnar nerve till complete sensory block was achieved. Sensory block was graded as: grade 0- sharp pain felt, grade 1- dull sensation felt (onset of analgesia), grade 2- no sensation felt (surgical anesthesia) [6]. Onset of sensory block was considered when there was a dull sensation to pin prick along the distribution of any of the above mentioned nerves and complete sensory block was achieved when there was complete loss of sensation to pin prick. The palmer surface of the index and little finger was used to test the sensory block for the median and ulnar nerve respectively. The dorsal surface of the thumb was used to test the sensory block for the radial nerve. Duration of the sensory block was measured as the time interval between the administration of the drug and the first appearance of pain requiring systemic analgesic and this time was recorded. Motor block was determined according to the modified Bromage scale for upper extremities on a 3-point scale [7]. Assessment of motor block was carried out at every 1 min after the drug administration till the complete motor block was established. Onset of motor blockade was considered when there was grade 1 motor blockade. Peak motor blockade was considered when there was grade 2 motor blockades. The block was considered incomplete when any of the dermatomes supplied by the median, radial, ulnar nerve did not produce analgesia even after 30 min of drug administration. These patients would be supplemented with injection fentanyl 2 microgram per kg. Block was considered failed when sensory block was not achieved in all dermatomes within 30 min after the administration of levo bupivacaine. Those with incomplete or failed block would be excluded from this study.

Baseline and intraoperative heart rate (HR), noninvasive blood pressure (NIBP) and oxygen saturation (SpO_2) were monitored every 5 min and their average was calculated. No analgesic was given during the intraoperative period. Duration of analgesia was assessed by

first complain of pain and administration of rescue analgesics. Diclofenac aqueous solution was given IV 1.5 mg/kg for postoperative analgesia. Duration of motor blockade was determined by asking the patients to note the time they could first move their fingers on the blocked extremity. All patients were observed for any side effects like hypotension, bradycardia, nausea, vomiting, dryness of mouth, puncture of vessels, pneumothorax, hematoma, Horner`s syndrome, local anesthetic systemic toxicity (LAST).

Data was entered into Microsoft Excel Spread sheet and was analyzed using standard statistical methods with the help of standard statistical software. The data collected was tabulated and analyzed by SPSS program. The data between the two groups was compared by using 'unpaired t test. $P < 0.05$ was considered as statistically significant.

Results

The demographic data, duration of surgery, baseline HR, MAP, SpO2 were comparable in both groups (Table 1). The average intraoperative HR, MAP, SpO2 were comparable in both groups (Table: 3, Figure 1). The onset of sensory block was earlier along the median (9.65 ± 0.68 vs13.31 ± 0.86), radial (10.91 ± 0.78 vs11.60 ± 0.69) and ulnar (11.31 ± 0.86 vs 17.45 ± 1.03) nerve in supraclavicular block group than inter scalene group (Table 4, Figure2) which was statistically significant (p = 0.000). The onset of motor block was significantly earlier in supraclavicular group than inter scalene group (16.28±0.98 vs 21.71±0.92, p= 0.000) (Table: 5, Figure 3). The duration of sensory block was significantly more in the supraclavicular group than the interscalene group (630.02 ± 7.86 vs 530.74 ± 8.24 respectively, p value 0.0000) but the duration of motor block was similar between the groups (Table 6, Figure 4). There was no episode of bradycardia, hypotension, nausea and vomiting, dryness of mouth, pneumothorax and LAST in the both groups. Incidence of vessel injury (5 among 35 patients) and Horner's syndrome (8 among 35 patients) was more in supraclavicular group and interscalene group respectively (Table 7). There was no incidence of incomplete or failed block among the study population. There was no dermatomal sparing effect in the both groups.

Discussion

The brachial plexus is formed by the anterior rami of fifth to eight cervical (C5–8) and first thoracic (T1) spinal segment. The ventral rami of C5-C8 and the T1 nerve roots leave the intervertebral foramina and converge to form trunks, divisions, cords, and the terminal nerves. Three distinct trunks are formed between the anterior and middle scalene muscles and they are vertically arranged. The superior trunk (C5-6), the middle trunk (C7) and the inferior trunk (C8–T1) pass over the lateral border of the first rib and under the clavicle, each trunk divides into anterior and posterior divisions. As the brachial plexus emerges below the clavicle, the fibers combine again to form lateral, medial and posterior cords. At the lateral border of the pectoralis minor muscle, each cord gives off a large branch before terminating as a major terminal nerve. The lateral cord gives off the lateral branch of the median nerve and terminates as the musculocutaneous nerve. The medial cord gives off the medial branch of the median nerve and terminates as the ulnar nerve. The posterior cord gives off the axillary nerve and terminates as the radial nerve.

