

## COMPARATIVE STUDY OF ULTRASOUND-GUIDED AND LANDMARK-BASED BLOCK OF BILATERAL SUPERIOR LARYNGEAL NERVE FOR AIRWAY ANAESTHESIA TO FACILITATE FLEXIBLE SCOPE INTUBATION

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**Abstract** Flexible scope intubation is a well-established method for managing problematic airways. Ultrasonography is a safe, rapid, portable, non-invasive method for airway examination and operative approaches in anaesthesia. Our study compared the efficiency of new ultrasonic guidance during a bilateral internal branch of the Superior Laryngeal Nerve block for upper airway anaesthesia to the efficacy of a landmark-guided approach to help awake fiberoptic intubation. **Materials and Methods:** This prospective randomised observational study was conducted in Mahathma Gandhi Memorial Hospital from February 2020- August 2021. Sixty adult patients were randomly allocated into Group L and Group U, with Group L receiving landmark-guided and Group U receiving ultrasound-guided guided. The quality of airway anaesthesia was assessed using a 5-point scale, and time to intubation was measured. Hemodynamic variables were recorded, and patient perception of pain and discomfort was evaluated. **Results:** There was no significant difference in gender, age, height, weight, ASA, and MPC between the groups. Systolic blood pressure, diastolic blood pressure, SPO<sub>2</sub>, and heart rate all showed significant differences at baseline, 1, 3, 5, 7, 10, and 15 mins. The quality of airway anaesthesia in Group U was significantly better than in Group L, with a lower quality of airway Anaesthesia score and lower patient perception of pain and discomfort during intubation. The patient's perception of pain and discomfort during intubation was significantly lower in Group U, with a p-value of 0.001. **Conclusion:** Ultrasound-guided bilateral internal branch of Superior Laryngeal Nerve block provides excellent anaesthesia and improved patient comfort in difficult intubation.

### INTRODUCTION

In challenging airways, flexible scope intubation is a well-established airway management method. The patient's psychological and pharmacological preparation is critical to the technical success of awake fiberoptic intubation.<sup>[1,2]</sup> Patients experience pain during awake fiberoptic intubation. Several strategies for achieving airway anaesthesia have lately been reported, including topical application of local anaesthetics, nebulisation, sprays, and injection of local anaesthetic agents at precise anatomic landmarks to block afferent neuronal transmission from the oropharynx and larynx.<sup>[3]</sup>

The Superior Laryngeal Nerve (SLN) is a vagus nerve branch that descends posterior to the carotid artery and into the larynx. It splits into exterior and internal branches at the hyoid bone. The superior laryngeal nerve's external branch innervates the cricothyroid muscle. The internal branch is located directly inferior to the larger horn of the hyoid bone. It approaches the thyrohyoid membrane and the superior laryngeal artery, a branch of the superior thyroid artery. The internal branch supplies sensory innervation to the mucous membrane of the larynx above the vocal cords, the base of the tongue, and the epiglottis.<sup>[4]</sup> An internal branch of SLN (ibSLN) block bilaterally by local anaesthesia is frequently performed in patients undergoing awake fiberoptic

intubation as part of airway anaesthesia. This is done by identifying the greater horn of the hyoid bone and superior horn of the thyroid cartilage as anatomic landmarks as they traverse the thyrohyoid membrane to the submucosa of the pyriform sinus.<sup>[5,6]</sup>

The superior laryngeal nerve block, combined with topical treatment of the oral and nasal cavities and transtracheal injection, offers a full airway block, allowing awake fiberoptic intubation an easy and comfortable operation. Ultrasonography is a non-invasive method that provides real-time dynamic pictures and is utilized for airway evaluation and procedural approaches in anaesthesia. The purpose of this study was to compare the efficacy of new ultrasound guidance during a bilateral internal branch of the Superior Laryngeal Nerve block for upper airway anaesthesia to a landmark-guided approach to help awake fiberoptic intubation.

