



## STUDY OF ULTRASOUND GUIDED LOWER APPROACH INTERSCALENE BRACHIAL PLEXUS BLOCK

<b>Dr Pauravi Bhatt</b>	Associate Professor, SVP Hospital and Smt. NHL Medical college, Ellisbridge, Ahmedabad, Gujarat.
<b>Dr Khushali Tilwawala</b>	Assistant Professor, SVP Hospital and Smt. NHL Medical college, Ellisbridge, Ahmedabad, Gujarat.
<b>Dr Mansi Shukla</b>	Second Year Anaesthesiology resident doctor, SVP Hospital and Smt. NHL Medical college, Ellisbridge, Ahmedabad, Gujarat.
<b>Shailja Bhatt</b>	Third year MBBS medical student, B J medical college, Ahmedabad.
<b>Dr Palak Patel</b>	Second Year Anaesthesiology resident doctor, SVP Hospital and Smt. NHL Medical college, Ellisbridge, Ahmedabad, Gujarat.

**ABSTRACT** **Objective:** The purpose of this experiment was to study ultrasound guided low approach interscalene brachial plexus(LISB) block for upper limb surgery. **Materials And Methods:** A prospective, observational study was conducted in 30 patients with ASA grades I and II ,ranging from 18 to 60 years and weighing from 45 to 65 kgs who underwent upper limb surgery. After establishing standard monitors, baseline parameters such as heart rate, blood pressure, electrocardiogram and oxygen saturation were recorded. Ultrasound Guided LISB was given using Inj. Bupivacaine 0.5% 15ml and Inj. lignocaine 1.5% 10ml. Block execution time, Number of attempts, Evaluation of sensory and motor blockade of individual nerve at 5 min and at 15 min, Quality of block, Supplementation if needed, complications, Total duration of motor blockade, rescue analgesia and Patient's satisfaction was observed. **Results:** In our study, The mean block execution time was  $5.86 \pm 0.86$  minutes and the ultrasound guided block was completed with a single attempt in 28 patients out of 30. we found that sensory blockade in musculocutaneous, radial, median and ulnar were 93.3%, 90%, 73.3% and 83.3% respectively at the end of 5 min and 100% in all four nerves at the end of 15 min and motor blockade in musculocutaneous, radial, median and ulnar were 90%, 86.6%, 70% and 80% respectively at the end of 5 min and 100% in all four nerves at the end of 15 min. The mean duration of the motor block was  $207.33 \pm 25.45$  minutes. There were no signs of any block related complications. **Conclusion:** The study confirmed that sensory as well as motor blockade of the nerves in the upper extremities including the ulnar nerve were achieved appropriately at the end of fifteen minutes with ultrasound guided LISB without any complications and with utmost patient satisfaction.

### KEYWORDS :

#### INTRODUCTION

Brachial plexus block<sup>[1]</sup> is routinely given by anaesthetist in upper limb surgeries as a standalone anaesthesia as well as for post op analgesia. It can be given by the following approaches:

1. Supraclavicular
2. Axillary
3. Infraclavicular
4. Interscalene

The interscalene brachial plexus block also known as "standard/winnie's approach"<sup>[2]</sup> is given at inter-scalene groove at the level of cricoid cartilage (C6 level) for shoulder and arm surgeries. However, it is not appropriate for all of the upper limb surgeries because of the long distance between local anaesthetic deposition at the level of C6 and the lower trunk of brachial plexus sparing lower trunk (C8-T1, ulnar nerve) of the brachial plexus. A low approach to the interscalene block (LISB) deposits local anaesthetic further caudal on the brachial plexus. The Interscalene brachial plexus block can be performed by conventional blind; nerve stimulator (NS)-guided or ultrasound (US)-guided technique. Ultrasound (US) in regional anaesthesia offers a new standard in nerve-location and identification, allows real-time imaging of nerves and direct needle guidance with lower complication rate.

Standard or conventional interscalene brachial plexus block is associated with high failure rates, injury to nerves and surrounding structures and high chances of complications such as hemidiaphragmatic paresis as a result of phrenic nerve block while ultrasound guided block<sup>[3]</sup> has improved the success rate with excellent localization as well as improved safety margin.

Therefore, we planned to study ultrasound guided low approach interscalene brachial plexus block for upper limb surgery.

#### AIMS AND OBJECTIVES:

The present study was conducted in 30 adult patients with ASA grade I or II undergoing upper limb surgeries with ultrasound guided LISB.

