Original Research Article

Comparison of “standard” versus “lower” approach interscalene brachial plexus block for upper extremity surgery using peripheral nerve stimulator

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Abstract

Background: Interscalene brachial plexus block can be used solely to facilitate anaesthesia and analgesia or as an adjunct to provide prolonged postoperative analgesia for shoulder and upper 1/3 arm surgery. The “Standard” approach is difficult to master and has significant side effects like horner syndrome, hemidiaphragmatic palsy, ulnar nerve sparing, etc. With the lower interscalene block approach, local anaesthetic is deposited more caudad in brachial plexus and has higher success rate, less sparing of ulnar nerve and negligible complications as compared to standard approach. **Aims and Objectives:** The aim of this study was to compare the efficacy and success rates of “standard” and “lower” approach interscalene block using peripheral nerve stimulator for upper extremity surgeries. **Materials and Methods:** 40 patients of ASA grading I and II aged between 18-65 years undergoing elective upper extremity surgery were selected and divided randomly in two groups- **Group S** - block given, using standard approach and in **Group L**- block given, using lower approach interscalene brachial plexus block with peripheral nerve stimulator. Injection Lignocaine Hydrochloride 2% 10ml and injection Bupivacaine plain 0.5% 10ml were injected after adequate motor response. **Results:** Lower interscalene block has higher success rates, lesser sparing of ulnar nerve and lesser time to perform (7.06 ± 2.40 mins) as compared to standard technique (12.78 ± 2.60 mins) p value<0.05. There was no significant difference statistically for onset of sensory block. **Conclusion:** Lower approach interscalene brachial plexus block can be safely used for upper extremity surgeries with advantages like lesser block performance time, high success rate, lesser sparing of ulnar nerve and negligible complications. Thus, lower approach interscalene block is superior to standard approach as well as general anaesthesia.
Key Words: Interscalene block, Lower approach, Standard approach, Upper extremity surgery.

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INTRODUCTION

Peripheral nerve blocks have assumed a prominent role in modern anaesthesia practice as they provide ideal operative conditions without any sedation or major systemic hemodynamic effects. With the development of new techniques such as ultrasound and peripheral nerve stimulator, the scope of anaesthesia has shifted from general anaesthesia for isolated upper limb surgery, to peripheral nerve blocks. Providing adequate analgesia is a major challenge for anaesthesiologist in patient undergoing surgeries like shoulder manipulation, surgery on shoulder and arm, proximal 1/3 arm surgery. Brachial plexus block is among the most commonly performed peripheral nerve blocks for upper extremity. Brachial

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plexus block was first accomplished by Halsted in 1884 when he freed the cords and nerves of the brachial plexus after blocking the roots by direct injection with cocaine solution. Interscalene brachial plexus block (ISBPB) is a well established technique and can be used solely to facilitate anaesthesia and analgesia or as an adjunct to provide prolonged postoperative analgesia for shoulder and upper 1/3 arm surgery. Its first description by Winnie was in 1970. The "Standard" or "Classic" approach of interscalene block has significant side effects like horner syndrome, hemidiaphragmatic palsy, recuurent laryngeal nerve palsy, ulnar nerve sparing. To overcome this, alternative technique "Lower" approach of interscalene block is used. With the low interscalene block (LISB) approach, local anaesthetic is deposited more caudad in brachial plexus and thus more distal distribution of anaesthesia, higher success rate, less sparing of ulnar nerve and negligible complications as compared to standard approach. The present study was undertaken to evaluate and compare the efficacy and success rates of "standard" and "lower" approach interscalene block using peripheral nerve stimulator for upper extremity surgeries.

MATERIALS AND METHODS

After approval from institutional ethical committee, present study was conducted in 40 indoor patients of either sex, between age group 18-65 years, ASA grade I and II, admitted to our tertiary care hospital and scheduled for upper extremity surgeries. In this prospective randomized, observational study, patients were randomly divided into two groups of 20 each. Exclusion criteria included patient refusal to participate in study, local infection at site of block, ASA grade III or higher, patients with peripheral neuropathy, patients with coagulopathy or on anticoagulants, patients with allergy to local anaesthetics. Preanaesthetic evaluation of all patients, prior to surgery, was done and necessary routine investigations like complete blood count, blood sugar and electrolytes, Chest X-ray and Electrocardiogram, if indicated, were carried out. Thorough general and systemic examination including airway and the surface anatomy where the block was to be given, was done. Written informed consent was taken. The patients were randomly and equally divided into 2 groups and total volume of drug injected was 20 ml (Inj. Lignocaine plain 2% 10ml + Inj. Bupivacaine plain 0.5% 10ml)