## MATERIALS AND METHODS

This prospective randomised observational study was conducted in Mahatma Gandhi memorial government hospital attached to KAPV Govt. Medical College, Tiruchirappalli, from February 2020 to August 2021.

### Inclusion Criteria

ASA physical status I & II, aged 18-65 years, MPC class 3 & 4, inter incisor distance <2.5 cm, restricted neck movements scheduled for General anaesthesia under Flexible scope intubation were included.

### Exclusion Criteria

Any neck disease, coagulopathy, intellectual impairment for effective communication, morbid obesity, patient refusal, and a history of hypersensitivity to local anaesthetics were excluded. After receiving institutional ethics committee permission and signing an informed consent, 60 adult patients who satisfied the inclusion and exclusion criteria were enrolled. Using computer-generated random numbers, they were randomly assigned to Group L and U [30 in each group]. Group L (30) received 1ml of 1% lignocaine for a landmark-guided bilateral internal branch of the Superior Laryngeal Nerve block. Group U (30) had an ultrasound-guided bilateral internal branch of the superior laryngeal nerve block - 1ml of 1% lignocaine was used to identify the Superior Laryngeal Nerve space.

Intravenous glycopyrrolate 0.01mg/kg and midazolam 0.03 mg/kg were used as premedication. Throughout the procedure, oxygen was supplemented. The nasal canal received 4 ml of 4% Lignocaine combined with adrenaline (1:200000 dilution), two for each nostril, while the oral cavity received 10% lignocaine spray.

Great Horn of Hyoid bone and thyroid cartilage were identified using the anatomical landmark approach (Group L). A 24-gauge needle was inserted from the lateral side of the neck, aiming

toward the greater cornu, under aseptic conditions. Following bone contact, the needle was walked inferiorly off the bone and advanced a few millimetres. It penetrated the thyrohyoid membrane, causing a "give way" sensation. After careful aspiration, a 1 mL injection of 1% lidocaine inhibits the internal branch of the Superior Laryngeal Nerve. The operation was repeated on the opposite side.

The ultrasound technique (Group U) linear [6–13 MHz] ultrasound transducer was used. Under aseptic precautions, the transducer probe was placed parasagittally over the submandibular area. The greater hyoid bone and thyroid cartilage horn were identified as hyperechoic structures. The thyrohyoid muscle and thyrohyoid membrane are visualised between these two structures. SLN space is bounded by hyoid bone cephalad, thyroid cartilage caudally, thyrohyoid muscle anteriorly, thyrohyoid membrane, and pre-epiglottic space posteriorly. By the out-of-plane approach, 1 mL 1% lignocaine was injected using a 23-gauge hypodermic needle between the Greater Horn of Hyoid bone and thyroid cartilage just above the thyrohyoid membrane. The procedure was repeated on the contralateral side.

All patients had a transtracheal injection of 3 mL 2% lignocaine between the thyroid and cricoid cartilages, followed by fiberoptic intubation. The primary goal is quality of Airway anaesthesia, which was graded on a 5-point scale by an observer unaware of the block procedure.

On a 5-point scale, the quality of airway anaesthesia was evaluated.

Grade 0 - No coughing or gagging as a result of intubation.

Grade 1 - Mild coughing or gagging that did not interfere with intubation.

Grade 2: Moderate coughing or gagging that interferes with intubation just a little.

Grade 3: Severe coughing or gagging that made intubation difficult.

Grade 4: Very severe coughing or gagging necessitated extra local anaesthesia or technique adjustments for effective intubation.

The time between putting a fiberoptic scope into the nostril and successfully placing the endotracheal tube, as verified by end-tidal CO<sub>2</sub>, was defined as time to intubation. Heart rate (HR), mean arterial pressure (MAP), and oxygen saturation were measured at baseline, during intubation, and at 1 minute, 3 minutes, 5 minutes, 7 minutes, 10 minutes, and 15 minutes following intubation. A Numerical rating scale (NRS) with values ranging from 0 to 10 was used to measure the patient's perception of pain and discomfort during intubation (with 0 representing no discomfort and 10 representing the worst discomfort).