After reviewing the anatomy it can be said that BPB by the inter scalene approach tends to produce the most intense block at the C5–C7 dermatomes and least intense block in the C8–T1 dermatomes whereas, supraclavicular approach provides dense block of the upper extremity except in the shoulder region[8]. The interscalene block is the most suitable for surgeries on the shoulder and upper arm, although this approach can be used for forearm and hand surgery and the supraclavicular block is mainly used for surgeries on the lower arm, elbow and forearm.

In this study onset of sensory block was earlier in the supraclavicular (SCB) group in comparison to theinterscalene (ISB) group. The previous study also found that the onset of the sensory block was earlier in the supraclavicular group than interscalaene group which corroborates with this study. [9] In the supraclavicular group the onset of sensory block was earlier in the dermatome of median nerve distribution than radial and ulnar nerve distribution. In the interscalene group the onset of sensory block was earlier in radial nerve distribution than median and ulnar nerve. The onset of sensory block was more rapid along all these three nerve distributions in the supraclavicular group in comparison to interscalaenae group (9.65 min vs. 13.31 min, 10.91 min vs. 11.60 min, 11.31 min vs.17.45 min

in the median, radial, ulnar nerve distribution respectively) which was statistically significant (p value 0.000). The previous study also found that the onset of sensory block was earlier in the radial nerve distribution in the ISB group and in the median nerve distribution in the SCB group [10].

The onset of motor block was earlier in the supraclavicular group (16.28 min) than the interscalene group (21.71 min) which was statistically significant (p value 0.000). The duration of sensory block was more in the supraclavicular group (630.02 min) than the interscalene group (530.74 min) which was statistically significant (p value 0.000). There was no statistically significant difference in the duration of motor block between the SCB and the ISB group(486.34 min vs. 486.82 min, p value 0.684).The earlier study observed that a higher incidence of complete sensory and motor block of the radial, median and ulnar nerve in supraclavicular BPB in comparison to interscalene BPB [11]. There was report of variation in the sensory and motor block rate by the interscalene approach whereas similar sensory and motor block was established by the supraclavicular approach [10]. In the present study, the onset of sensory and motor block was delayed in the interscalene group than the supraclavicular group but the complete sensory and motor block was achieved in the both groups.

The low interscalene block technique has been tried. In this technique the needle is inserted more caudally than the conventional site of puncture(at the level of the cricoid cartilage).

The reason is that at the lower neck, the interscalene groove is more shallow and easier to identify, the distribution of anesthesia is also adequate for elbow and forearm surgery and the chance of puncture of the carotid artery is less. Other studies also recommended that the lower inter scalene approach for more success rate than the classical supraclavicular approach [12]. In this study conventional interscalene BPB was administered and adequate sensory and motor block was found in all patients among the interscalene group. Different studies have compared levobupivacaine, ropivacaine and bupivacaine in brachial plexus block for upper limb surgery. [12,13] The long duration of sensory block associated with good analgesia and less toxicity of levobupivacaine makes it a better drug for regional nerve block for upper extremity. [15] The quality and duration of peripheral nerve block is improved with the use of higher concentrations of levobupivacaine, (0.50-75%). [16] So 0.5%levobupivacaine was used in this study.

There was more incidence of Horner's syndrome in the interscalene group than supraclavicular group (8 vs. 1, n= 35 in each group). The incidence of vascular puncture in the supraclavicular group was more than the interscalene group (5 vs. 0, n = 35 in each group).

In this study, it was observed that though the onset of the sensory and motor block was not similar, but all the dermatomes were blocked subsequently with satisfactory intraoperative and postoperative analgesia in all the cases. However, there are some limitations in the present study like the study population was small, it was not a multicentric study and the sensory block along the distribution of musculocutaneous nerve was not assessed.

Conclusion

Interscalene approach is equally effective regarding the sensory and motor blockade as supraclavicular approach of brachial plexus block for the lower arm, elbow and forearm surgeries with minimum complications.

	Gr.ISB	Gr.SCB	p value
Age	32.29 ± 5.82	31.97 ± 5.56	0.818
Weight	56.22 ± 2.38	56.28 ± 2.50	0.922
Duration of surgery	59.14 ± 14.01	61.42 ± 10.04	0.435

Table 1: *Demographic criteria and duration of surgery.*

	Gr.ISB	Gr.SCB	p value
HR(beats/min)	80.17 ± 4.24	79.57 ± 4.36	0.562
MAP(mm Hg)	75.14 ± 3.07	74.74 ± 3.07	0.588
SpO_2(%)	97.68 ± 1.02	97.34 ± 1.10	0.183

Table 2: *Baseline HR (beats/min), MAP (mm Hg), SpO_2(%).*

	Gr. ISB	Gr. SCB	p value
HR(beats/ minute)	86.80 ± 2.81	86.97 ± 2.95	0.805
MAP(mm Hg)	85.08 ± 3.37	85.94 ± 3.38	0.292
SpO_2 (%)	98.51 ± 0.50	98.48 ± 0.50	0.814