Group S- Interscalene block given by STANDARD approach

Group L- Interscalene block given by LOWER approach

In the recovery room, preoperative vitals and NBM status was noted. Intravenous line was secured and preloading was done with 10-15ml/kg crystalloid solution. All patients were premedicated 30 – 35 mins prior to induction with Inj Glycopyrrolate 0.005 – 0.01 mg/kg IM and Inj Midazolam 0.04 – 0.07 mg/kg IM. In the operation theatre, patients were connected to a noninvasive blood pressure manometer, pulse oximeter, electrocardiogram to monitor their vital signs. Patient lied supine with the arm on the abdomen and the head turned away from the operative side and elevated to make sternocleidomastoid prominent. Standard ISB is given at the level of cricoid cartilage (C6 level). A line extended laterally from the cricoid cartilage and intersecting the interscalene groove indicates the level of the transverse process of C6.

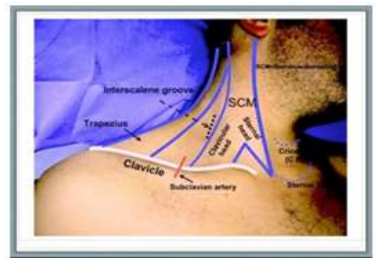

Figure 1:

With both fingers in the interscalene groove, a 1.5 inch, 22 guage insulated short bevel needle, inserted between the fingers at the level of C6 in a direction that is perpendicular to the skin in every plane. Needle advanced slowly until stimulation of brachial plexus was obtained. Once the motor response i.e. twitches of pectoralis major, deltoid, triceps, biceps, forearm and hand muscles, was elicited at minimum current of 0.4-0.6 mA current, it was accepted.

In the lower interscalene block, the block is given more caudad than the standard approach. A line is drawn (A) from the lateral side of the cricoid cartilage parallel to the superior border of the clavicle until intersecting with the lateral border of the sternocleidomastoid muscle i.e (B). Another vertical line is extended from point B to the upper border of clavicle, along the lateral border of sternocleidomastoid muscle. It is then, divided into 3 parts and at the junction of upper two-third and lower one-third, the palpating fingers are placed(X).

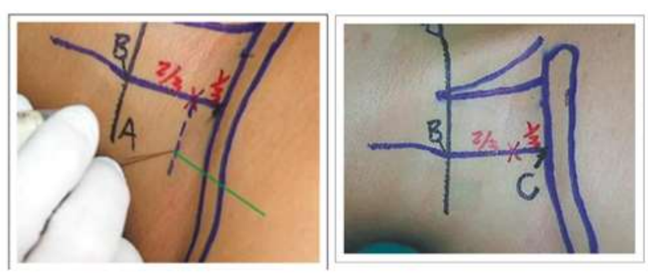

Figure 2:

The palpating fingers placed at posterior border of sternocleido-mastoid, touches to the clavicle below and are gently rolled laterally across the belly of anterior scalene muscle until encountering the lower interscalene groove.(Z). After palpating interscalene groove, needle was advanced perpendicular to skin plane and in slight caudal direction. Needle is advanced till adequate motor responses obtained and local anaesthetic was injected. Intraoperative vitals, block performance time, duration of onset of sensory and motor block, quality of block, complications, if any and total duration of block were noted. Block performance time was defined as the time from initial needle insertion to final needle removal. Sensory blockade was evaluated by pinprick over the regions based on dermatomal distribution: axillary, musculocutaneous, radial, ulnar, and median nerve.

0- Sharp pain on pinprick
1- Touch sensation
2- Not even touch sensation.

