

A STUDY OF ANATOMICAL VARIATIONS OF THE COMMON CAROTID ARTERIES: A CADAVERIC STUDY

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ABSTRACT

Background: Anatomical variations of carotid arterial system which are not infrequently encountered have a great impact on the surgical approaches of the neck. Although the described individual variations of the carotid arteries are well-known in the literature, the combination of anomalies reported in this study has not been, to the best of our knowledge, previously described. The carotid arteries show important variability and thus emphasise caution for clinicians during surgical procedures in the neck.

Methods: The present study was undertaken on 80 common carotid arteries (40 left, 40 right) of both sexes from embalmed adult human cadavers. The specimens were studied by detailed dissection method.

Results: In the present study, fiftyone (63.8%) bifurcations of common carotid arteries were high among which the most common levels of bifurcation was at the level of C 3 vertebral body (37.5%). The origin of the right common carotid artery was high and low in 10% and 2.6% of vessels respectively.

Conclusion: The carotid arteries show important variability and thus emphasise caution for clinicians during surgical procedures in the neck.

KEYWORDS: Common carotid artery (CCA); External carotid artery (ECA); Internal carotid artery (ICA); Brachiocephalic trunk (BCT).

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INTRODUCTION

The principal arterial of supply to the head and neck are the two common carotids; they ascend in the neck and each divides into two branches, the external carotid, supplying the exterior of the head, the face, and the greater part of the neck; the internal carotid, supplying to a great extent the parts within the cranial and orbital cavities. For most of the large arterial vessels, surgeons can rely on a constant anatomy. In head and neck surgery, the common carotid arteries are important landmarks, defining the plane of the dissection during radical neck surgery. Conventional angiography is considered the most accurate technique for diagnosis of carotid bifurcation

diseases, such as stenosis. In the classic literature, the brachiocephalic trunk is described as the first branch of the aortic arch, with a trajectory from 4 to 5 cm of length. Soon after its origin it emerges to the right of the trachea and from this point continues from the posterior part of the inferior portion of the manubrium of sternum upward to the level of the right sternoclavicular joint, in the posterior part, dividing into right subclavian artery and right common carotid artery [1]. Thus accurate evaluation of the carotid bifurcation level techniques remains an important goal and external anatomical landmarks can be clinically useful in predicting the bifurcation level of the

carotid artery with non invasive techniques remains an important goal and external anatomical landmarks can be clinically useful in predicting the bifurcation level of the carotid artery [2]. The knowledge of this kind of variations is of great importance in radiological examinations and surgery. Therefore it is necessary to understand the anatomy of these vessels and its variations to carry out surgeries with minimum operative and post operative complications [3]. The present study objects are to study the variations in origin and bifurcation of common carotid artery.

MATERIALS AND METHODS

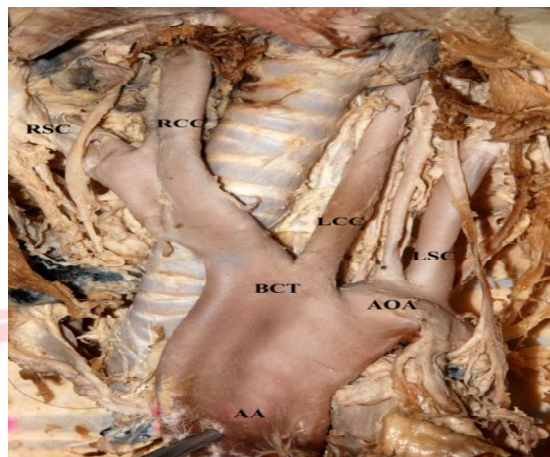
Cadavers used for dissection were availed from the Department of Anatomy, SS Institute of Medical sciences, Davangere. Eighty common carotid arteries (40 left, 40 right) were dissected for the purpose of data collection. The cadaveric specimens that were dry and difficult to dissect and those that were macerated by students before data collection were excluded from the study.

Skin incisions from, the chin to the suprasternal notch and along the lower border of the mandibles were made. Skin flaps were reflected for exposure of the anterior triangle of the neck. The bifurcation of the common carotid artery was then exposed as were the branches of the external carotid artery. The point of bifurcation of the brachiocephalic trunk was determined after removal of the insertions of the sternocleidomastoid muscle on the clavicle and the sternum and disarticulation of the sternoclavicular joint. The level of bifurcation of the common carotid artery, relation of the external carotid artery to internal carotid artery, branching pattern of the external carotid artery and level of origin of the right common carotid artery were observed and recorded. Variant patterns were those that did not fit the classical description of the branching pattern of the external carotid artery. High levels of bifurcation were considered to be above the C 3-4 intervertebral junction, and low bifurcations below it. The upper border of thyroid cartilage was the anterior landmark for the C 3-4 junction. High or low levels of origin of the right common carotid artery were defined in relation to the

level of the sternoclavicular joint. The results are summarised in the form of frequencies and presented in the form of frequency table and photographs.

