

## A Study of the Origin of Superior Thyroid, Lingual and Facial Arteries

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### Abstract

**Background:** The information on the branching pattern of external carotid artery helps clinicians during arterial imaging studies and surgeries of neck. There is increased possibility of iatrogenic injury to carotid arterial system if there is high level of unpredictability. These variations of external carotid artery are important during surgeries like thyroidectomy, laryngectomy, tonsillectomy, faciomaxillary, glossectomy and other neck surgeries. **Materials and Methods:** 42 (30 male and 12 female) human cadavers allotted to first M.B.B.S students at Government Mohan Kumaramangalam Medical College during the years 2012-2017 were studied to examine individual differences in external carotid arterial branching pattern. The origin of superior thyroid, lingual and facial arteries were noted. **Results:** Superior thyroid artery arises mostly from external carotid artery in right side when compared to left side. Variant origin of superior thyroid from common carotid artery is most common in left side. Linguofacial trunk is occurring more on the right side when compared with the left side. **Conclusion:** Head and neck surgeons must be cautious about the variable anatomy of the external carotid artery because of its clinical importance. Radiologists, while interpretation of various imaging studies, should be aware of these possibilities in the branching pattern of external carotid artery.

**Keywords:** Variations; Superior Thyroid Artery; Lingual Artery; Facial Artery.

### Introduction

The external carotid artery begins lateral to the upper border of thyroid cartilage, level with the intervertebral disc between the third and fourth cervical vertebrae. At its origin, it is in the carotid triangle and lies anteromedial to the internal carotid artery. As it ascends, it gives off the following branches-Superior thyroid artery, Ascending pharyngeal artery, lingual artery, facial artery, occipital and posterior auricular arteries. In the substance of the parotid gland behind the neck of the mandible, it divides into its terminal branches-the superficial temporal and maxillary arteries.

The superior thyroid artery is the first branch of the external carotid artery and arises from the anterior surface of the external carotid just below the level of the greater cornu of the hyoid bone.

The lingual artery provides the chief blood supply to the tongue and the floor of the mouth. It arises anteromedially from the external carotid artery opposite the tip of the greater cornu of the hyoid bone, between the superior thyroid and facial arteries. It often arises with the facial, or less often, with the superior thyroid artery. It may be replaced by a ramus of the maxillary artery.

The facial artery arises anteriorly from the external carotid in the carotid triangle, above the lingual artery and immediately above the greater cornu of the hyoid bone<sup>1</sup>.

The information on the branching pattern of external carotid artery helps clinicians during arterial imaging studies and surgeries of neck.

There is increased possibility of iatrogenic injury to carotid arterial system if there is high level of unpredictability. These variations of external carotid artery are important during surgeries like thyroidectomy, laryngectomy, tonsillectomy, faciomaxillary, glossectomy and other neck surgeries.

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## Materials and Methods

Fourty (42) (30 male and 12 female) human cadavers allotted to first M.B.B.S students at Government Mohan Kumaramangalam Medical College during the years 2012-2017 were studied to examine individual differences in external carotid arterial branching pattern. Dissection was performed bilaterally. The following parameters were noted:

1. The origin of superior thyroid artery from external carotid artery or common carotid artery or carotid bifurcation.
2. The origin of Lingual and Facial arteries, either individually or from a common trunk .
3. The level of origin of facial artery .
4. The position of external carotid artery-lateral or medial to internal carotid artery .

## Results

The following results were obtained in 84 specimens.

It is seen from the results that superior thyroid artery arises mostly from external carotid artery in right side when compared to left side. Variant origin of superior thyroid from common carotid artery is most common in left side. Linguofacial trunk is occurring more on the right side when compared with the left side.

Further, on the right side of a cadaver, the external carotid artery ran lateral to internal carotid artery (Figure 6) after bifurcation and a common linguofacial trunk emerged from it. The linguofacial trunk crossed internal carotid artery and ran for 2 cm, divided into lingual and facial arteries.