The data was entered into an MS Excel Spread Sheet. SPSS Version 25.0 was used to analyze the data. The mean SD was used to represent all continuous variables that were normally distributed. Percentage (%) was used to describe categorical

variables. The Chi-square test created a categorical variable, and p-values less than 0.05 were considered statistically significant.

## RESULTS

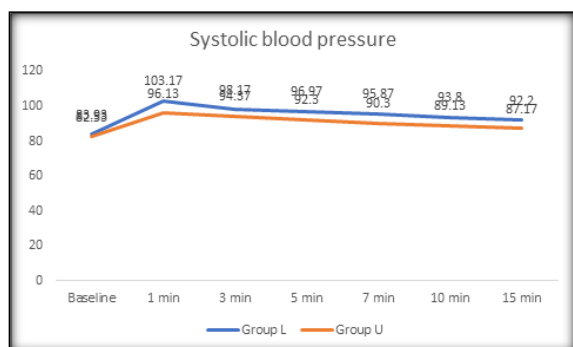
Among 30 patients, group L has 29 (96.7%) males and 1 (3.3%) females, and group U has 30 (100%) male patients only. There was no significant difference in gender, age, height, and weight between the groups.

**Table 1: Demographic data of the study**

		Group L	Group U	P-value
Age		32.47 ± 10.87	32.03 ± 9.39	0.869
Height		161.86 ± 3.59	160.80 ± 3.12	0.230
Weight		65.57 ± 7.08	62.70 ± 5.84	0.093
Gender	Male	29 (96.7%)	30 (100%)	0.313
	Female	1 (3.3%)	0	
ASA	I	19 (63.3%)	21 (70%)	0.584
	II	11 (36.7%)	9 (30%)	
MPC	III	12 (40%)	14 (46.7%)	0.602
	IV	18 (60%)	16 (53.3%)	

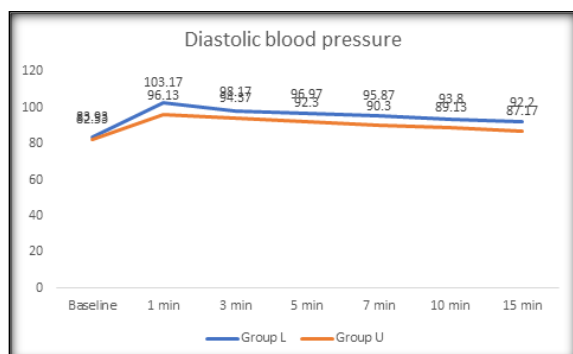
Group L has 19 patients under ASA I (63.3%), and Group B has 11 patients (36.7%). Group L has 21 patients under ASA II (70.0%), and Group U has nine patients (30.0%).

Group L has 12 patients under MPC III (40.0%), and Group U has 18 patients (60.0%). Group L has 14 patients under MPC IV (46.7%), and Group U has 16 patients (53.3%). The groups had no significant difference in ASA and MPC [Table 1].



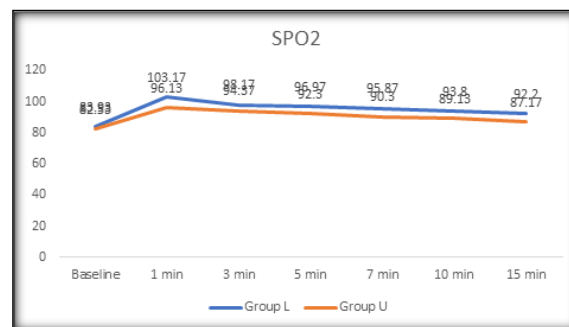
**Figure 1: Systolic blood pressure between groups**

Systolic blood pressure between groups shows no significant difference at baseline, 1, and 3 mins. But there was a significant difference between groups at 5, 7, 10, and 15 mins, ( $p=0.014$ ), ( $p<0.0001$ ), ( $p<0.0001$ ), and ( $p=0.001$ ) [Figure 1].



