VOLUME-6 | ISSUE-4 | APRIL - 2017 • ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 78.46

Relation of external branch of superior laryngeal nerve to superior thyroid artery and Cernea classification

Anatomy

KEYWORDS: superior thyroid artery; superior laryngeal nerve; external laryngeal nerve; thyroidectomy

Vinaya Chandra P H

Professor, Department of Anatomy, Kannur Medical College, Anjarakandy, Kannur, Kerala – 670612.

ABSTRACT

Background and Objectives: External branch of superior laryngeal nerve (EBSLN) is at risk of injury while ligating superior thyroid vessels during thyroid surgeries. The relation between nerve and artery varies. The aim of the study was to study the relation of EBSLN and superior thyroid artery (STA). The branches of EBSLN and STA were also studied.

Methodology: In a descriptive cadaveric study, 28 head and neck specimens of 14 cadavers were studied (12 males and 2 females).

Results: Type 1 Cernea variant is seen in sixteen specimens (57.4%). The mean distance between the crossing point of EBSLN and STA from the upper pole in type 1 specimens was 1.52 (± 0.31) cm. Type 2a variations was found in seven specimens (25%) with mean distance being 0.37 (±0.3) cm. Type 2b variation was found in two specimens. In four specimens, had EBSLN running almost parallel to STA was found. Only in twelve preparations, EBSLN was single trunk as far as cricothyroid muscle. In twenty one specimens, STA was arising from external carotid artery. In seven specimens, origin was very close to bifurcation of common carotid artery. In all 28 specimens, superior laryngeal artery was identified. Infrahyoid artery was noted in 18 specimens.

Conclusion: For routine identification of EBSLN during thyroid surgeries, the normal anatomical variation has to be considered. Cernea type 1 is the commonest scheme of relation between EBSLN and STA. In cases of non-localization of EBSLN, possibility of type 2b variation considered.

Introduction:

Superior thyroid artery (STA) is closely related to external branch of superior laryngeal nerve (EBSLN). During thyroidectomy, injury to EBSLN is not very rare[1]. It is advised to dissect the structures related to superior pole of thyroid gland and identify the EBSLN and STA before ligating and cutting the vascular pedicle[2,3]. Cricothyroid, the only externally placed intrinsic muscle of the larynx gets its motor supply from EBSLN. Iatrogenic injury to EBSLN lead to varying degree of changes in phonation. Because of such surgical importance, anatomical relations of these two structures are studies extensively.

The part of anterior triangle between upper pole of thyroid gland and superior thyroid vessels laterally, superiorly attachment of strap muscles, medially midline is referred as Joll's triangle[4]. Cricothyroid forms its floor. EBSLN is present within this triangle. This nerve is also known with an eponym – nerve of Galli-Curci, after a famous singer Amelita Galli – Curci suffered EBSLN damage after thyroid surgery[3]. EBSLN supplies cricothyroid muscle, that increases longitudinal tension of the vocal folds. Though minimal, its injury, results in reduction in pitch of the voice and in breathy voice.

Various surgeons have classified the course and relation of EBSLN in the past. The Friedman classification describes three courses of the nerve in relation to inferior constrictor of pharynx. The widely acclaimed Cernea classification defines course of EBSLN and relation with STA under three headings. Type 1, type 2a and type 2b. In type 1, EBSLN crosses STA more than 1 cm from the upper end of thyroid gland. In type 2a variation, EBSLN crosses STA within 1 cm from the upper pole of thyroid. In type 2b variations, nerve crosses STA under the cover of upper pole of thyroid (table 1). Kierner classification in a similar fashion describes course and relation of EBSLN with STA under 4 classes.

Table 1: Compilation of different classification schemes for relation of external branch of superior laryngeal nerve (EBSLN) and superior thyroid artery (STA); UTG – Upper pole of thyroid gland, IC – inferior constrictor muscle of pharynx

Classification	Type	Description
Cernea[2]	Type 1	> 1 cm between EBSLN and STA crossing and UTG
	Type 2a	< 1 cm between EBSLN and STA crossing and UTG
	Type 2b	EBSLN and STA crossing below UTG
Friedman[5]	Type 1	The nerve runs superficial to the IC
	Type 2	The nerve penetrates the lower part of the IC
	Type 3	The nerve runs deep to the IC
Selvan[6]	Type 1a	EBSLN < 1 cm of the entry of the vessels into UTG either anterior or between the branches of the STA and within 3 cm from the cricoid cartilage
	Type 1b	EBSLN located posterior to the STA but within 1 cm of the entry of the superior thyroid vessel into the gland
	Type 2	EBSLN within 1 to 3 cm of the entry of the vessels into the UTG
	Type 3	EBSLN within 3 and 5 cm of the entry of the vessels into the UTG

There are many studies from Indian subcontinent–[7-9] and various other countries––[10-14] regarding STA. However, many the researchers have not attempted to study the relation of STA with EBSLN. The objective of the present study was to study the relation of EBSLN and STA. Meanwhile, the branches of EBSLN and STA were also studied.