Onset of sensory blockade was taken as the time from injection of local anaesthetic to complete loss of sensation (score 2). Duration of sensory block was defined as the time from complete block to the return of parasthesia (sensory score 1). Motor blockade was assessed by movements corresponding to radial, median, ulnar and musculocutaneous nerves - 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), flexion and opposition of the fourth and fifth fingers toward the thumb (ulnar nerve). Onset of motor block was taken as the time from injection of local anaesthetic to loss of flexion and extension at elbow and wrist. Duration of block was defined as the time from complete block to return of flexion and extension at elbow and wrist joints. Quality of block was graded as complete, partial and failed. A complete block was defined when no sensation was felt at the primary innervations sites and the subject was unable to raise the arm, flex or extend the elbow and wrist. A failed block was defined when no degree of sensory or motor block was achieved after 30 min of block placement. A partial block was defined as when some analgesics were required during the surgery. The incidence of side effects or complications, like sparing of ulnar nerve, Horner syndrome, recurrent laryngeal nerve block, hemidiaphragmatic paralysis, circumoral numbness, etc. were noted intra as well as postopertively. Ulnar nerve sparing was defined as no sensory and motor block in ulnar nerve distribution. Horner syndrome was noted by signs such as ptosis, miosis, skin flushing and nasal congestion. Recurrent laryngeal nerve block resulted into hoarseness of voice. We confirmed cases of hemidiaphragmatic paralysis after the surgery by performing a chest X ray and consulting radiologist regarding the results. Inferential and descriptive statistics were used for data analysis. Descriptive statistics were used for demographic variables. Student's t test was used for comparison of parameters among 2 groups and comparison was analysed by Chi square test. A p value of less than 0.05 was considered significant.

RESULTS

The present study was conducted in 40 indoor patients of either sex, between age group 18-65 years, ASA grade I and II, admitted to our tertiary care hospital, and scheduled for upper extremity surgeries. There was no significant difference noted between the groups in relation to age, weight, height, duration of surgery and were comparable in both the groups.

TABLE 1

DEMOGRAPHIC PROFILE	MEAN ± SD		P VALUE
	Group S	Group L	
Age (years)	32.72 ± 4.90	34.33 ± 3.07	0.18
Height (cm)	154 ± 7.81	155.63 ± 3.42	0.49
Weight (kg)	59 ± 7.89	56.93 ± 6.19	0.43
Duration of surgery (min)	110.16 ± 3.35	115.9 ± 4.24	0.42

There was no significant difference in the intraoperative vitals and hemodynamics between both the groups. A highly significant difference was noted in the block performance time between the standard approach technique (12.78 ± 2.60 min) and lower approach technique (7.06 ± 2.40 min) p value < 0.05). There was a significant difference in time of onset of motor block between Group S (10.21 ± 3.10 min) and Group L (8.76 ± 2.22 min) p value < 0.05. There was no statistically significant difference in time of onset of sensory block between both the groups. There was significant difference in total duration of both sensory between Group S (7.11 ± 1.72 hours) and Group L (8.96 ± 2.34 hours) p value<0.05. A significant difference was also noted in total duration of motor block between Group S (4.12 ± 0.76 hours) and Group L (5.97 ± 1.60 hours) p value < 0.05.

Table 2

PARAMETER	MEAN ± SD		p value
	GROUP S	GROUP L	
BLOCK PERFORMANCE TIME (min)	12.78 ± 2.60	7.06 ± 2.40	**0.0007**
ONSET OF SENSORY BLOCK (min)	13.65 ± 2.37	12.35 ± 2.58	0.268
ONSET OF MOTOR BLOCK (min)	10.21 ± 3.10	8.76 ± 2.22	**0.029**
DURATION OF SENSORY BLOCK (hrs)	7.11 ± 1.72	8.96 ± 2.34	**0.03**
DURATION OF MOTOR BLOCK (hrs)	4.12 ± 0.76	5.97 ± 1.60	**0.01**

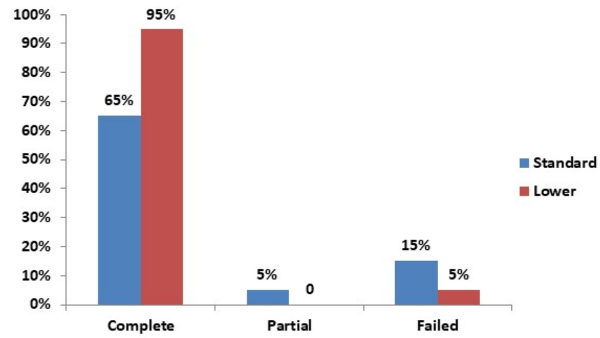

CHART 1: Quality of Block

In Chart 1, the quality of block in both the groups is shown. The success rate was 95% in lower approach as compared to 65% in standard approach of interscalene nerve block. No effect of block was evident in 15% of patients in group S and 5% of patients in group L and these patients received general anaesthesia for the surgery to be conducted.

