



A STUDY OF BRANCHING PATTERN OF EXTERNAL CAROTID ARTERY IN THE CAROTID TRIANGLE – A CADAVERIC STUDY

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ABSTRACT **Background** Carotid triangle is an important neurovascular area located in the anterior cervical region of the neck. Variations in the external carotid artery in carotid triangle may complicate surgeries like radical neck dissection, aneurysm repair in the carotid triangle **Aim and Objective** To study the branching pattern and variations of external carotid artery in carotid triangle **Method** This study includes 30 formalin fixed cadavers from the Department of Anatomy, Sri lakshmi Narayana institute of medical sciences Puducherry . This study includes all the cadavers during routine anatomical dissection by the students. **Results** In this present study both sides of the neck regions , a total of 60 sides were dissected. External carotid artery branches in the carotid triangle were traced. In the study period we found 3% of superior thyroid artery arising from common carotid artery and common unilateral linguofacial trunk in 6% of cadavers. Other branches of external carotid artery in the carotid triangle were traced. **Discussion And Conclusion** Carotid triangle is a vascular area contains common carotid artery and its terminal branches, important area for auscultation and palpation of vessels. With in the carotid triangle common carotid artery divides into internal and external carotid arteries at the level of upper border of thyroid cartilage. External carotid artery gives eight branches with in this five branches arises from carotid triangle. The study of branches of external carotid artery in the carotid triangle was paramount important to avoid iatrogenic injury during neck dissection.

KEYWORDS : External Carotid Artery , Carotid Triangle, Vascular Surgeries

INTRODUCTION

Carotid triangle is an important neurovascular area located in the anterior cervical region of the neck. This triangle is bounded by superior belly of omohyoid, posterior belly of digastric and anterior border of sternocleidomastoid. Carotid triangle contains carotid system of arteries where pulse can be auscultated and palpated .

The major vessels in the carotid triangle are common carotid artery and internal jugular vein; vein lies lateral to the artery. Both structures are enclosed by carotid sheath which is derived from prevertebral and pretracheal fascia. These vessels supplies the brain, anterior part of face , cervical viscera and deep muscles of neck. At the level of upper border of thyroid cartilage common carotid artery divides into external carotid artery and internal carotid artery. Internal carotid artery has no branches in the neck and enters the cranium through carotid canal.

External carotid artery is the main vessel which has more branches and supply all the structures in head and neck region. The common carotid artery and its terminal branch external carotid artery are the main vessels in the carotid triangle. There are individual variations in the branching pattern of external carotid artery in carotid triangle. Variations in the external carotid artery may complicate surgeries like radical neck dissection, aneurysm repair in the carotid triangle. The present study aimed to look for the branching pattern of external carotid artery in the carotid triangle.^(1,2,3)

MATERIALS AND METHODS

This prospective descriptive study was conducted in cadavers during routine anatomical dissection over a period of 2 years from July 2020 to June 2022. This study includes 30 formalin fixed cadavers including both right and left sides(60 specimens) from the Department of Anatomy, Sri Lakshmi Narayana institute of medical sciences, Puducherry, India. Ethical committee approval was obtained from institute ethical committee . This study includes all the cadavers during routine anatomical dissection by the students. Those specimens which are damaged during dissection were excluded.

The head and neck of the cadavers were well supported by a wooden block. After proper position skin incised from chin to sternum in midline. The next incision was taken on chin from inferior border of mandible to angle of mandible. Skin flap was reflected inferomedially and Platysma was reflected upwards. Boundaries of carotid triangle - Sternocleidomastoid, superior belly of omohyoid and posterior belly of digastric were identified. Fat and fascia were removed. Carotid sheath with ansa cervicalis were identified and incised. Internal jugular vein, common carotid artery, external carotid artery, internal carotid artery were exposed.^(2,3) External carotid artery branches were traced in

carotid triangle and variations in its origin, course were noted. The results were analysed statistically.