The objectives were evaluated in terms of:

- 1) Block execution time.
- 2) Number of attempts.
- 3) Assessment of sensory and motor anaesthesia.
- 4) Evaluation of sensory blockade of individual nerve.
- 5) Evaluation of motor blockade of individual nerve.
- 6) Peri-operative hemodynamic changes.
- 7) Supplementation if needed
- 8) Incidence of complications.
- 9) Patient's satisfaction.

#### METHODOLOGY:

This is a prospective, observational study in which after approval from institutional ethical committee, written informed consent from each patient was taken.

The present study was conducted with following inclusion criteria :

- Patients with ASA grades I and II who underwent upper limb surgeries.
- Patients with age ranging from 18 to 60 years.
- Patients with weight ranging from 45 to 65 kgs.

We have excluded the patients with following criteria:

- Patients who refuse to participate in the study.
- Patient suffering from coagulopathy.
- Patients with known allergy to the local anaesthetics.
- Patients with skin infection at the proposed site of block.
- Patients with pre-existing neurological deficits in the upper limbs.
- Pregnant females.

In our study, Sensory block was evaluated by using 3 point scale at 5 min and 15 min for individual nerve :

- 0 = Normal sensation
- 1 = Loss of sensation of pin prick (analgesia)
- 2 = Loss of sensation of touch (anaesthesia)

And Motor block was evaluated by using modified bromage scale for upper extremities on a 3-point scale :

Grade 0 = Normal motor function with full flexion and extension of elbow, wrist and fingers  
 Grade 1 = Decreased motor strength with ability to move the fingers and wrist only  
 Grade 2 = Complete motor block with inability to move elbow, wrist and fingers.

**Study Protocol**

**Preoperative Assessment:**

All the patients underwent a thorough pre anaesthetic checkup and Procedure to be carried out was explained. All patients were advised nil by mouth as per fasting guidelines.

**Preoperative Preparation:**

An intravenous line was secured, standard monitoring such as Pulse oximeter, non-invasive blood pressure and ECG was done and baseline parameters such as heart rate, blood pressure, electrocardiogram and oxygen saturation were recorded. They were pre medicated with Inj. Ondansetron 0.15 mg/kg IV before surgery. Pre-procedure vitals were noted.

**Technique:**

The patients were positioned supine with the arm by the side and head turned to the opposite side of the intended block. The linear probe of the ultrasound was placed on the interscalene groove, 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. A 23 G 1.5 inches needle was connected to a 10 cm extension line and primed with the drug. It was inserted using an in-plane approach and the needle movement was observed in real time. After negative aspiration, a predetermined volume of drug was injected and the spread of the drug was observed. When necessary, the needle was repositioned to achieve an ideal perineural distribution of the drug.

**Hemodynamic Monitoring:**

The heart rate, blood pressure, ECG, and oxygen saturation (SpO2) were noted at baseline, thereafter every 5 minutes for the initial 15 minutes, then every 30 minutes till the end of the surgery, then every hourly upto 4 hours and then every 2 hourly up to 12 hours in post-operative period.

**Complications:**

Patients were observed for complications like: Horner's syndrome, Hoarseness of voice, Hypotension, Bradycardia, Dyspnea, Nausea and Vomiting & Ipsilateral Phrenic Nerve Palsy

**Post Operative Period:**

Patients were supplemented with Inj. Dynapar 75mg IV when they complained of pain.

**Patient Satisfaction:**

was assessed using a questionnaire which classified the patient's responses in 3 categories: Not satisfied/ Satisfied OR Very satisfied

**Statistical Analysis**

All the Data was entered in a spreadsheet program and statistical analysis was done using Microsoft Excel software.

**OBSERVATION AND RESULTS**

Observation and results are summarised and described below.

**I. Age Distribution**

Our study comprised of number of patients of age ranging from 18 to 60 years and mean age was 39.2 ± 13.9 years.

**II. Weight Distribution**

Our study comprised of number of patients weight ranging from 45 to 65 kgs and mean weight was 56.8 ± 5.12kgs.

**III. Asa Grading And Gender**

Our study consisted of patients having ASA grades I and II. There were 20 males and 10 females.

**IV. Duration Of Surgery**

The Mean duration of different surgeries for all the patients was 95.5 ± 33.5 min.

