International Journal of Anatomy and Research,
Int J Anat Res 2023, Vol 11(2):8625-28. ISSN 2321-4287
DOI: https://dx.doi.org/10.16965/ijar.2023.129

Original Research Article

To Identify the Dangerous length of external Laryngeal nerve in relation to Thyroid pole in Cadaveric Thyroid Glands

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ABSTRACT

Introduction: The external laryngeal nerve passes through the "space of Reeve" cricothyroid space. It has also been described as lying in the Joll's triangle. It is often inadvertently neglected during thyroid surgeries. It has been named after a singer who lost her voice after a thyroid surgery, as the "nerve of Galli Curci"
Aim: To identify the dangerous length of the external laryngeal nerve in relation to the thyroid pole.
Material and Methods: Fifty laryngeal nerves were dissected using conventional method of dissection, in twenty-five embalmed cadavers used for teaching purpose at Karpaga Vinayaga Institute of Medical Sciences and Research, Madurantakam. The observations were noted and photographs taken. The course and relations were carefully noted.
Results: 38 specimens (76%) had the superior laryngeal nerve measuring 4cm. in 8 specimens (16%) it was 3.5 cm and in 04 specimens (8%) it measured 3.8 cm. It was observed that the external laryngeal nerve crossed the superior thyroid pole at less than 1cm only in three (6%) of the fifty nerves.
Conclusions: The critical length of the nerve would be dangerous if the nerve crosses the superior thyroid pedicle close to thyroid pole at less than 1 cm. The consequences of neglecting the critical length would injure the nerve and cause dysphonia or raspy voice.
KEY WORDS: Thyroid gland, Artery, Nerve, Laryngeal nerve, Pole of the thyroid.

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Access this Article online	Journal Information
Quick Response code	**International Journal of Anatomy and Research** ISSN (E) 2321-4287 | ISSN (P) 2321-8967 **https://www.ijmhr.org/ijar.htm** **DOI-Prefix:** https://dx.doi.org/10.16965/ijar
DOI: 10.16965/ijar.2023.129	**Article Information**
	Received: 01 Mar 2023 Accepted: 23 Apr 2023 Peer Review: 03 Mar 2023 Published (O): 05 Jun 2023 Revised: 15 Mar 2023 Published (P): 05 Jun 2023

INTRODUCTION

The superior laryngeal nerve divides into the external and internal laryngeal nerves. The external laryngeal nerve is related to the apex of the lateral lobe of thyroid gland. Here it lies close to superior thyroid artery. It passes through a space called cricothyroid space, a triangular space formed between sternothyroid muscle,inferior constrictor and cricothyroid muscles.the superior pole of thyroid gland lies inferior to the space [1]. The nerve has been described as lying in Joll's triangle [2]. The superior pole of thyroid gland lies lateral to this triangle.

During surgeries the external laryngeal nerve is often inadvertently neglected and as a result the injury to the nerve is compromised. Especially when the distance between the nerve and the superior thyroid artery is variable and not fixed. When the exact point

of this distance and the crossing is identified the surgeon can avoid injuries to the nerve and its consequences more efficiently.

This study aimed at determining the distance of the external laryngeal nerve from the upper pole of thyroid gland and the length of superior laryngeal nerve from its origin to termination.

MATERIALS AND METHODS

The study used embalmed cadavers obtained for teaching, in the department of anatomy at Karpaga Vinayaga Institute of Medical Sciences and Research Centre. The neck region was dissected using conventional method of dissection to expose the superior laryngeal nerve and the external laryngeal nerve close to the thyroid gland.

OBSERVATION AND RESULTS

In all the specimens of neck dissected, it was found that the nerve had the same origin, arising at a distance of 3mm from the inferior sensory ganglion of the vagus nerve. The nerve divided at the level of greater cornu of hyoid bone. The length of the nerve varied by being lesser by 0.2-0.5 cm only in 24% (12 specimens).

Table 1: Length of SLN from origin to bifurcation.

Length in cm	No of specimens
3.5 cm-4cm	38 (76%)
3.5cm	8 (16%)
3.8 cm	4 (8%)

Table 2: Distance of intersection with superior thyroid artery.

Distance of intersection with superior thyroid artery	No of specimens
More than 1cm	72%
At 1 cm	22%
Less than 1cm	6%

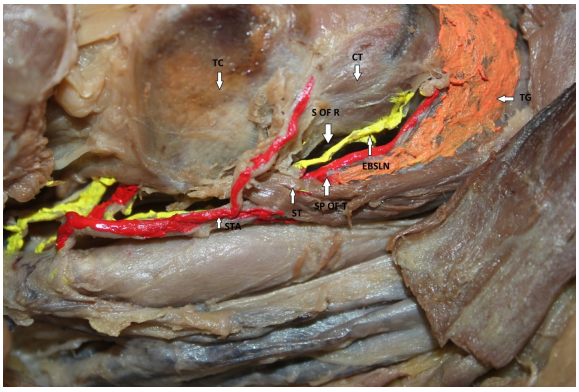

Fig. 1: Space of Nerve.

