Original Article

Study of Superior Thyroid Artery and its Relationship with the External Laryngeal Nerve

Relation of Superior Thyroid Artery with External Laryngeal Nerve

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ABSTRACT

Objective: This study aims to study the origin of the superior thyroid artery and investigate the relationship of STA with the external laryngeal nerve.

Study Design: Cross Sectional Study

Place and Duration of Study: This study was conducted at the Sharif Medical and Dental College Lahore from the year March 2018 till November 2019.

Materials and Methods: We take 44 preserved human cadavers. We assure that the common carotid arteries of the cadevers were not damaged. Those cadavers with complete information of internal carotid artery (ICA) and external carotid artery were included for this research. Before surgical incision we inspect superior thyroid artery and facial artery of cadavers. Bilateral dissection was conducted on the anterior region of the neck to investigate the origin of STA. Distance from the upper pole of thyroid gland and measurement STA was notified from the point of EBSLN rotation.

Results: Out of 41 cadavers, 26 were female and 18 were male. In 71% of specimens of our study, we found STA emerge out from the exterior carotid artery, 39% belongs to the right side whereas 32% emerges from the left side of the external carotid artery. We did not find any significant relationship between sex and age of specimen which affects the relationship of STA and ELN.

Conclusion: We conclude that a huge diversity of the population has a huge impact on the relationship between STA and ELN.

Key Words: Superior thyroid artery, external carotid artery, common carotid artery, high sound pitch, external branch of the superior laryngeal nerve (EBSLN)

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INTRODUCTION

From upper part of thyroid gland muscles a connection between larynx and skin of neck region take place with the help of superior thyroid artery (STA)[1-3]. Though it is a main artery to supply gland but its origin is still confusing. The Exterior carotid artery is considered as a branching point of STA which further spread at the low level of the hyoid motor to reach the superior pole of the thyroid gland, it further subdivides into the lateral border of thyrohyoid muscle anterolateral to the external branch of the superior laryngeal nerve (EBSLN)[1, 3-7].

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Previous literature considers the common carotid artery and bifurcation of the common carotid artery (CCA) as a starting point of STA after deep observations[2,3]. Furthermore, branches of STA are named as infrahyoid, superior laryngeal, sternocleidomastoid, and cricothyroid[1,3,8]. Superior Thyroid Artery plays a tremendous role in the surgical procedure of the neck and head[9]. In case of thyroid embolization for head and neck tumor, emergency cricothyroidotomy, radical neck dissection, diagnostic and therapeutic catheterization, plastic surgery, reconstruction of the aneurysm, carotid endarterectomy, it acts as a recipient and helps in implantation of microvascular free tissue[2,7,9]. During thyroid surgery, STA also assists in the recognition of EBSLN[10]. Thyroid diseases require surgical intervention and become a common medical practice in recent years. On the other hand, it needs a complete knowledge of the blood supply of glands to prevent the chance of future hemorrhage[3]. For head and neck surgeons it is necessary to study the origin and variation patterns of STA because EBSLN and STA have a strong relationship[8,11]. Usually, EBSLN runs parallel to the STA but sometimes STA crosses EBSLN from the lower and upper portion of the thyroid gland[4,7]. EBSLN provides the cricothyroid muscle. Cricothyroid muscle puts pressure on the vocal folds which result in

the production of high-frequency sound during phonation. This muscle is also responsible to build a shield in between airways that protect against aspiration during breathing and swallowing[11,12].

EBSLN are generally responsible for the production of high pitch tone usually above 150 Hz and utilize mostly by professional singers[13]. During thyroidectomy, hemostasis is maintained with the help of ligated STA[8]. During the process of ligation, EBSLN is at high risk due to its close relationship with STA[11,14]. Injury to the EBSLN cause weakness in cricothyroid muscle leads to the alteration of in airways protection and mechanism and results in dysphagia[11]. Weakness, tightness, maximum effort during the speech, increased throat clearance, and vocal fatigue are the common clinical symptoms that cause during EBSLN injury[15,16].

MATERIALS AND METHODS

This descriptive cross sectional study was conducted in Sharif Medical and Dental College Lahore from the year March 2018 till November 2019. We take 44 preserved human cadavers. We assure that the common carotid arteries of the cadevers were not damaged. Those cadavers with complete information of internal carotid artery (ICA) and external carotid artery were included for this research. Before conducting research we checked that either lingual artery, vague nerve, superior laryngeal artery, EBSLN, and lobes of the thyroid gland of cadavers were present or not. In case of any damage to these structures, we withdraw that cadaver from research. All the macerated cadavers and which were hard for dissection were excluded from research. Cadavers were placed into a supine position and a longitudinal midline cut was made from the tip of the chin superiorly to the downward side of the sternal notch. We further performed two incisions on the lower margin of the mandible and each side of the superior margin of the clavicle. On the lower side of platysma sectioned, the skin was reflected and at the upper side of superficial fascia which was removed and cleaned from cadavers. We further retracted each side of the sternocleidomastoid which contains visceral, and thyroid gland deep Fascia with muscular parts and fats at the posterior belly of digastric, at the backside of omohyoid, and the front side of the sternocleidomastoid were laterally removed. Removed parts revealed information about the carotid sheath. We further incise the carotid sheath to study its contents e.g. common carotid artery, internal jugular vein, vagus. We further observed the origin of the superior thyroid artery its length and diameter and take notes from each cadaver. We further reflected the internal carotid artery to expose the external laryngeal nerve (ELN). We exposed the external laryngeal nerve after the dissection of the carotid artery. In the end, we investigate the relationship between the STA and ELN at the crossing points of the superior pole of the thyroid gland[18].