**V: Operative Procedure Of Upper Limb**

Type of procedure	Number of patients
Humerus plating	3
Radius plating	3
Ulna plating	2
Humerus nailing	4
Radius and ulna nailing	5
Radius nailing	2
Ulna nailing	1
ROI (Nail/Plate)	2
Radius K wire	3
Ulna K wire	1
Olecranon TBW K wire	2
Ganglion excision	1
Elbow curettage debridement and K- wire	1

Table suggests all types of surgeries related to the upper limb from shoulder to radius ulna could be possible via lower approach because of blockade of the lower trunk of the brachial plexus (C8-T1, ulnar nerve).

**VI: Pre-op Vitals**

Parameter	Patient (Mean)	Patient(SD)
Pulse (/min)	101.9	4.2
Systolic BP (mmHg)	135.5	7.3
Diastolic BP (mmHg)	80.8	3.2
SpO2 (%)	99	0
Respiratory Rate (per min)	15.8	0.7

**VII: Block Execution Time:**

The mean time taken for block execution was **5.86 ± 0.86 min.**

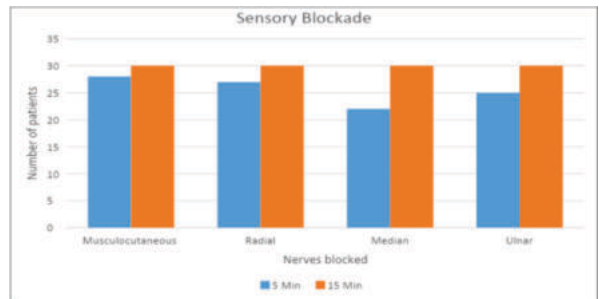
**VIII: Number Of Attempts**

Successful block was given in 28 patients in a single attempt while in 2 patients the block was successfully given in second attempts.

**IX: Sensory Block Characteristics Using 3 Point Scale**

		Patients with score 2	
		Percentage (%)	
Musculocutaneous N	5 Min	28	93.3%
	15 Min	30	100%
Radial N	5 Min	27	90.0%
	15 Min	30	100%
Median N	5 Min	22	73.3%
	15 Min	30	100%
Ulnar N	5 Min	25	83.3%
	15 Min	30	100%

Table shows the number and percentage of patients achieving complete sensory blockade that is scored 2 out of 3 point scale at the end of 5 min and at the end of 15 min.

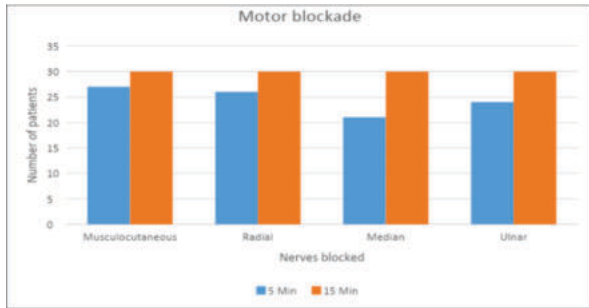


**X: Motor Block Characteristics Using Modified Bromage Scale For Upper Limb**

		Patients with score 2	
		Percentage	
Musculocutaneous N	5 Min	27	90.0%
	15 Min	30	100%
Radial N	5 Min	26	86.6%
	15 Min	30	100%
Median N	5 Min	21	70.0%
	15 Min	30	100%

Ulnar N	5 Min	24	80.0%
	15 Min	30	100%

Table shows number and percentage of patients achieving complete motor blockade, that is score 2 of modified bromage score for upper limb at the end of 5 min and at the end of 15 min.



**XI (a) : Per-op Vitals**

	Pulse (/min)	SBP (mmHg)	DBP (mmHg)	SPO2 (%)	RR (/min)
Immediate	102 ± 5.42	135 ± 5.52	80 ± 2.24	99	15 ± 0.58
5min	96 ± 3.81	131 ± 5.75	79 ± 4.42	99	15 ± 0.55
10min	92 ± 4.02	127 ± 7.31	78 ± 3.48	99	15 ± 0.72
15min	87 ± 3.58	124 ± 6.00	78 ± 3.41	99	14 ± 0.56
30min	84 ± 4.23	122 ± 4.51	77 ± 4.47	99	14 ± 0.68
60min	82 ± 3.25	120 ± 4.49	77 ± 4.22	99	14 ± 0.53
90min	80 ± 4.60	120 ± 3.48	76 ± 4.08	99	14 ± 0.59
120min	80 ± 4.21	120 ± 4.56	77 ± 4.22	99	14 ± 0.54
150 min	80 ± 2.98	121 ± 4.79	77 ± 4.36	99	14 ± 0.54