OBSERVATIONS

Specimen No. 1:



Specimen No. 1: LCC(left common carotid artery) originated from the left side of the proximal portion of the BCT(brachiocephalic trunk).

Embryological basis –proximal part of left third aortic arch getting absorbed into the right limb of aortic sac instead of left limb.

Specimen No. 2:



Specimen No. 2: bifurcation of left common carotid artery(LCC) into external carotid artery(ECA) and internal carotid artery(ICA). In 7% cases,the Left Common Carotid A from proximal part of BCT as in our case.The third common pattern -the left vertebral artery as branch of Arch Of Aorta close to Left Subclavian A, in about 2.5% cases.

Level of bifurcation of the common carotid artery: In 51 (63.8%) cases bifurcations were high among which the most common levels of bifurcation was at the level of C 3 vertebral body (37.5%). The most common low bifurcation was at C 4 vertebra level (3.75%) (Table 1). There were no statistically significant side-to-side differences in level of bifurcation.

Table No 1: Frequency of levels of bifurcation of common carotid artery.

Level of bifurcation of common carotid Artery		Numbers	Percentage
High	C2	12	15
High	C2-3	8	10
High	C3	30	37.5
Normal	C3-4	19	23.7
Low	C4	3	3.75
Low	C5	2	2.5
Low	C6-7	6	7.5

Relation and pattern of branching: The normal relation of external carotid artery (anteromedial) to internal carotid artery was seen in 56 (70%) cases. Variant pattern of branching of the external carotid was observed in seven (9%) of the dissected vessels.

Level of origin of the right common carotid: Of all the right common carotid arteries dissected, 10% had an origin above sternoclavicular joint (Figure 3) while 2.6% had an origin below the joint. Majority (87.5%) had an origin behind the sternoclavicular joint.

DISCUSSION

The present study has recorded a frequency of 37.5% for common carotid bifurcation at the C 3 vertebra and 23.7% at the C 3-4 intervertebral disc level. Terminations higher than C 3/C3-4 level were found in 25% of vessels. Earlier gross anatomical studies and those examining angiographs have indicated variable incidence for C3/C3-4 bifurcation levels (4) foetuses, the incidence of C 3 bifurcation was noted to be 55% by Zumre et al [4] while the angiographic study by Hayashi et al [3] found C 3 termination in 100% adult carotids. Among adult Japanese a C 3 termination occurs in 57.5% of carotid vessels [5, 6]. Our results on side symmetry in the pattern of bifurcation is also at variance with some earlier reports. In the angiographic report by Smith and Larsen [7], the left carotid bifurca-

tion was higher than the right in 50% of the cases and the right bifurcation higher than left in 22% of the cases.

Such accounts pose clinical challenges as they may predispose to angiographic data misinterpretation [5] and surgical complications [6]. A high common carotid is at a higher risk of impingement by intra-articular screws during procedures on cervical vertebrae [8, 9].

Variations in the level of origin of the common carotid artery are reported as part of the abnormalities of the supra-aortic trunks [10]. Higher levels of origin are associated with higher incidences of penetrating vascular injuries (5). The branching pattern of the external carotid artery was normal in the majority (91.2%) of vessels in the current study. The linguofacial trunks, external carotid origin of the internal laryngeal artery and the absence of the occipital artery add to the body of literature depicting the variation of the external carotid artery [11].

CONCLUSION

Anatomical knowledge of variations in the origin, course, and branching pattern of the carotid arteries will be useful in angiographic studies, transcatheter embolization procedures and in surgical procedures of the head and neck region. Variations of the origin and branches of the external carotid arteries on both sides are rare findings and impart important knowledge that is especially useful for surgeons who operate on the face and neck regions, as well as for radiologists in the interpretation of imagings. The origin of LCCA from BCT is an important observation for Head and neck surgeons, vascular and cardiothoracic surgeons. Angiographic detection can be a marker for presence of other cardiac defects. In case of common origin, stenosis or occlusion can cause severe ischaemic consequences and prone for atherosclerosis.

Conflicts of Interests: None

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