Original Research Article

Origin of superior thyroid artery and superior laryngeal artery - A cadaveric study

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Abstract

Background and Objectives: Of late, there is heightened interest among anatomists and surgeons in determining origin of superior thyroid artery. The aim of present study was to report the variations in origin of superior thyroid artery, superior laryngeal artery and distance of origin from common carotid artery. **Methodology:** In a descriptive cadaveric study, 32 head and neck specimens of 16 cadavers were studied (13 males and 3 females). After dissecting the Joll's triangle, origin of superior thyroid artery, superior laryngeal artery were noted and classified. Distance of origin of superior thyroid artery from external carotid artery was noted. **Results:** Superior thyroid artery was arising from external carotid artery in 19 cases (59.3 %). Type III was most common. In 12 cases (37.5%), the origin was from bifurcation of common carotid artery (type I). Thyrolingual trunk (type IV) was identified in one case. Distance of STA origin in type III from common carotid artery bifurcation was 4.1 (±1.4) mm. In 30 cases (93.8%) the superior laryngeal artery was arising from superior thyroid artery (type I). In 2 cases (6.2%) SLA was arising from external carotid artery as separate branch (type II). **Conclusions:** Origin of superior thyroid artery from external carotid artery was the commonest. Average distance of origin of superior thyroid artery from external carotid artery was 4.1mm. Superior laryngeal artery was most commonly arising from superior thyroid artery. Knowledge about variations of these arteries is important during thyroid surgeries and angiographic procedures in neck.

Key Words: superior thyroid artery; superior laryngeal artery; thyroid gland; variations

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INTRODUCTION

There is heightened interest among anatomists and surgeons in determining origin of superior thyroid artery (STA). There has been proposal of newer classification models based on the recent observations.[1] STA is the principal artery supplying superior part of thyroid, larynx, sternocleidomastoid and strap muscles of neck.[2] With complex factors interplaying during the development of neck vessels, wide variations are expected in STA and other nearby vessels. These variations are of significance for surgeons working in the neck region, particularly during thyroid surgeries. Also, knowledge about arterial variations are of significance considering spurt in the angiographic procedures undertaken in this region. There are few studies indicating ethic variations in the neck vasculature.[1,3] Majority of the anatomical texts says, STA arise from external carotid artery.[4] Developmentally, the 3rd pharyngeal arteries on both sides forms the stem of common carotid artery and internal carotid artery. External carotid system develops as offshoot from this primitive vascular structure. Tongue being the essential structure, lingual artery is a relatively constant origin. Thyroid developing as endodermal down-growth from junction of anterior two third and posterior one third, descends down to the adult position in relation to developing laryngeal scaffold. During the process of descent, the artery supplying the thyroid (STA) can be expected to draw a concave loop from its origin from

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external carotid artery. However, there can also be downward shift of the origin of STA to the beginning of external carotid artery or to bifurcation of common carotid artery. Very rarely, it can be seen arising directly from common carotid artery. Such origin of STA from common carotid artery is exception to the general rule that there are no arteries arising from the common carotid artery in the neck except for terminal branches. The aim of present study was to report the variations in origin of STA and distance of origin from common carotid artery. The secondary objective was to report the variation in origin of superior laryngeal artery.

METHODOLOGY

In a descriptive cadaveric study, 32 head and neck specimens of 16 cadavers were studied (13 males and 3 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. Joll's triangle or sternothyrolaryngeal triangle, bounded laterally by upper pole of thyroid gland and superior thyroid vessels, superiorly by attachment of the strap muscles and deep investing layer of fascia to the hyoid, medially the midline and has cricothyroid muscle as the floor.5 The external branch of superior laryngeal nerve lies within this triangle. Origin of superior thyroid artery (STA) from external carotid artery, bifurcation of common carotid artery of from common carotid artery was noted. Origin of STA from carotid bifurcation was classified as type I, from common carotid artery as type II, from external carotid artery as type III, from external carotid artery as thyrolingual trunk as type IV, and as thryrolinguofacial trunk as type V. In type V, STA arise from a common trunk that trifurcates into STA, lingual artery and facial artery. Origin of superior laryngeal artery (SLA) was noted separately. Origin of SLA from STA was classified as type I, from external carotid artery as type II, from common carotid artery as type III and from bifurcation of common carotid artery as type IV. 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

STA origin and branches

Out of 32 sides studied (16 head and neck specimens), STA was arising from external carotid artery in 19 cases (59.3 %). Type III was most common. In 12 cases (37.5%), the origin was from bifurcation of common carotid artery (type I). Thyrolingual trunk (type IV) was identified in one case. Type II (origin from common carotid artery) and type V (origin as thyroliguofacial trunk) was not observed. Distance of STA origin in type III from common carotid artery bifurcation was 4.1 (±1.4) mm. The maximum distance was 6 mm and minimum was 1mm. Thyrolingual trunk in one case was arising at 3 mm from the external carotid artery from the bifurcation.