Methodology:

In a descriptive cadaveric study, 28 head and neck specimens of 14 cadavers were studied (12 males and 2 females). All cadavers were unclaimed bodies from district hospital and age range could not be ascertained. All cadavers were formalin fixed via femoral artery and neck was not dissected for the purpose of embalming.

Anterior triangle was dissected via a midline incision. After reflecting platysma and the related fascia, strap muscles were cut in the middle and reflected. Thyroid gland superior pole and Joll's triangle is exposed and neurovascular structures were studied. Relation of external branch of superior laryngeal nerve (EBSLN) to superior thyroid artery (STA) was noted. Relations were categorized based on Cernea classification2. Number of branches and branching pattern of EBSLN, distance between EBSLN and STA crossing and superior pole of thyroid pole and branches of STA were identified and noted. Images of EBSLN relation to STA were written on the transparencies. Similar images were examined for common course and relation of these two structures. Common principal components were analysed before classifying the relations. As the study is directed to evaluate the relations of EBSLN and STA, right – left differences in the values obtained were not studied for statistical difference. All other data were analysed and mean values with standard deviation were calculated.

Results:

EBSLN and STA relation and Cernea classification (figure 1)

EBSLN was identified in all 28 preparations. Fixteen specimens (57.4%) had Cernea type 1 variety. The mean distance between the crossing point of EBSLN and STA from the upper pole in type 1

specimens was 1.52 (± 0.31) cm. Type 2a variations was found in seven specimens (25%) with mean distance being 0.37 (±0.3) cm. Two specimens had EBSLN traversing behind the superior pole of thyroid gland. In four specimens, had EBSLN running almost parallel to STA was found. These four specimens the relation of EBSLN to STA was not classified with Cernea criteria as the nerve and artery were not crossing.

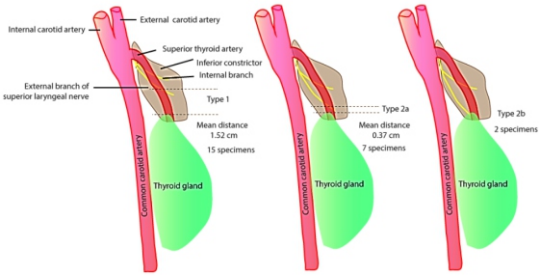

Figure 1: Schematic representation of relation of External branch of superior laryngeal nerve and superior thyroid artery according to Cernea classification

EBSLN branches

Only in twelve preparations, EBSLN was single trunk as far as cricothyroid muscle. Out of such specimens branch to cricopharyngeus (lower part of inferior consctictor) was identified in 9 specimens. In sixteen other specimens, EBSLN had atleast two twigs below the level of upper pole of thyroid gland. Out of these specimens, nerve twigs to cricopharyngeus was identified in eleven preparations.

STA origin and branches

In twenty one specimens, STA was arising from external carotid artery. In seven specimens, origin was very close to bifurcation of common carotid artery. Thyrolingual trunk (co-origin of STA with lingual artery) was noted in one specimen. In all 28 specimens, superior laryngeal artery was identified. Infrahyoid artery was noted in 18 specimens. Muscular artery to sternocleidomastoid was identified in only 10 specimens. Only three specimens showed distinct muscular arterial twig to cricothyroid. In all specimens, STA divided into anterior and posterior branches at the upper pole of thyroid gland. In 7 specimens, an additional lateral branch was noted at the upper pole of thyroid gland.

Discussion:

The present study with 28 hemi – head and neck specimens, Cernea type 1 variation was commonest. Even though, Cernea classification was followed in during the study, we report four cases, where EBSLN and STA do not cross superior to the upper end of thyroid gland. Similar reporting made by Antonius C. Kierner et al.–14 They have modified Cernea classification, introduced a fourth variation to classify such course of EBSLN and STA. Contrary to many reports on Cernea classification, we report the mean distance of EBSLN and STA crossing from the upper pole of thyroid gland. This adds to clarity to the dissection of nerves and vessels at the upper pole of thyroid while operating.

Recurrent laryngeal nerve is routinely identified and preserved in thyroidectomy. In a similar way, identification of EBSLN prevents undue injury to the nerve. However, few head and neck surgeons are of the opinion that in Cernea type 2b variation and Friedman type 3 variation, it is not always possible to identify the nerve.3 International Neural Monitoring Study Group advocates use of intra operative neural monitoring to identify and preserve the EBSLN.15 Injury to EBSLN will result in decreased pitch of the voice, mild hoarseness, decreased voice projection and patient gets fatigue after prolonged voice use. Iatrogenic injury to the nerve can be prevented by routine identification of the nerve during surgery.