RESULTS

In this present study both side neck regions , a total of 60 sides were dissected. External carotid artery branches in the carotid triangle were traced. In one specimen on the right side of neck region lingual and facial artery arise from common trunk with in the carotid triangle. This common trunk located 2.4 cm distal to common carotid bifurcation. The length of the trunk is 0.7 cm. lingual artery runs upwards above the greater cornu of hyoid bone and disappear deep to the muscle hyoglossus. Facial artery arise from the common trunk which runs upwards passes beneath the digastric and stylohyoid muscles. In another specimen over the left side of neck superior thyroid artery arises from common carotid artery 1.8 cm proximal to the bifurcation. It passes downwards and reach the thyroid gland. In another specimen division of common carotid artery seen at higher level compared to normal division. In this cadaver superior thyroid artery arise from point of bifurcation of common carotid artery. This higher division was unilateral and other side was normal. One specimen shows common trunk for lingual and facial artery on the left side. The linguofacial trunk lies 1.7 cm above the carotid bifurcation . The Lingual artery runs upwards and forming a loop over the greater cornu of hyoid bone and later it disappear under hyoglossus muscle. Facial artery arises right angle to lingual artery from the common trunk, runs on the superior constrictor muscle and reaches the angle of mandible. Other branches of external carotid artery in the carotid triangle were traced. No abnormalities in the origin and course of ascending pharyngeal and occipital artery.

Table 1. Percentage of variations of level of divisions of common carotid artery on both sides in carotid triangle

Common carotid artery	Right side	Left side	Total percentage (%)
Higher division	3	-	5%
Lower division	1	-	2%

Table 2. Percentage of linguofacial trunk and abnormal origin of superior thyroid artery in carotid triangle

Variations	Right side	Total (%)	Left side	Total (%)
Linguofacial trunk	4	6.6%	1	1.6%
Superior thyroid artery arising from common carotid artery	2	3%	1	1.6 %
Superior thyroid artery at bifurcation	-	-	1	1.6 %
Superior thyroid artery arising along with lingual artery (Thyrolingual trunk)	-	-	1	1.6 %

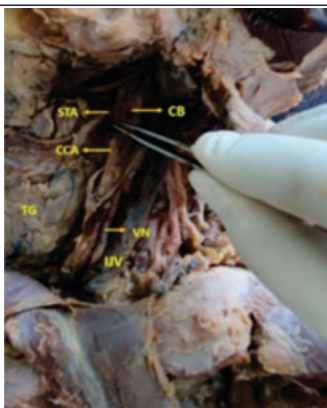


Figure 1 : Superior thyroid artery arising from carotid bifurcation in carotid triangle. TG –Thyroid gland, CCA– Common carotid artery, IJV – internal jugular vein, VN- Vagus nerve, STA – Superior thyroid artery, CB- Carotid bifurcation

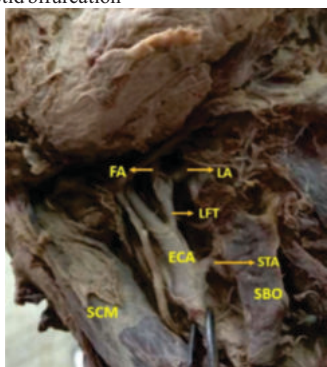


Figure 2 : Anomalous origin of lingual and facial artery by a common trunk from external carotid artery in carotid triangle. SCM- Sternocleidomastoid, SBO – Superior belly of omohyoid, ECA – External carotid artery, STA – Superior thyroid artery, LFT – Linguofacial trunk, FA– Facial artery, LA– Lingual artery

DISCUSSION

Carotid triangle is a vascular area contains common carotid artery and its terminal branches, important area for auscultation and palpation of vessels. It is bounded by superior belly of omohyoid, posterior belly of digastric and anterior border of sternocleidomastoid. Carotid triangle in the neck region has carotid sheath and its contents. Carotid sheath contains internal jugular vein laterally, common carotid and its branches medially. Within the carotid triangle common carotid artery divides into internal and external carotid arteries at the level of upper border of thyroid cartilage. Internal carotid artery does not giving any branches in the neck region. It passes upwards and enters the carotid canal where it supply the brain and structures of orbit. External carotid artery gives eight branches with in this five branches arises from carotid triangle. They are superior thyroid artery, lingual artery, facial artery, occipital artery, ascending pharyngeal artery.⁽⁵⁾ Hence the study of branches of external carotid artery in the carotid triangle was paramount important to avoid iatrogenic injury during neck dissection.

