

## A Study on Anatomy of Superior Laryngeal Nerve

Mohd Abid Ali<sup>1</sup>, S. Saraswathamma<sup>2</sup>

<sup>1</sup>Assistant Professor, Department of Anatomy, Bhaskar Medical College, Moinabad, Hyderabad, Telangana State.

<sup>2</sup>Assistant Professor, Department of Anatomy, Bhaskar Medical College, Moinabad, Hyderabad, Telangana State.

---

Received: 25-10-2022 / Revised: 25-11-2022 / Accepted: 30-12-2022

Corresponding author: Dr. S. Saraswathamma

Conflict of interest: Nil

---

### Abstract

**Background:** The innervation of intrinsic muscles of larynx, lacks its uniformity in the mode of branching and pattern of distribution of the superior and recurrent laryngeal nerves. Internal branch of superior laryngeal nerve gives motor fibres to the interarytenoid muscle. So, the nerve supply of interarytenoid muscle is yet controversial. The fact that internal branch of superior laryngeal nerve under the risk of injury causes loss in the cough reflex. Therefore the study on morphology of internal branch of superior laryngeal nerve is essential, as it is the only nerve traversing from lateral to medial.

**Aim and Objective:** To study the anatomy of superior laryngeal nerve - its origin, course and terminal branches.

**Materials and Method:** This is observational descriptive study conducted 20 adult human larynx specimens were collected from the Department of Anatomy, Bhaskar Medical College, Moinabad. Bilateral gross dissections were made on each specimen and fixed in 10% formalin to find the exact course, relations and terminations of internal, external branch of superior laryngeal nerve, recurrent laryngeal nerve and also the intrinsic laryngeal muscles innervated by them were dissected, analysed.

**Observation & Conclusion:** From overall observation and discussion with other study, internal branch of superior laryngeal nerve under the risk of injury causes loss in the cough reflex. Therefore the study on anatomy of internal branch of superior laryngeal nerve is essential, as it is the only nerve traversing from lateral to medial. The EbSLN crosses about 1cm more above the superior pole of thyroid gland in 67.5% and lies dorsal to the superior thyroid artery in 75% of the dissected specimens. The EbSLN divides into two branches at the level of cricoids in 32.5% of the specimens and innervates cricothyroid muscle. The recent research shows the multiple roles of this nerve in voice and speech. Cricothyroid muscle is the primary control of fundamental frequency of voice.

**Keywords:** IbSLN, EbSLN, Lateral cricoarytenoid, Thyroid Gland

---

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

---

### Introduction

The larynx is an organ of phonation and an air passage, extends from the root of tongue to the trachea. In the adult, it is situated opposite to third, fourth, fifth and sixth cervical vertebrae. It lies anteriorly

between the great vessels of the neck and is covered ventrally by the skin, the fascia and depressor muscles of hyoid bone. The skeletal framework of the larynx is made up of cartilages, ligaments, membranes

and muscles. The muscles of the larynx consist of two groups: 1. extrinsic 2. intrinsic muscles. They are innervated by superior and recurrent laryngeal nerves.

According to the text books of anatomy [1-3], states that all the intrinsic muscles of larynx are supplied by the recurrent laryngeal nerve except the cricothyroid muscles, which is innervated by the external branch of superior laryngeal nerve (EbSLN). The internal branch of superior laryngeal nerve (IbSLN) gives motor fibers to the interarytenoid muscle. So the nerve supply of interarytenoid is yet controversial. The fact that internal branch of superior laryngeal nerve (IbSLN) under the risk of injury causes loss in the cough reflex therefore, the study on the morphology of internal branch of superior laryngeal nerve is essential as it is the only nerve traversing from lateral to medial.

The anatomy of the Superior laryngeal nerve (SLN) is important because of its variability in the level of divisions and its branches. Even though many controversies regarding the branches and termination of these nerves, that it gives detailed description of these branches and divisions of nerves. An accurate knowledge of the nerve supply of the intrinsic muscle is necessary and required to achieve a successful selective reinnervation of larynx damage to the nerve, can be caused due to tumour involvement or during thyroid surgeries or during intubation, which leads to impairment of not only voice, but also impairment in gland function and sensation in the region. So, a good dissection will reduce the risk of nerve injury. Thus we have undertaken this study the terminal branches of superior laryngeal nerve (SLN) and its distribution among the muscles of larynx.

