

A comparative study between usg guided classical interscalene block and low approach interscalene block in shaft humerus surgery

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Abstract

Background: Classical interscalene approach of Brachial plexus block has become the anesthetic technique of choice in upper arm and shoulder surgery but one of the principal concerns is high risk of complications and sparing of C8-T1 nerve roots. Here we used low approach of interscalene block for shaft humerus surgeries. Previously none of the study compare USG guided LISB to the conventional approach for shaft humerus surgeries, Hence, this study was designed to compare onset, duration, density of sensory-motor block, severity of complication between ISB and LISB. **Materials and Methods:** Patients with fracture of shaft humerus at the age group of 18yrs- 55yrs of three hundred twenty four, ASA I and II patients, were randomly assigned into two groups I and L, where Classic Interscalene block and Low Interscalene block were used, respectively. The primary objective of the study was to find out the difference in density of sensory-motor blockade and severity of complications if any, between the two groups, by using the Group differences were analyzed by parametric (t test) and nonparametric (Wilcoxon rank order test) tests; 2 was used for tests of independence. **Results:** At five minutes and fifteen minutes after the performance of the block, the degree of the block in the ulnar nerve was found to be 2.8 ± 2.6 and 1.1 ± 1.8 , respectively, based on a ten-point scale. Motor block occurred in the median nerve after fifteen minutes in 151 patients out of 162 (92.8%), and in all of the other three nerves in all 162 patients. Horner syndrome and hoarseness were less frequent in LISB patients than in ISB patients (P 0.0009 and 0.003, respectively) which was statistically significant. **Conclusion:** The present study confirmed the achievement of an appropriate sensory and motor block in the shaft humerus surgery, including the ulnar nerve, fifteen minutes after LISB, with no complications than ISB.

Keywords: ISB- Interscalene Block, LISB- Low Interscalene Block, ASA- American Society of Anaesthesiology.

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Introduction

Peripheral nerve blocks are excellent anaesthesia technique, gained popularity for providing good quality of anaesthesia and perioperative analgesia[1]. Brachial plexus block used for upper extremity surgery. The brachial plexus runs from the C5-T1 ventral rami, forms the superior, middle, and inferior trunks, divides under the clavicle, leads to the lateral, posterior, and

medial cords, and finally forms the peripheral nerves running to the arms. The brachial plexus block is popular for anesthetic and pain control purposes in the upper limbs. There are a few approaches to the block, including the interscalene approach, supraclavicular approach, infraclavicular approach, and the axillary approach. The classic interscalene approach has been performed at the C6 level located in the cricoid cartilage and is useful in controlling pain after shoulder surgeries, upper 1/3rd of arm. With the conventional approach to ISB, a needle is inserted at the C6 level to deposit local anesthetic in the interscalene groove[2]. However, a single-injection ISB at this level often spares the lower trunk of the brachial plexus (C8-T1; ulnar nerve) in up to 50% of blocks [3], and associated

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with complications like Horner syndrome, Hoarseness of voice, Hemidiaphragmatic palsy[4]. With the low ISB (LISB) approach, local anesthetic is deposited more caudad in the brachial plexus than with the ISB approach higher success rate of blockade in the ulnar nerve distribution, lesser complications. However, there have been no studies that have reported this method comparing ISB used with ultrasound. Hence, this prospective, double blind, parallel group, randomized study was designed to compare the onset, degree of motor and sensory blockade, severity of complications.

Materials and methods

The present study was conducted on three twenty four patients (162 in each group) who were classified as physical status 1 or 2 by the American Society of Anesthesiologists (ASA) and who were scheduled to receive a shaft humerus surgery at SSKM hospital (orthopaedic operation theatre), after taking Institutional ethical committee approval and written informed consent from each patient. We excluded patients with coagulation disorders, those who were under the age of 18 or over the age of 75, those who weighed less than 50 kg or more than 100 kg, patients with any kind of neurological deficit, or patients with surgical site infections. We explained to the patients the objective of the study as well as potential risks and complications of the procedure. The study proceeded following consent from the patients. The patients were not premedicated prior to receiving anesthesia. After they arrived in the operating room, patients were connected to a non-invasive blood pressure manometer, pulse oximeter, and electrocardiogram to monitor their vital signs every three minutes. The patients were in the supine position with their heads facing away from the side of the block. The region was prepped with betadine and the linear probe of the ultrasound (SonoSite M-Turbo, SonoSite, Inc., Bothell, WA, USA) was placed on the interscalene groove, for ISB USG probe was placed at the level of c6 cartilage in the interscalene groove, for LISB which is located at about two-thirds of the distance caudally from C6 when the distance between C6 and the clavicle is divided into three sections, as suggested by Kim et al [3] (Figure 1). Sterilized plastic wrap and gels, and 22G, 50 mm needles (UniPlex NanoLine facet tip UP 3/50, Pajunk Medical Produkte GmbH, Geisingen, Germany) were used. After identifying the Brachial plexus and confirming the absence of blood vessels in the trajectory of the needle by colour Doppler imaging the operator advances the insulated needle 22G, 5 cm