**Table 1:**

Observation	Total	Right Side	Left Side
Origin of superior thyroid artery from external carotid artery(fig 1)	5(5.95%)	4(4.76%)	1(1.19%)
Origin of superior thyroid artery from common carotid artery(fig 2)	6(7.14%)	2(2.38%)	4(4.76%)
Origin of superior thyroid artery from Carotid bifurcation(fig 3)	73(86.9%)	36(42.85%)	37(44.04%)
Origin of lingual artery and facial artery separately(fig 4)	70(83.33%)	33(39.28%)	37(44.04%)
Occurrence of linguofacial trunk(fig 5)	14(16.66%)	9(10.71%)	5(5.95%)



**Fig. 1:** Superior thyroid artery from External carotid artery

- 1- Common carotid artery
- 2- External carotid artery
- 3- Internal carotid artery
- 4- superior thyroid artery

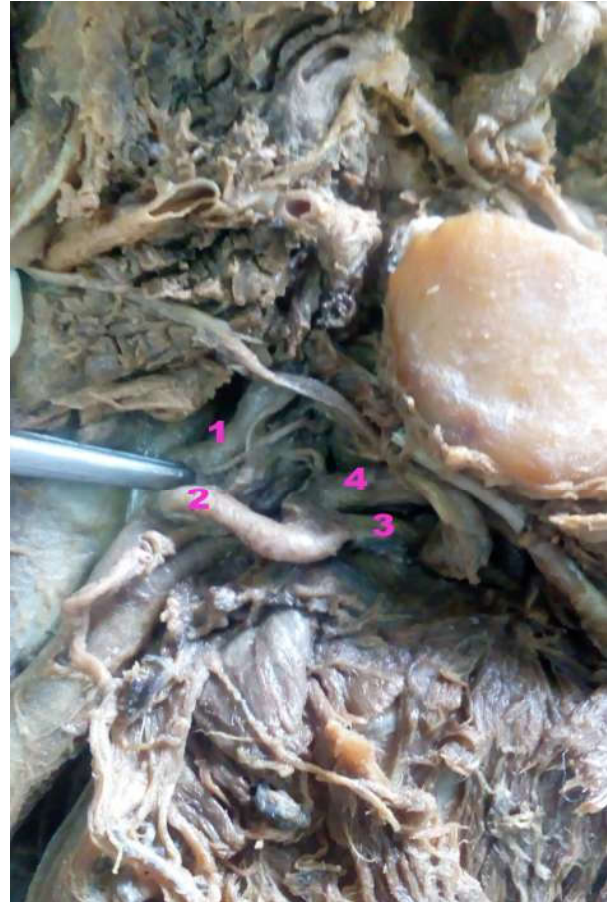


**Fig. 2:** Superior thyroid artery from common carotid artery

- 1- Common carotid artery
- 2- External carotid artery
- 3- Internal carotid artery
- 4- Superior thyroid Artery



**Fig. 3:** Superior Thyroid Artery from carotid bifurcation  
 1- Common carotid artery  
 2- Carotid bifurcation  
 3- External carotid artery  
 4- superior thyroid artery



**Fig. 5:** Linguofacial trunk from external carotid artery  
 1- External carotid artery  
 2- Linguofacial trunk  
 3- Lingual artery  
 4- Facial artery



**Fig. 4:** Original of Lingual Artery and facial artery separately from External carotid artery  
 1- External carotid artery  
 2- Lingual Artery  
 3- Facial artery  
 4- Hypoglossal Nerve



**Fig. 6:** External carotid artery lateral to internal carotid artery  
 1- Common carotid artery  
 2- External carotid artery  
 3- Internal carotid artery

It was further observed that on the left side of a cadaver, the facial artery arose from external carotid artery at the level of angle of mandible. (Fig. 7).



Fig. 7: High origin of facial artery

- 1- Common carotid artery
- 2- External carotid artery
- 3- Internal Carotid artery
- 4- Facial artery
- 5- Hypoglossal Nerve

## Discussion

Sanjeev et al. [2], in their study have reported the origin of superior thyroid artery from external carotid artery in 64.86% and from common carotid artery in 35.14%, the origin of lingual artery individually in 78.38% and as a common linguofacial trunk in 18.92%, the origin of facial artery individually in 81.08% and as a common linguofacial trunk in 18.92%.

Sara. B. Heltzel [3], in their study have found the origin of superior thyroid artery from carotid bifurcation/external carotid artery in 55% and from common carotid artery in 44%, the origin of lingual and facial artery individually in 79% and as a common trunk in 21%.

Anjalee et al [3] have reported linguofacial trunk in 17 cases (28.33%) on right side and in 18 cases (30%) on the left side-totally 58.33%. Further, superior thyroid artery -the origin of which was from common carotid artery in 2 (3.33%) cases on the right side and in 5 (8.33%) cases on the left side-totally 11.66%.