**XI (b) : Post Op Vitals**

180 min	82 ± 3.92	123 ± 3.79	78 ± 2.94	99	14 ± 0.76
240 min	88 ± 4.53	128 ± 4.96	79 ± 2.10	99	15 ± 0.80
300 min	93 ± 4.15	132 ± 4.54	80 ± 1.92	99	15 ± 0.67
360 min	96 ± 3.49	132 ± 1.41	82 ± 3.57	99	15 ± 0.54

No complications, such as hypotension, bradycardia, nausea/vomiting, dyspnea, Horner's syndrome or hemi diaphragmatic paralysis were noted.

We have excluded the failure cases from the study.

**XII: Duration Of Anaesthesia And Analgesia**

	Min
Duration of motor block	207 ± 25.45
Duration of rescue analgesia	275 ± 29.32

No side effects or adverse reactions were observed whatsoever. 28 out of 30 patients graded the experience as being very satisfied with the anaesthetic technique.

**DISCUSSION**

US guidance helps to identify peripheral nerves , optimizes the spread of the local anaesthetic solution, enables to secure an accurate needle position, monitor the distribution of the local anaesthetic in real time. Hence, resulted in improved success rate and decreased procedural time.

In the classic approach of interscalene block, the ulnar nerve is not affected in about 30-50%. Hence in the lower approach, where the injection is performed on the caudal side of the C6 nerve root, has the advantage of blocking the inferior trunk (C8, T1) of brachial plexus.

Phrenic nerve palsy induced hemi diaphragmatic paralysis can be reduced in LISB.

We studied 30 randomly selected patients who underwent upper limb surgeries and administered ultrasound guided LISB. We analysed the data obtained.

**Block Execution Time:**

The mean block execution time was **5.86 ± 0.86** minutes, which was comparable with the study by Ahuja *et al*<sup>[5]</sup> found that procedure time in the US group was 5.26 ± 1.05 minutes.

Janet L. Dewees *et al*<sup>[6]</sup> found the mean performance time for standard

ISB to be 9.62 ± 5.31 minutes which is more than the low ISB . The less time for the block execution was found using lower ISB can be explained by more superficial location of brachial plexus at this level.

**Number Of Attempts:**

It was seen that the block was completed with a single attempt in 28 patients out of 30 with the use of ultrasound guidance. A. McNaught *et al*<sup>[7]</sup> concluded that the US reduces the number of attempts compared to NS for ISB block.

**Volume Of Local Anaesthetic Solution Used:**

We have used a fixed volume of 25 ml of local anaesthetic for all 30 patients in our study.

Young Hoon Jeon *et al*<sup>[8]</sup> studied that the volume of local anaesthetic needed can be reduced by monitoring the spread of local anaesthetics under ultrasound. Thus, continuously observing the distribution of local anaesthetic and replacing the needle when mal-distribution of the injectate occurs.

**Sensory Blockade:**

In our study, we found that sensory blockade in musculocutaneous, radial, median and ulnar were 93.3%, 90%, 73.3% and 83.3% respectively at the end of 5 min and 100% in all four nerves at the end of 15 min using LISB.

Manisha surwade *et al*<sup>[9]</sup> studied that in standard ISB ulnar nerve analgesia was present in 72% patients whereas it was present in lower ISB in 92% patients.

**Motor Blockade:**

In our study, we found that motor blockade in musculocutaneous, radial, median and ulnar were 90%, 86.6%, 70% and 80% respectively at the end of 5 min and 100% in all four nerves at the end of 15 min using LISB.

Plante *et al*<sup>[10]</sup> studied that about 82.1% of motor neurons were blocked at five minutes, but 100% were blocked after fifteen minutes, which was comparable with our study.

**Complications And Hemodynamic Stability:**

In our study there were no signs of any complications such as dyspnea or Horner syndrome, hoarseness of voice, hemi diaphragmatic palsy.

Concomitant phrenic nerve block frequently occurs after ISB procedures in the neck. Renes SH *et al*<sup>[11]</sup> studied two patients in the US group showed complete paresis of the hemi diaphragm, but in the nerve stimulation group, 12 patients showed complete and 2 patients had partial paresis of the hemi-diaphragm and concluded that Ultrasound-guided ISB performed at the level of root C7 reduces the incidence of hemi-diaphragmatic paresis which was comparable with our study.