### Materials and Method

**Study Design:** This is Observational descriptive study.

**Study Period:** For the period of One year

**Study Place:** Department of Anatomy, Bhaskar Medical College, Moinabad.

**Study Samples:** A total of 20 adult human larynx specimens.

**Inclusion Criteria:** Adult Human Larynx Specimens

**Exclusion Criteria:** Specimens with hanging, neck injury.

### Method

After getting an institutional ethical clearance bilateral neck dissection were done as follows; the cadaver were placed in supine position on the necropsy table and extend the neck by placing rolled pad behind the shoulders. The neck was slightly rotated to the contra lateral side the as in a lateral neck incision. The incision were made in all cadavers, superior to the hyoid bone inferior to the thyroid gland, posterior to the oesophagus and pharynx and Lateral to the thyroid cartilage and including with the specimen the carotid sheath structures. Bilateral gross dissections were made on each specimen and fixed in 10% formalin to find the exact course, relations and terminations of internal and external branch of superior laryngeal nerve and also reveal the origin & insertions of intrinsic muscles of larynx. The vagus nerve was dissected carefully from the Jugular foramen to the origin of superior laryngeal nerve (SLN) followed by dissection of internal branch of superior laryngeal nerve (IbSLN) and external branch of superior laryngeal nerve (EbSLN). The anatomical relationships between the external branch of superior laryngeal nerve (EbSLN) and adjacent structures like superior thyroid artery and also between the internal branch of superior laryngeal nerve (IbSLN) and superior laryngeal artery were observed and analysed. The recurrent laryngeal nerve (RLN) was identified about 3Cm divisions above its origin as it placed in the tracheoesophageal groove. The point of divisions and number of extra laryngeal branches were recorded.

**Observation and Results**

20 specimens of human larynx were dissected bilaterally. The superior

laryngeal nerve were documented and tabulated under the following headings.

**Table 1: Relation of Internal Branch of Superior Laryngeal Nerve with Thyrohyoid Membrane TM**

Relation with TM	Right Side	Left Side	Total
Piercing Medial to the Midline of TM	11(55%)	10(50%)	21
Piercing Lateral to the Midline of TM	9(45%)	9(45%)	18

**Table 2: Relation of Internal Branch of Superior Laryngeal Nerve with Superior Laryngeal Artery**

Relation with SLA	Right Side	Left Side	Total
Parallel and Medial to SLA	17(85%)	16(80%)	33
Inferior and Medial to SLA	3(15%)	4(20%)	7

**Table 3 : The Level of Branching of Internal Branch of Superior Laryngeal Nerve in Thyroid Membrane**

No of Branches of IbSLN in Larynx (3 Branches)	Right Side	Left Side	Total
Before Piercing the TM	2(8%)	3(12%)	5
After Piercing the TM	16(64%)	14(56%)	30

**Table 4: Branching of External Branch of Superior Laryngeal Nerve to Cricothyroid Muscle.**

Branching of EbSLN	Right Side	Left Side	Total
2 Branches	6(24%)	7(28%)	13
No Branches	9(36%)	10(40%)	19



**Figure 1: Relation of External Branch of Superior Laryngeal Nerve with Superior Thyroid Artery**

**Table 5: Relation of External Branch of Superior Laryngeal Nerve to Superior Pole of Thyroid Gland.**

Relation to Superior Pole of Thyroid Gland	Right Side	Left Side	Total
About 1 CM above the Superior Pole of TG	14(56%)	13(52%)	27
Within 1 CM of Superior Pole of TG	2(8%)	2(8%)	4
Under Cover of TG	1(4%)	1(4%)	2

## Discussion

The superior laryngeal nerve arises from the vagus nerve at the level of C1 and C2 vertebra. Here it bifurcates into internal and external branches under internal carotid artery at the level of the C2 vertebra.

### ❖ Internal branch of Superior Laryngeal Nerve (IbSLN)

Internal branch of superior laryngeal nerve (IbSLN) injury during Spine surgery, thyroid surgery and during carotid endarterectomy causes loss of cough reflex and therefore it needs knowledge regarding the detailed anatomy of this nerve. This reflex protects human larynx from aspiration of foreign material. Otherwise it leads to aspiration pneumonia and other respiratory illness. However, the dual innervation of the larynx by SLN decreases the risk of cough reflex loss. Around the thyrohyoid membrane is the highest risk of injury i.e. between the thyroid cartilage and hyoid bone. According to Amar Keray in 2006, IbSLN is the only nerve which travels from lateral to medial side. In most cases, this nerve is accompanied with superior laryngeal artery, a branch of the superior thyroid artery. According to B.C. Gupta [4], the IbSLN pierces the thyrohyoid membrane and lies in the mucosa of the pyriform fossa and divided into 3 main divisions. The superior branch of the IbSLN supplies the mucosa of the epiglottis and vallecula the middle branch innervates the aryepiglottic folds it is a sensory branch the inferior branch supplies a few twigs to the interarytenoid muscles and anastomosis with anterior branch of recurrent laryngeal nerve also.