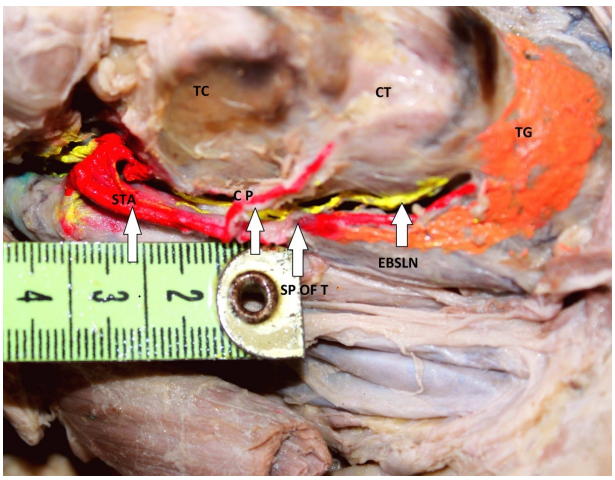

Fig. 2: External laryngeal nerve intersecting superior thyroid artery.
CP- Crossing point of the external laryngeal nerve and the superior thyroid artery,
EBSLN- External branch of the superior laryngeal nerve,
STA- Superior Thyroid artery,
SPT- Superior pole of thyroid,
CT- Cricothyroid muscle,
TC- Thyroid cartilage

DISCUSSION

Barczynski M, Randolph W [7] described the origin of the superior laryngeal nerve as arising below the ganglion of the vagus nerve, at the level of second cervical vertebra. The present study also observed the same level of origin of the nerve in all the specimens. There was no variation observed in any specimen.

The length of the superior laryngeal nerve was found to be between 3.5 cm to 4 cm in the present study [table-1] coinciding with the findings reported by Berry M, Bannister LH et al [8] who reported that the length of the nerve ranges from 2- 4 cm.

The length of the external laryngeal nerve was reported to be 8-9cm by Mortan and Keiner [9] which differed markedly from the observation made in the present study as 6.2 to 7.4cm, The length has been found to be shorter in the present study.

Kokocharov S et al (10) based their study on laryngoscopy to evaluate the technique of ligating the superior thyroid vessels during surgeries on thyroid gland. They opined that the external laryngeal nerve has to be carefully exposed at the distal 1.5 to 2 cm of the superior thyroid vessels, to ensure safe ligature.

In the present study the relationship of the external laryngeal nerve with the superior

thyroid artery was seen at more than 1 cm above the superior pole of thyroid in 36 (72%) of the specimens. In 11(22%) specimens, the nerve was seen at 1cm above the superior pole of thyroid and in 3(6%) specimens) it crossed at less than 1 cm from the superior pole of thyroid. (Table-2)

The external laryngeal nerve was always related medial to the thyroid gland as discussed by Aina and Hisham et al [11]. In present study it was observed that the external laryngeal nerve was always found medial to the superior pole of thyroid gland.

The present study correlates well with the findings of Pradeep et al and Cernea et al studies for type 1 and type Ni. The present study found more of type 2a compared to Pradeep and Cernea studies. The type 2b was the same as Pradeep et al study but much less compared to Cernea et al study. In the present study in most of the cases the external laryngeal nerve crosses the superior thyroid artery at more than 1cm above the superior pole of the thyroid.

Friedman et al [12] has described three variations in relation to inferior constrictor muscle. In type I it is inserted into the cricothyroid muscle and lies lateral to inferior constrictor of pharynx.

In type-II it pierces the cricopharyngeus part of inferior constrictor muscle. In type-III the nerve enters the upper fibres of inferior constrictor. In the present study, the cricothyroid muscle was pierced by the external laryngeal nerve in 72% of the cases.[type-1], 12% of the cases belonged to type-II, coursing anterior to inferior constrictor, and pierced the lower border of the cricothyroid muscle and 16% of cases the nerve entered the superior fibres of inferior constrictor.[type-III]

According to Selvan's classification,[13] the present study found the external laryngeal nerve located within 1 to 3 cm, in relation to superior thyroid artery at the superior pole of thyroid

Moose and DeWeese et al [14] have reported that the external laryngeal nerve enters the cricothyroid muscle (89%) and 11% enters the inferior constrictor muscle. The present study correlates well with their study and found 84% inserted into cricothyroid muscle and 16% into inferior constrictor muscle. Moosman and DeWeese et al, in their study further discussed that 21% of the specimens had an abnormal course with 15% being very close to the superior thyroid artery and 6% close to the superior pole branches.

Lennquist et al [15] described that if the external laryngeal nerve passed medial (normal) to the artery they called it type I. If it passed lateral (variant) to the superior thyroid artery it was named type II. They found14–18% of nerves were the lateral variant nerves (type-II)

CONCLUSION

The external laryngeal nerve has lots of variations especially in relation to superior thyroid artery and superior pole of thyroid gland. If the nerve crosses the superior thyroid pedicle close to thyroid pole at less than 1 cm, this centimeter is termed as dangerous length or critical length. In cases like this where the nerve lies within 1 cm if the nerve is not noticed or neglected the ligation of superior artery pedicle causes dysphonia and raspy voice.

The external laryngeal nerve can be preserved and protected by careful dissection for identification using naked eye method. For this careful observation in the space of Reeve or Joll is used. The external laryngeal nerve injury can be avoided and preserved by careful capsular dissection and then individual ligation of the branches of the superior thyroid artery close to the thyroid pole. High level of mass and blind ligation causes injury to external laryngeal nerve during thyroidectomy.

ABBREVIATIONS

SLN: Superior Laryngeal nerve

EBSLN: External branch of superior laryngeal nerve

STA: Superior thyroid artery

Conflicts of Interests: None

Sources of support: NIL

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How to cite this article:

Anthony Ammal Soosai Mariam, N. Shakuntala Rao, Ramamurthi Kadathur Srinivasan, Kamalakannan Solaiappan. To identify the dangerous length of external laryngeal nerve in relation to thyroid pole in cadaveric thyroid glands. Int J Anat Res 2023;11(2):8625-8628. **DOI:** 10.16965/ijar.2023.129