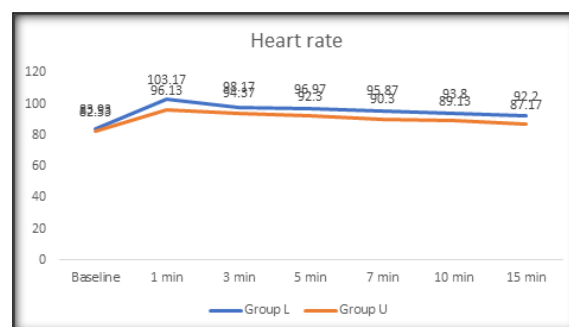
**Figure 2: Diastolic blood pressure between groups**

Diastolic blood pressure between groups shows no significant difference at baseline, 1, and 3 mins. But there was a significant difference between groups at 5, 7, and 15 mins, ( $p=0.002$ ), ( $p<0.0001$ ), and ( $p<0.0001$ ) [Figure 2].



**Figure 3: SPO2 between groups**

SPO2 between groups shows no significant difference at baseline and 5 mins. But there was a significant difference between groups at 1, 3, 7, 10, and 15 mins, ( $p=0.037$ ), ( $p=0.001$ ), ( $p=0.042$ ), ( $p<0.0001$ ), and ( $p=0.004$ ) [Figure 3].



**Figure 4: Heart rate between groups**

The heart rate between groups shows no significant difference at baseline. But there was a significant difference between groups at 1, 3, 5, 7, 10, and 15 mins, ( $p=0.001$ ), ( $p=0.029$ ), ( $p=0.004$ ), ( $p<0.0001$ ), ( $p=0.002$ ), and ( $p=0.001$ ) [Figure 4].

**Table 2: Quality of airway anaesthesia grading and numerical rating scale between groups**

Quality of Airway anaesthesia	Group L	Group U	P-value
Grade 0	1 (3.3%)	24 (80%)	<0.0001
Grade 1	9 (30%)	6 (20%)	0.371
Grade 2	14 (46.7%)	1 (3.3%)	<0.0001
Grade 3	6 (20%)	0	0.01
Grade 4	0 (0%)	0(0%)	NA
Numerical Rating Scale			
0	2 (6.7%)	24 (80%)	<0.0001
1-3	15 (50%)	5 (16.7%)	0.006
4-7	12 (40%)	1 (3.3%)	0.001
8-10	1 (3.3%)	0	0.313

The quality of airway anaesthesia that was assessed by an independent observer showed that 24 patients in Group U had Grade 0 in contrast to just 1 person in Group L with a p-value of <0.001. Grade 1 Category in Group L was 9 Patients (30.0%) and 6 Patients (20.0%) in Group U with a p-value of 0.371. Grade 2 had been seen in 14 patients (46.7%) in Group L and one patient in Group U (3.3%) with a p-value of <0.0001. Six patients in Group L and no one in Group U had Grade 3 airway grading. The quality of airway Anaesthesia, as assessed by an observer blinded to the block technique, was significantly (P < 0.001) better in Group U, with lower quality of airway Anaesthesia score compared to Group L.

The patient perception of pain and discomfort during intubation assessed postoperatively based on a numerical rating scale [NRS] was significantly lower with better patient tolerance in Group U as compared to Group L. 15 patients in Group L expressed 1-3 score and 12 patients Grade 4-6 when compared to only five patients expressing Grade 1-3 and one patient felt NRS of Grade 4-6 in Group U. Most patients in Group U felt no discomfort during a procedure with a p-value of <0.001 (significantly lower).