The present study shows that the IbSLN originates at the level of C2 vertebra and lies parallel and medial to the superior laryngeal artery in 82.5% of dissected specimens which correlates with the study of Furlan's [5]. IbSLN pierces the thyrohyoid membrane at the level of C4

vertebra predominantly and branched distal to thyrohyoid membrane in 75% and proximal to it as 12.5 %

### ❖ External branch of Superior Laryngeal Nerve (EbSLN)

External branch of Superior Laryngeal Nerve ( EbSLN ) arises from the superior laryngeal nerve at the level of greater cornu of hyoid bone. At this level this nerve lies just posterior to the superior thyroid artery. Moorseman and Deweere [6] stated that the EbSLN found in Jolles space. 20% of cases, the nerve not able to be visualized due to subfacial course along with inferior constrictor muscle. The EbSLN is smaller than IbSLN and supplies motor fibres to cricothyroid muscle, inferior constrictor muscle, thyroarytenoid muscle and an extra laryngeal muscle that acts as a tensor of vocal folds (Cernea et al 1992) [7] and also provides sensory fibres to glottis.

According to Patricia Whitfield (2010) [8] the EbSLN had 2 branches to cricothyroid muscle in 34%. Moorseman and Deweere [6] stated that the EbSLN bifurcates into 2 branches at the level of cricoid entering separately at the pars recta and pars obliqua of cricothyroid muscle. [9]

The present study shows that the EbSLN predominantly originates at the level of greater cornu of hyoid bone, this nerve crosses greater than 1cm above the upper border of thyroid gland in 67.5% and lies posterior to the superior thyroid artery in 75% of dissected specimens. The EbSLN bifurcates into 2 branches at the level of cricoid in 32.5% and it coincides with the study of Patricia Whitfield.

## Conclusion

From overall observation and discussion with other study, internal branch of superior laryngeal nerve under the risk of injury causes loss in the cough reflex. Therefore the study on anatomy of internal branch of superior laryngeal nerve is essential, as it is the only nerve traversing

from lateral to medial. The EbSLN crosses about 1cm more above the superior pole of thyroid gland in 67.5% and lies dorsal to the superior thyroid artery in 75% of the dissected specimens. The EbSLN divides into two branches at the level of cricoids in 32.5% of the specimens and innervates cricothyroid muscle. The recent research shows the multiple roles of this nerve in voice and speech. Cricothyroid muscle is the primary control of fundamental frequency of voice.

**Acknowledgement: None**

### Reference

1. Cunningham. Textbook of Anatomy. Edition VII, Oxford Press, NewYork, 1937.
2. Grey Henry. Anatomy of the Human Body. Edition XXIII, Lea andFebiger, Philadelphia, 1936.
3. Morris. The reourrent laryngeal nerve. Edin. M. J., Human Anatomy. Edition IX, P. B1e. Kiston and Sons, Philadelphia,1933; 40: 344-354.
4. Gupta B. C., R. N. Misra and D. Narayan. Innervation of the human larynx. Indian Journal of Otolaryngo -logy.1959;11(4): 199-212.
5. Furlan J.C., Sympathetic fiber origin of the superior laryngeal nerve and its branches: an anatomic study. Clinical Anatomy, 2002;15: 271-275.
6. Moosman D.A. and Weese D. E., 1968. The external laryngeal nerve as related to thyroidectomy. Surg. Gynaecol. Obstet., 127: 1011-1016.
7. CR Cernea et al. Surgical Anatomy of the External Branch of the Superior Laryngeal Nerve Head Neck. Sep-Oct 1992;14 (5): 38 0-383.
8. Whitfield, Patricia, Randall P. Morton, and Saad Al-Ali. Surgical anatomy of the external branch of the superior laryngeal nerve. ANZ journal of surgery. 2010; 80(11): 813-816.
9. V A., Rajakumar S., & Rajagopal G. Possible steroidal effect of Boswellia serrata and homeostasis of Histidine – HDC- Histamine in Psoriasis. Journal of Medical Research and Health Sciences, 2022;5(11): 2324–2328.