needle (stimuplex) slowly by in plane approach taking care to avoid any vascular structures and keeping the needle in view at all times. Then an assistant aspirate and injects 1ml of local anaesthetic. The optimal needle location visualized as the spreads of the local anaesthetics as a hypoechoic area around the nerve roots. Once the ideal local anaesthetic spread is visualized, the assistant injects lignocaine with adrenaline 2% @5mg/kg, and bupivacaine 0.5% @ 2mg /kg but we keep the total volume of drug around 20 ml with continuous monitoring for early sign and symptoms of intravascular injection. At five and fifteen minutes after the injection of the local anesthetic, we confirmed the sensory block using alcohol wipes on the musculocutaneous nerve, median nerve, radial nerve, and ulnar nerve with a scale ranging from 0 (no sensation) to 10 (normal sensation). We also checked for muscular contractions by assessing flexion of the elbow (musculocutaneous nerve), extension of the elbow and wrist (radial nerve), pronation of the arm and flexion of the wrist (median nerve), and flexion and opposition of the fourth and fifth fingers toward the thumb (ulnar nerve), and considered signs of paralysis (loss of contraction) to indicate a successful motor block. After block we also checked for any complications like Horner syndrome, Hoarseness of voice and Hemidiaphragmatic palsy. One anesthesiologist performed the LISB and ISB procedure and one orthopaedician performed the surgery. We confirmed cases of hemidiaphragmatic paralysis after the surgery by performing a chest X-ray and consulting a radiologist regarding the results.

Results

Among the 324 subjects of this study, 162 were male and 162 were female. The patients' demographic and clinical data including age, body weight, height, gender, surgery length are illustrated in Tables 1 and 2. All patients were posted for shaft humerus fracture ORIF. At five and fifteen minutes after the block procedure, the degree of sensory block in the ulnar nerve was found to be 2.6 ± 2.0 and 1.2 ± 1.7 , respectively for low approach interscalene block and 4.5 ± 2.3 and 3.3 ± 2.8 for classical approach interscalene block on a scale of ten. Muscular block occurred in the median nerve after fifteen minutes in 154 of the 162 patients (92.8%), and in all of the other three nerves in all 162 patients (Tables 3 and 4) for low approach interscalene block and 140 of the 162 patients in the median nerve after fifteen minutes and in all of the other three nerves in all 162 patients. In case of low approach interscalene none of the patients received

additional analgesics after the surgery, there were no signs of complications, such as dyspnea or Horner syndrome, hemidiaphragmatic palsy, hoarseness of voice during the surgery, in the recovery room, or in

the wards whereas in classical approach 18 patients develops horner syndrome and hoarseness of voice and 10 patients develops hemidiaphragmatic palsy which was statistical significant ($p>0.005$).

Table 1: Patient Demographic Data

	LISB	ISB
Age (yr)	47.8 ± 14.6	45.5 ± 15.2
Height (cm)	160.0 ± 8.6	156.5 ± 7.8
Weight (kg)	59.7 ± 10.6	55.9 ± 12.2
Sex (M/F)	81/81	81/81
Operation time (min)	59.6 ± 33.0	61 ± 30.2
Block performance time (sec)	341.7 ± 59.2	365.1 ± 60

Values are mean ± standard deviation or number of patients.

Table 2: Characteristics of the Sensory Block Using a Low Approach Interscalene Brachial Plexus Block and Classical Interscalene Brachial Plexus Block

	LISB		ISB		Level of significance	Level of significance
	5 min after injection	15 min after injection	5 min after injection	15 min after injection		
Sensory block (0–10)					After 5 min	After 15 min
Musculocutaneous nerve	0.7 ± 1.3	0.2 ± 0.6	1.3 ± 1.0	1.3 ± 1.0	P < 0.001	P < 0.001
Median nerve	1.6 ± 2.3	0.9 ± 1.9	1.9 ± 1.2	1.7 ± 1.3	P = 0.142	P < 0.001
Radial nerve	0.5 ± 1.1	0.1 ± 0.3	2.0 ± 1.3	2.0 ± 1.1	P < 0.001	P < 0.001
Ulnar nerve	2.8 ± 2.6	1.1 ± 1.8	4.1 ± 1.5	3.3 ± 2.3	P < 0.001	P < 0.001

Values are mean ± standard deviation. Sensory block (0–10); 0: loss of sensation, 10: normal sensation.