## DISCUSSION

If difficult intubation is encountered, awake fiberoptic intubation is ideal as it allows the patients to breathe spontaneously, thereby maintaining a patent airway. Several strategies for anaesthetizing the tracheobronchial tree include lidocaine nebulisation, spray-as-you-go approach, trans tracheal injection, and bilateral ibSLN block, each having advantages and disadvantages. An optimal anaesthetic procedure should use less local anaesthetic agents, have a greater block success rate, take less time to execute, and have fewer complications.<sup>[2]</sup>

Ultrasound-guided SLN block was performed using a high-frequency linear array probe to define SLN space, followed by injection of local anaesthetic into SLN space using an out-of-plane approach. However, few studies have used ultrasonic imaging techniques for upper airway anaesthesia. The first example of an ultrasound-guided ibSLN block was documented by Manikandan et al. In a patient

undergoing posterior cervical spine fixation, they placed the transducer in the transverse plane and performed an ibSLN block using an in-plane approach. An ultrasound-guided SLN block is possible in our study because we use the SLN space as a marker to block the ibSLN nerve.<sup>[2]</sup> Barberet et al., Vaghadia et al., and Green et al.<sup>[7,8,9]</sup> all concur that finding the Superior Laryngeal Nerve might initially be challenging.

Age, gender, weight, height, and ASA grade were comparable between groups in our study and were statistically insignificant. It has been reported that bilateral SLN block under ultrasound guidance coupled with topical airway anaesthesia improves patient comfort and hemodynamic stability. Group U had greater hemodynamic stability regarding SBP, DBP, MAP, and heart rate than Group L, which was statistically significant with a p-value < 0.001. Kundra et al. found that combining a bilateral superior laryngeal nerve block with topical airway anaesthetic improved hemodynamic stability and patient comfort.<sup>[10]</sup>

In our study, an independent observer graded the quality of airway anaesthesia. It was statistically significant (P 0.001) in Group U, with a shorter length of intubation, higher patient tolerance, and hemodynamic stability than in Group L. In terms of intubation success rate, there was no difference between groups. Nonetheless, the gag reaction was much greater in an anatomical Group [Group L] than in an ultrasonography Group [Group U].

In their investigation, Chatrath et al. inhibited three reflexes in patients: the gag reflex, cough reflex, and glottis closure reflex, using bilateral glossopharyngeal nerve block, bilateral superior laryngeal nerve block, and recurrent laryngeal nerve block. They concluded that combined regional nerve blocks improve intubating circumstances, patient comfort, and security.<sup>[11]</sup> Because the landmark-guided approach has various limitations, such as the difficulty of deep palpation of the hyoid bone in obese individuals with short or thick necks, it can be painful for the patient and is linked with a greater failure rate.<sup>[12,13]</sup> Excessive manipulation of the larynx has also resulted in hypotension and bradycardia, resulting in vasovagal responses.

In our study, Group L resulted in a greater patient sense of discomfort and agony during intubation, as evidenced by a substantially higher NRS score due

to the requirement for deep palpation of the hyoid and excessive manipulation of the larynx. With a p-value < 0.001 (significantly lower), the majority of the patients [24 patients] in Group U experienced no discomfort throughout the surgery. Similarly, Wiles et al. determined that thorough probing of the hyoid bone may be painful for individuals. Furthermore, hypotension and bradycardia may be caused by excessive laryngeal manipulation, which results in a vasovagal reaction.<sup>[14]</sup>

El Deek et al. recognized pulsations of the superior laryngeal artery (as a landmark) to block ibSLN by softly placing the ultrasonography probe since hard insertion might compress the artery and alter the natural architecture. Using the superior laryngeal artery as a reference, they completed successful intubation under ultrasound guidance.<sup>[15]</sup>

### Limitations

Our study has fewer limitations: we did not identify SLN to block; instead, we used SLN space to perform fiberoptic intubation. Then the sample size we took into account is small. Finally, linear ultrasound probes with limited resolution are difficult to visualise in obese patients and limited neck mobility.

## CONCLUSION

In difficult intubation, ultrasound-guided bilateral ibSLN block as a part of airway anaesthesia to facilitate flexible intubation provides excellent quality of anaesthesia and improves patient comfort compared to landmark guided group.

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