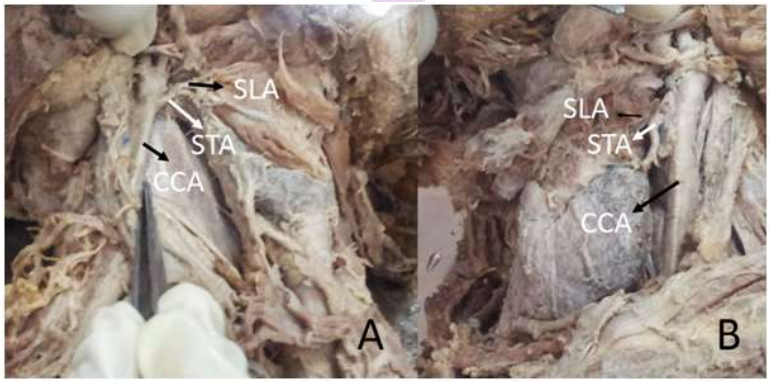

Figure 1: Dissected head and neck specimen showing origin of superior thyroid artery (STA) from bifurcation of common carotid artery (CCA), type I (both A and B) and superior laryngeal artery (SLA) from superior thyroid artery, type I (STA).

In all 32 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.

SLA origin

In 30 cases (93.8%) the SLA was arising from STA (type I). In 2 cases (6.2%) SLA was arising from external carotid artery as separate branch (type II).

DISCUSSION

The present study with 32 hemi – head and neck specimens, type III – origin of STA from external carotid artery was the commonest. Takkallapalli Anitha,6 Abhijeet Joshi[7], Sophia Anagnostopoulou8 and Shivaleela9 have reported similar findings. We report 59.3% incidence of STA origin from external carotid artery. However, Shivaleela *et al* report much higher incidence of 76%. Deviating from our report, studies by Konstantinos Natsis [1] and Va´zquez[10] reports that origin of STA from common carotid artery bifurcation (type 1) as commonest. However, a meta-analysis evaluating origin of STA from 890 cadavers reveals that majority of the studies have reported type III (420 cases out of 890) as most common.[10] Contrary to our study, Sung-Yoon Won have reported 16% cases with thyrolingual or thyrofacial common trunk from external carotid artery.[11] Aviram Mizrachi *et al* have classified the superior thyroid pole of thyroid into three types based on branching pattern of STA.[12] In type 1 superior thyroid pole features a narrow pyramid-shape superior pole with narrow vascular pedicle. In type 2, superior thyroid pole is characterized by a Δ-shape vascular pedicle. In type 3, superior thyroid pole has a very wide structure with wide vascular pedicle and multiple branching blood vessels. Such classification was not attempted in the present study, as the aim of study was not to determine the superior thyroid pole relation to STA but to report the origin of STA and SLA from the carotid system. In the present study, we have evaluated the distance of origin of STA from bifurcation of common carotid artery. This data is of important in ascertaining safe working area in the upper pole of thyroid gland from the common carotid artery while ligating STA pedicle. There are studies that have reported distance of origin of STA from the upper margin of thyroid cartilage.[7,9,13] Such data from cadaver will give arbitrary location of STA origin from the laryngeal cartilaginous framework. We have not tried to measure this in the present study as in the dissected specimens, the thyroid gland and cartilage will all be dislocated from their original positions once the pre-tracheal fascia (false capsule) adhering the gland is taken off. SLA has not enjoyed a similar importance as that given to STA. Very few researchers have sought to report SLA origin variations. Sharmadha *et al* have reported a case report where SLA was arising from external carotid artery.[14] We have noted two such origin of SLA from the external carotid artery. After extensive literature search, there are two case reports regarding SLA in the last four years.[15,16] However, our results are in line with Teresa Va´zquez who have reported 72% of SLA arise from STA.[10]

LIMITATIONS

In the present study, we tried to determine the origin of STA from carotid system and also reported the distance from bifurcation of common carotid artery. However, the division of common carotid artery itself varies. It divides at C6 in nearly two third of individuals. In one tenth of normal population, division is much higher. Distances and course of STA may not portray complete picture without considering the level of common carotid bifurcation. This was a cadaveric study. The practical applicability of the study design would have gained weightage if similar findings were from patients undergoing thyroid surgeries or other neck surgeries. Angiographic studies gives information about diameter of arteries.

CONCLUSIONS

Origin of superior thyroid artery was arising from external carotid artery (59.3%). Distance of STA origin in type III from common carotid artery bifurcation was 4.1 (±1.4) mm. In 30 cases (93.8%) the superior laryngeal artery was arising from superior thyroid artery. These variations in origin of superior thyroid and superior laryngeal arteries are of importance during thyroid surgeries and angiographic procedures in the neck.

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