Table 3: Characteristics of the Motor Block Using a Low Approach Interscalene Brachial Plexus Block

	LISB		ISB	
	5 min after injection	15 min after injection	5 min after injection	15 min after injection
Motor block (%)				
Musculocutaneous nerve	154 (95%)	162 (100%)	140	150
Median nerve	123 (73.4%)	159 (98%)	90	129
Ulnar nerve	149 (91.9%)	162 (100%)	106	125
Radial nerve	145 (89.5%)	162 (100%)	138	149

Values are number of patients (percentage).

Table 4: Analgesic Requirement and Complications after a Low Approach Interscalene Brachial Plexus Block

	LISB	ISB
Patients requiring analgesics during operation	10	20
Patients with complications	6	40
a. Horner syndrome		
b. Hoarseness of voice	5	35
c. Hemidiaphragmatic palsy	2	28
d. Dyspnea	2	30

Discussion

This study confirmed that an appropriate sensory and motor block was achieved in the upper extremities, including the ulnar nerve, fifteen minutes after LISB, and that there were no complications associated with the block. Two methods of LISB have been introduced, namely the anatomical landmark approach and the ultrasound-guided approach. There are three approaches to the anatomical landmark method: first, it can be performed in between the cricoid cartilage and the clavicle. Second, it can be performed 2 cm above the clavicle, and third, it can be performed on the interscalene groove, which is located at about two-thirds of the distance caudally from C6 after dividing the distance between C6 and the clavicle into three sections. Although different studies define and name the procedures slightly differently (low approach, lower interscalene approach, or superior trunk approach), these procedures are identical in terms of using an approach through the lower regions of the C6 level compared to the existing ISB. It has been known that the ulnar nerve is not affected in about 30-50% of ISBs performed with the classic approach [1]. Hence, in the present study, we used 20 ml of local anesthetics to ensure a quick onset and complete block of the ulnar nerve. LISB is known to involve a short effect distance (from the C5 nerve root to the C8 nerve root) and to diffuse local anesthetics via the deep cervical fascia. In addition, LISB has been reported to bring about appropriate sensory and motor blocks required for upper limb surgeries even with a single injection [10]. Against this backdrop, the present study was planned and conducted. Moreover, according to Plante et al., [9] who compared two groups of patients who were injected with local anesthetics either in the upper region of the C5 nerve root or the lower region of the C6 nerve root during an ultrasound-guided interscalene brachial plexus block for analgesia in arthroscopic shoulder surgeries, the group of patients who received local anesthetics in the lower region of the C6 nerve root had appropriate sensory blocks in all of the nerves; they reported that the sensory and motor blocks were especially noticeable in the ulnar nerve and that there was a rapid onset in the ulnar nerve. The results of this study showed that the sensory block in the ulnar nerve was 2.8 ± 2.6 on a 10-point scale at five minutes after LISB and 1.1 ± 1.8 at fifteen minutes after LISB. In addition, there were no additional injections of analgesics during the surgery. Therefore, it can be said that the ulnar nerve was appropriately blocked via LISB. Meanwhile, ISB is known to induce a temporary paralysis in the ipsilateral hemidiaphragm due to phrenic nerve palsy. The phrenic nerve is located within 2 mm of the brachial plexus of the cricoid

cartilage and divides 3 mm per 1 cm as it descends caudally. Thus, it can be predicted that the incidence of phrenic nerve palsy-induced hemidiaphragmatic paralysis can be reduced if ISB is performed more caudal to the C6 level or on the superior trunk [11, 12]. In the present study, there were no signs of dyspnea or hemidiaphragmatic paralysis. In addition, LISB is known to reduce the damage to the dorsal scapular and long thoracic nerves, both of which split from the C5 nerve root[4]. Although we did not assess whether any such damages occurred in the present study, none of the patients experienced any such problems. As mentioned above, there were no complications in the current study. We presume that we were able to reduce the risk of complications, such as vascular injection or nerve injury, by using an ultrasound nerve stimulator in addition to the inherent merits of the LISB method. In the present study, the motor block in the median nerve was shown to be about 71.4% at five minutes after the procedure was performed. The block increased to 92.8% at fifteen minutes, and there were no additional analgesics injected and no additional block was performed. Other studies have also reported similarly slow blocks in the median nerve within fifteen minutes [9], which is thought to be due to the fact that the median nerve innervates all of C5, C6, C7, and T1. Thus far, studies on LISB are only in the form of case reports or brief reports; hence, In conclusion, the present study confirmed that the nerves in the upper extremities, including the ulnar nerve, were appropriately blocked fifteen minutes after the performance of LISB, and that there were no complications induced by the block.

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