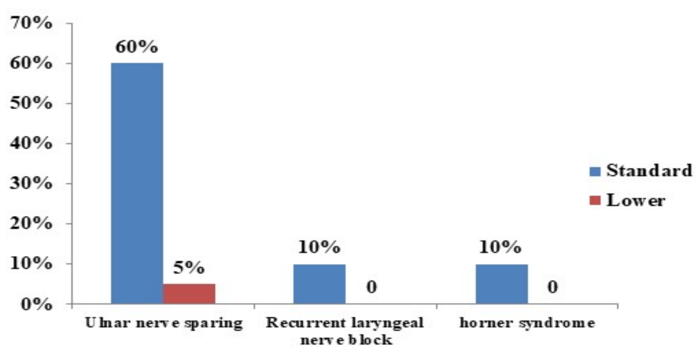

CHART 2: COMPLICATION RATE

In Chart 2, the side effects and complication rates among both the groups are shown. Ulnar nerve sparing was very common in the standard approach group as compared to lower approach group (60% vs 5%). Recurrent laryngeal nerve block and Horner syndrome were noted in few patients of Standard group. There were no complications noted in Lower approach group. No incidence of pneumothorax was noted.

DISCUSSION

A randomized prospective study was conducted in 40 patients of ASA I and II, aged between 18-65 years, of either sex, undergoing upper extremity orthopaedic surgery. The patients were randomly and equally divided into 2 groups and total volume of drug injected was 20ml (Inj. Lignocaine plain 2% 10ml + Inj. Bupivacaine plain 0.5% 10ml)

Group S- Interscalene block given by STANDARD approach

Group L- Interscalene block given by LOWER approach

The anatomical configuration of the upper limb, with nerves often bundled around an artery, makes regional anaesthesia of the arm both accessible and reliable. Interscalene block (ISB) using nerve stimulation has been in practice for decades and provides excellent anaesthesia for upper extremity surgery. A common misconception regarding the performance of brachial plexus block is that it requires a lengthy period to perform and may slow room turnover. The shorter time for performing the block with LISB (7.06 ± 2.40 min) can be explained by more superficial location of the brachial plexus at this level. The negligible chances of ulnar sparing with LISB is due to more caudal distribution of the drugs and involvement of the inferior trunk too. Our study confirmed that with the lower interscalene approach, an appropriate sensory and motor block was achieved with no complications. Interscalene block is known to induce a temporary paralysis in the ipsilateral hemi-diaphragm due to phrenic nerve palsy. The phrenic nerve is located within 2 mm of brachial plexus at 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 in LISB. In our present study, there were no signs of dyspnea or hemidiaphragmatic paralysis. Manisha S *et al.* (2014) compared the two techniques of interscalene nerve block and had shorter block performance time for lower approach, but there were no significant differences in onset of motor and sensory blockade. Janet L. Dewees *et al.* (2006) conducted the study for comparison of interscalene and intersternocleidomastoid for proximal upper extremity surgery and found the block performance time to be 9.62 ± 5.31 min and had similar results. Darshana S *et al.* (2017) conducted the study of USG guided low approach interscalene block and had promising results with higher success rates than standard approach. Srirojanakaul W *et al.* (2008) performed the lower interscalene approach – the novel landmark in fresh cadavers , where he injected methylene blue dye and differentiated and loacalised the trunks by both approaches and found the distal coverage of the limb by lower approach. In our present study, Lower interscalene block had higher success rates, lesser sparing of ulnar nerve and lesser time to perform (7.06 ± 2.40 mins) as compared to standard technique (12.78 ± 2.60 mins) p value<0.05. There was no significant difference statistically for onset of sensory block.

From our study, we concluded that lower approach interscalene block:

Requires shorter block performance time

Appropriately blocks the nerves in the upper extremities, including the ulnar nerve.

Higher success rate with more distal spread of sensory-motor coverage.

No complications induced by the block.

The lower approach interscalene block is safe, easy to perform, requires shorter time to perform and has high success rate

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