**Duration Of Motor Blockade And Rescue Analgesia:**

The mean duration of the motor block was 207.33 ± 25.45 minutes. Kapral S *et al*<sup>[12]</sup> found that the extent of motor blockade was significantly better in the ultrasound group when compared with the nerve stimulation group.

The duration of rescue analgesia in our study was 275 ± 29.32min which is comparable to a study done by Raghove P *et al*<sup>[13]</sup> who found that duration of analgesia in group USG was 312 ± 54 min which was more in comparison to blind technique.

It could be due to accurate deposition and spread of local anaesthetics around the nerve plexus in ultrasound guided group.<sup>[14]</sup>

**CONCLUSION**

In conclusion, the present study confirmed that sensory as well as motor blockade of the nerves in the upper extremities including the ulnar nerve were achieved appropriately at the end of fifteen minutes with ultrasound guided lower approach interscalene brachial plexus blockade without any complications induced by the block and with utmost patient satisfaction.

**REFERENCES**

- 1) Mian A, Chaudhry I, Huang R, Rizk E, Tubbs RS, Loukas M (2014) Brachial plexus anesthesia: a review of the relevant anatomy, complications, and anatomical variations. *Clin Anatomy* 27:210–221.
- 2) Winnie AP. Interscalene brachial plexus block. *Anesth Analg* 1970;49:455-66.
- 3) Chan VWS Applying ultrasound imaging to interscalene brachial plexus block. *Reg*

*Anesth Pain Med.* 2003; 28: 340-343

- 4) Marhofer P, Harrop-Griffiths W, Willschke H, Kirchmair L. Fifteen years of ultrasound guidance in regional anaesthesia: part 2—recent developments in block techniques. *Br J Anaesth.* 2010;104:673–83. doi: 10.1093/bja/aeq086
- 5) Ahuja K, Dureja J, Chaudhary G, Middha S. A Comparative Evaluation of Techniques in Interscalene Brachial Plexus Block: Conventional blind, Nerve Stimulator Guided and Ultrasound Guided. *Ann. Int. Med. Den. Res.* 2016;2(3):61-6.
- 6) Janet L. Dewees et al.. Comparison of two approaches to brachial plexus anesthesia for proximal upper extremity surgery. *AANA journal* June 2006; 74(3):201-206
- 7) McNaught A, Shastri U, Carmichael N, et al. Ultrasound reduces the minimum effective local anesthetic volume compared with peripheral nerve stimulation for interscalene block. *Br J Anaesth.* 2011;106:124–30.
- 8) Young Hoon Jeon Easier and safer regional anaesthesia and peripheral nerve block under ultrasound guidance *Korean J Pain* 2016 January; vol.29, No. 1: 18-22 pISSN 2005-9159 eISSN 2093-0569
- 9) Manisha S, Ganesh N, Sirsat V. Standard and lower approach interscalene block - A comparative study. *Medpulse – International Medical journal* , Issn 23482516, EISSN 2348-1897, vol. 1, iss 1, Jan 2014.
- 10) Plante T, Rontes O, Bloc S, Delbos A. Spread of local anesthetic during an ultrasound-guided interscalene block: does the injection site influence diffusion? *Acta Anaesthesiol Scand.* 2011;55:664–669.
- 11) Renes SH, van Geffen GJ, Rettig HC, Gielen MJ, Scheffer GJ: Minimum effective volume of local anesthetic for shoulder analgesia by ultrasound-guided nerve block at root C7 with assessment of pulmonary function. *Reg Anesth Pain Med* 2010;35: 529–534.
- 12) Kapral S, Greher M, Huber G, et al. Ultrasonographic guidance improves the success rate of interscalene brachial plexus blockade. *Regional Anesthesia and Pain Medicine* 2008; 33: 253–8.
- 13) Raghove P, Singh K, Taxak S, Ahlawat M, Hooda S. Comparison of Ultrasound Guided Technique with Conventional Landmark Technique for Supraclavicular Brachial Plexus Nerve Block in Patients Undergoing Upper Limb Surgery. *Int J Pharmacol and Clin Sci.* 2016;5(1):1–4.
- 14) Sinha S et al : Ultrasound guided interscalene needle placement; *Anaesth, and Anal;* 2007; 105; 848-852.