Table 3: *Average intraoperative HR (beats per minute), MAP (mm of Hg), SpO_2 (%)*

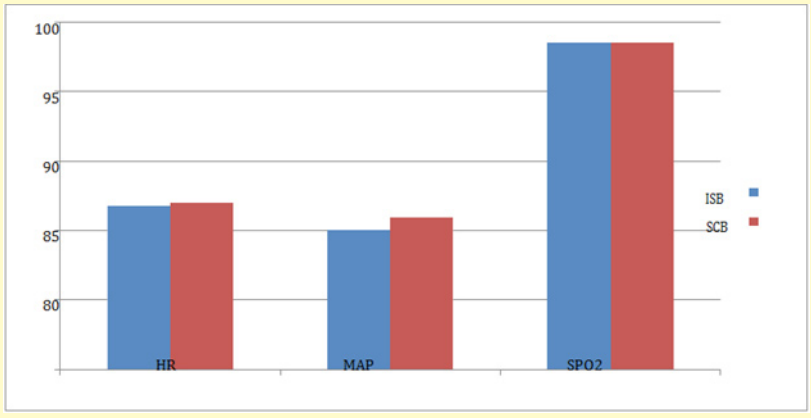

Figure 1: *Comparison of average intraoperative HR (beats per minute), MAP (mm of Hg), and SpO_2 (%).*

	Gr. ISB	Gr. SCB	P value
MN (mins)	13.31 ± 0.86	9.65 ± 0.68	0.000
RN (mins)	11.60 ± 0.69	10.91 ± 0.78	0.000
UN (mins)	17.45 ± 1.03	11.31 ± 0.86	0.000

Table 4: *Onset of sensory block (minutes) in median (MN), radial (RN)and ulnar (UN) nerve distribution.*

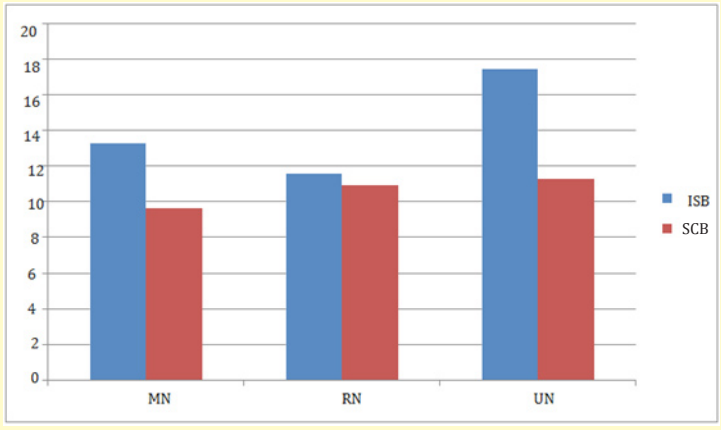

Figure 2: *Comparison of onset of sensory block (minutes) of median(MN), radial(RL) and ulnar nerv(UN) distribution.*

Gr. ISB	**Gr. SCB**	**P value**
21.71 ± 0.92	16.28 ± 0.98	0.000

Table 5: *Onset (minutes) of motor block.*

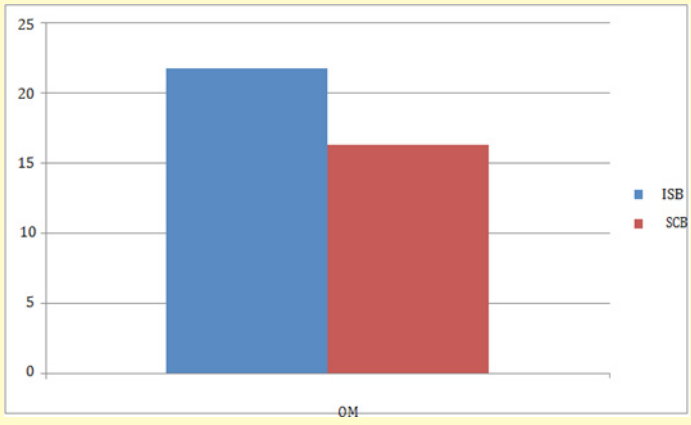

Figure 3: *Comparison of onset of motor block (OMB) between the two groups.*

Figure 4: *Comparison of duration of sensory and motor block between the two groups.*

	Gr. ISB	Gr.SCB	p value
Sensory(mins)	530.74 ± 8.24	630.02 ± 7.86	0.000
Motor(mins)	486.82 ± 4.63	486.34 ± 5.2	0.684

Table 6: *Duration of sensory and motor block (minutes).*

	Gr.ISB	Gr.SCB
Vascular puncture	0(n = 35)	5(n = 35)
Pneumothorax	0(n = 35)	0(n = 35)
Horner's syndrome	8(n = 35)	1(n = 35)

Table 7: *Complications.*

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