Padmashree et al. [4], have reported a case of origin of superior thyroid artery from common carotid artery on one side. Further on the other side, Superior thyroid artery, ascending pharyngeal artery and lingual artery arose from common carotid artery.

Abhijeet Joshi et al. [5] have reported that superior thyroid artery arose from external carotid artery in 66.67% cases, from carotid bifurcation in 31.81% cases and from common carotid artery in 1.51% of cases.

Shivaleela C et al. [6] have reported that superior thyroid artery arose from external carotid artery in 76.19%, from carotid bifurcation in 21.43% and from common carotid artery in 2.38%.

Manjunath C.S et al. [7] have mentioned that superior thyroid artery arose from external carotid artery in 60% of cases, from carotid bifurcation in 23.3% and from common carotid artery in 16.66%.

Sung-yoon woo et al. [8] have mentioned the origin of superior thyroid artery from external carotid artery in 20%, from carotid bifurcation in 40% and from common carotid artery in 40%.

Natis K et al. [9] have considered a new classification proposal-the origin of superior thyroid artery is considered at the level of carotid bifurcation and not from external carotid artery as stated in many classical textbooks. Our study strongly supports this fact and to conclude the origin of superior thyroid artery could be reconsidered as from carotid bifurcation or common carotid artery rather than from external carotid artery.

The branches of external carotid artery are the key landmarks for appropriate placement of cross-clamps on the carotid arteries during carotid endarterectomy. Therefore surgical anatomy of the carotid arteries have to be understood well to minimise iatrogenic injuries.

Ashutosh Mangalagiri et al. [10] in their study, in 2 out of 60 specimens have found facial artery to arise at a higher level (within parotid gland).

Mohandas Rao KG et al. [11] have reported a case of high origin of facial artery. The facial artery arose in digastric triangle, passed without grooving the submandibular gland, glandular branch to submandibular gland arose from external carotid artery about 1 cm below the origin of facial artery.

Venugopal Rao et al. [12] in their study have reported in one specimen, the facial artery arising near the angle of the mandible.

Mustafa vali et al. [13] have reported high origin of facial artery at the level of angle of mandible

(much higher than its normal level of origin). We have found the same occurrence in one of our cadaver.

High origin of facial artery should be taken into account in submandibular and parotid gland surgeries.

Kishore P.S et al. [14] reported a case of linguofacial trunk in a 72 year old male cadaver.

Suma Dnyanesh et al. [15] have reported a case of linguofacial trunk in their study in right side. The lingual and facial arteries on the right side arose as a trunk, coursed upwards for about 1.2 cm and then divided into lingual and facial arteries.

In our study, Linguofacial trunk was observed in 14 specimens (16.66%) which is similar to sanjeev et al study.

Annette Kirchgessner [16] have reported a case of lateral external carotid artery and linguofacial trunk. In our study also, we encountered a similar finding in a cadaver. Such occurrence of lateral external carotid artery and linguofacial trunk in a single cadaver is being reported second time after Annette's observation in our study.

Normally, external carotid artery runs medial to the internal carotid artery. A possibility of laterally placed external carotid artery must be kept in mind when performing arterial ligatures in the carotid triangle, to avoid any haemorrhagic incidents. Surgeons and radiologists must be aware of encountering these variations. Knowledge of linguofacial trunk is essential during oral and faciomaxillary surgeries.

Variation in external carotid arterial branching pattern could be due to the disintegration of arterial precursors (aortic arches 1 and 2) from which it is derived. Aortic arches 1 and 2 largely disappear during cardiovascular development while arches 3-6 persist. Derivatives of 3-6 arches exhibit less variation in formation and structure (Common carotid artery, Arch of aorta, Brachiocephalic trunk, Pulmonary trunk).

Increased variations observed on the right side due to increased foetal blood flow to right side creating increased flow forces which happened during embryonic vasculature.

The higher occurrence of superior thyroid artery from carotid bifurcation on left side may be due to the lower origin of common carotid artery (from arch of aorta) in comparison to the common carotid artery origin on the right (from brachiocephalic trunk).

## Conclusion

Head and neck surgeons must be cautious about the variable anatomy of the external carotid artery because of its clinical importance. Radiologists, while interpretation of various imaging studies, should be aware of these possibilities in the branching pattern of external carotid artery.

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