Bilateral dissection was conducted on the anterior region of the neck to investigate the origin of STA. Distance from the upper pole of thyroid gland and measurement STA was notified from the point of EBSLN rotation. Furthermore we measured the space between the CCA bifurcation and the origin of the STA by cm.

For taking accurate observations we fixed position with pins and compared the origin of STA with the lamina of the thyroid cartilage. Based on the cornea, we classified the relationship of EBSLN to the superior thyroid pole as follows. In the category of type 1, from the superior pole, more than 15 mm of nerve crosses the artery. Whereas in type 2, the external branch of the superior laryngeal nerve (EBSLN) crosses the artery in between 10-15 nm. At last in type 2b, below the superior pole ESBLN crosses the artery[19].

All the collected information was analyzed through the IBM SPSS version 21.0. Nominal variables were presented in the form of percentage whereas continuous variables were presented in the form of mean and standard deviations. Variables that are beyond the normal distribution were analyzed through the student t-test and Chi-square were used for normal distribution and nominal variables. p-value < 0.05 considered significant in all the analyses.

RESULTS

Out of 41 cadavers, 26 were female and 18 were male. In 71% of specimens of our study, we found STA emerge out from the exterior carotid artery, 39% belongs to the right side whereas 32% emerges from the left side of the external carotid artery. After applying the statistical test we did not find any statistically significant difference among males and females. The p-value was >0.05.

Table No.1: Origin site and aspect of superior thyroid artery

	Overall (n= 44		Females (n= 26)		Male (n= 18)	
Sight of origin	Left	Right	Left	Right	Left	Right
Common carotid artery	7 (16%)	5 (11%)	4	2	3	3
External carotid artery	14(32%)	17(39%)	8	11	6	6
Absent	1(2%)	0	1	0	0	0
Anteromedial	1(2%)	1 (2%)	0	0	1	1
Posterior-medial	1(2%)	0	1	0	0	0
Medially	20(46%)	21(48%)	12	13	8	8

Table No.2: Mean length and diameter of superior thyroid artery

	Mean length (mm)		Mean diameter (mm)	
	Female	Male	Female	Male
Left side	50.1	53.6	6.6	7.4
Right side	53.3	50.6	6.7	7.2

On the other hand in one of our female specimen left STA was not present. The ratio of STA origination from the common carotid artery was comparatively less (27%). Meanwhile in our study medial region was a more reliable origin of STA. In our study, the mean length was between 50-53 mm whereas the mean length of both sides was between 6.5- 7.4 mm.

Table No.3: Relationship between ELN and STA

	Both sides	Female		Male		Overall	
		Left	Right	Left	Right	left	Right
Un-crossed	6(13%)	2	0	2	2	4 (9%)	2 (5%)
< 10 mm	21 (48%)	6	9	3	3	9 (21%)	12 (27%)
10-15 mm	10 (23%)	3	3	3	1	6 (13%)	4 (9%)
> 15 mm	7 (16%)	2	1	1	3	3 (7%)	4 (9%)

Table No.4: Percentage of specimens according to type classification

	Percentage %
Type 1	38%
Type 2	48%
Type 3	-
Type 4	14%

In our study majority of the specimens were belongs to type 2 classification.

DISCUSSION

Generally, many anatomical books considered the external carotid artery (ECA) as the originating point of STA but many studies negate this point and observed variation among the genesis of STA[20]. Researchers observed that infrequent cases, STA came out from ECA just above the carotid bifurcation[21-23]. Some other studies claim that it can be originated from the common carotid artery and CCA bifurcation or sometimes it started from the common trunk which is associated with the lingual and facial branches of ECA[24,26].

In our study, we confirm the claim of STA origination from the external carotid artery (70%). This observation is greater than the previous study of Gavrilidou[27] and Anitha[29]. In contrast, other studies recorded the common carotid artery as an origin of STA. The variation in results found due to the selection of the population, in Toni studies they observed that majority of the Caucasians population STA begins from the ECA, and the majority of the Eastern population STA has an origin of the common carotid artery. In some cases, the superior thyroid artery was not present bilaterally and only found on one side. Among these cases, inferior thyroid glands are responsible for the supply of lobes of glands. In our studies, we also reported one case with the absence of STA on one side and inferior thyroid Artery supply the lobes. In a previous study, he observed the bilateral and unilateral anastomoses between the thyroid arteries. He further explores one case in which he found anastomoses between lingual through a suprahyoid branch whereas found STA from the cricothyroid branch.

CONCLUSION

We conclude that a huge diversity of the population has a huge impact on the relationship between STA and ELN. The close relationship between STA and ELN depicts that different surgical procedures and methods of fixation may also cause variation in the assessment of STA and ELN relationships. It also helps us to understand about anatomical variation among the nerve and artery.

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Author's Contribution:

Concept & Design of Study:	Sabahat Zulfiqar
Drafting:	Naveed Lodhi
Data Analysis:	Sobia Ramzan
Revisiting Critically:	Sabahat Zulfiqar, Naveed Lodhi
Final Approval of version:	Sabahat Zulfiqar

Conflict of Interest: The study has no conflict of interest to declare by any author.

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