Lingual artery arises from the external carotid artery opposite to the tip of greater cornu of hyoid bone. It passes upwards, forwards passes deep to hyoglossus muscle and it gives suprahyoid artery. Facial artery arises from the anterior aspect of external carotid artery and runs upwards over the superior constrictor. It gives ascending palatine, tonsillar artery and submental branches in the neck region. Anjalee Govindharao ovhal et al found linguofacial trunk arise from right external carotid artery in 28.33 % and 30 % from left side. According to their study thyrolingual trunk noted in 3.33 over right side and 5% in left side and there was no thyrolinguofacial trunk detected.⁽⁴⁾ According to R.Cobiella et al bilateral linguofacial trunk was noted in 27.8% cases and the origin of linguofacial trunk is caudal to the usual facial artery origin.⁽⁵⁾ Madan kapre, Ashutosh s noticed thyrolingual trunks were the most common anomalies compared to linguofacial trunks and both arise from external carotid artery.⁽⁶⁾ A study conducted by Sanjeev I k et al shows that linguofacial trunk was more (18.92%) than thyrolingual trunk (2.7%). In their study linguofacial trunk lies above 4- 10 mm above the origin of external carotid artery.⁽⁷⁾

Superior thyroid artery arises from external carotid artery below the tip of greater cornu of hyoid bone. It passes downwards, forwards accompany external laryngeal nerve and reach upper pole of thyroid gland. Al- Rafiah et al found that superior thyroid artery arising at the level of carotid bifurcation in 46 cases and it arise above the carotid bifurcation from external carotid artery in 2 cases. They also found varying position of common carotid bifurcation 18.3% higher level and 5% at lower level.⁽⁸⁾ Thwin S S, Soe M M et al found high division of common carotid artery on right and left side in the carotid triangle. In one cadaver common carotid artery divide at C2 level at right side and C3 level at left side. Within that superior thyroid artery arise immediately above the bifurcation of external carotid artery.⁽⁹⁾ Mustafa vali S K et al found trifurcation of external carotid artery which includes ascending pharyngeal artery, lingual artery, facial artery. They also found another rare variation in which external carotid artery gives 2 divisions in that one division give rise to superior thyroid artery, another division trifurcates into ascending pharyngeal, lingual and facial arteries.⁽¹⁰⁾

A study done by Deepa devadas et al shows higher level of carotid bifurcation in 25% of cases. In there study bilateral linguofacial trunk(12.5%) is more common than unilateral trunk(7.5%). Ascending pharyngeal artery arises from the external carotid artery from its medial side. After origin it ascends along the wall of pharynx and reach the base of the skull. It gives pharyngeal, tympanic and meningeal branches. Deepa et al also found higher origin of ascending pharyngeal artery in one case and in another case double ascending pharyngeal arteries were found.⁽¹¹⁾

Occipital artery arises from external carotid artery opposite to the facial artery origin. It passes upward, backward beneath the posterior belly of digastric and gives upper and lower sternomastoid branches. A study done by Mamatha et al found a common trunk for occipital artery and posterior auricular artery. They also found another common trunk for superior thyroid artery and lingual artery, facial artery in that cadaver enters the face without forming the loop in the submandibular gland.⁽¹²⁾ Abnormal branches and course of the blood vessels in the carotid triangle prone for injury during surgical procedures like lymphnode resection, vascular surgeries in the neck.

CONCLUSION

In this study external carotid artery and its branches were traced and variations in their branching pattern was noted. It was observed that 8% of samples had variations in the origin of lingual and facial artery as linguofacial trunk and more variations were found on the right side compared to the left. 8% had variations in the level of origin of superior thyroid artery with no significant difference based on the side of the neck. No variations found in the origin of ascending pharyngeal artery and occipital artery. Variations in external carotid branches may lead to iatrogenic injury during surgical lymph node resection and aneurysmal repair that can cause life threatening bleeding. A profound anatomical knowledge of external carotid artery and its branches is paramount important for good surgical outcome.

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