Many recent cadaveric studies have pointed out a newer understanding of origin of STA. Accordingly, STA is now established to origin from common carotid artery bifurcation point and not from external carotid artery.10,12,16 In the present study, though origins close to common carotid artery bifurcation was noted in seven cases, we have not categorically classified origin of STA from common carotid artery. In all remaining 21 cases it was originated from external carotid artery as explained in classical anatomical books. However, the information of origin of STA is not of great importance to surgeons as the ligation during thyroidectomy is not near its origin, but towards the gland. STA branches near gland are in accordance with previous reports, into anterior and posterior branches in most cases.–[1012]

Conclusion:

For routine identification of EBSLN during thyroid surgeries, the normal anatomical variation has to be considered. Cernea type 1 is the commonest scheme of relation between EBSLN and STA. In cases of non-localization of EBSLN, possibility of type 2b variation considered.

Competing interests: The authors declare that they have no competing interests.

Acknowledgements: The authors wish to thank all the teaching and non-teaching staff for their support.

References:

1. Sakorafas GH, Kokoropoulos P, Lappas C, Sampanis D, Smyrniotis V. External branch of the superior laryngeal nerve: applied surgical anatomy and implications in thyroid surgery. Am Surg. 2012 Sep;78(9):986–91.
2. Cernea CR, Nishio S, Hojaij FC. Identification of the external branch of the superior laryngeal nerve (EBSLN) in large goiters. Am J Otolaryngol. 1995 Sep 1;16(5):307–11.
3. Patnaik U, Nilakantan A. Identification of External Branch of the Superior Laryngeal Nerve in Thyroid Surgery: Is it Always Possible? J Thyroid Disord Ther [Internet]. 2013 Aug 20 [cited 2017 Mar 3]; Available from: https://www.omicsgroup.org/journals/identification-of-external-branch-of-the-superior-laryngeal-nerve-in-thyroid-surgery-is-it-always-possible-2167-7948.1000127.php?aid=19462
4. Kaplan E, Mercier F, Applewhite M, Angelos P, Grogan RH. Chapter 21 SURGERY OF THE THYROID. In: De Groot LJ, Chrousos G, Dungan K, Feingold KR, Grossman A, Hershman JM, et al., editors. Endotext [Internet]. South Dartmouth (MA): MDText.com, Inc.; 2000 [cited 2017 Mar 3]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK285564/
5. Friedman M, LoSavio P, Ibrahim H. Superior laryngeal nerve identification and preservation in thyroidectomy. Arch Otolaryngol Head Neck Surg. 2002 Mar;128(3):296–303.
6. Selvan B, Babu S, Paul MJ, Abraham D, Samuel P, Nair A. Mapping the compound muscle action potentials of cricothyroid muscle using electromyography in thyroid operations: a novel method to clinically type the external branch of the superior laryngeal nerve. Ann Surg. 2009 Aug;250(2):293–300.
7. Manjunath C S, Tejaswi Hiremarali Lokanathan. Anatomical variations in the origin of superior thyroid artery and its clinical significance. Int J Anat Res. 2016;4(3):2656–8.
8. V Rajapriya, T Preethi Ramya, T S R Anjana. An anatomical study on the origin and length of the superior thyroid artery in adult human cadavers with its clinical significance. Int J Anat Res. 2017 Jan;5(1):3421–5.
9. Mithu Paul, Reshma Ghosh, Chiranjit Samanta, Manotosh Banerjee, Saktipada Pradhan, Maitreyee Kar, et al. Variations of the superior thyroid artery and Internal jugular vein. Indian J Basic Appl Med Res. 2015 Dec;5(1):25–9.
10. Toni R, Della Casa C, Castorina S, Malaguti A, Mosca S, Roti E, et al. A meta-analysis of superior thyroid artery variations in different human groups and their clinical implications. Ann Anat Anat Anz Off Organ Anat Ges. 2004 Jun;186(3):255–62.
11. Won S-Y. Anatomical considerations of the superior thyroid artery: its origins, variations, and position relative to the hyoid bone and thyroid cartilage. Anat Cell Biol. 2016 Jun;49(2):138–42.
12. Ozgur Z, Govsa F, Celik S, Ozgur T. Clinically relevant variations of the superior thyroid artery: an anatomic guide for surgical neck dissection. Surg Radiol Anat. 2009 Mar 1;31(3):151.
13. Kambi V, Žargi M, Radšel Z. Topographic anatomy of the external branch of the superior laryngeal nerve: Its importance in head and neck surgery. J Laryngol Amp Otol. 1984 Nov;98(11):1121–4.
14. Kierner AC, Aigner M, Burian M. The External Branch of the Superior Laryngeal Nerve: Its Topographical Anatomy as Related to Surgery of the Neck. Arch Otolaryngol Neck Surg. 1998 Mar 1;124(3):301–3.
15. Barczyński M, Randolph GW, Cernea CR, Dralle H, Dionigi G, Alesina PF, et al. External branch of the superior laryngeal nerve monitoring during thyroid and parathyroid surgery: International Neural Monitoring Study Group standards guideline statement. Laryngoscope. 2013 Sep;123 Suppl 4:S1–14.
16. Natsis K, Raikos A, Foundos I, Noussios G, Lazaridis N, Njau SN. Superior thyroid artery origin in Caucasian Greeks: A new classification proposal and review of the literature. Clin Anat New York N. 2011 Sep;24(6):699–705.