

Variation anatomy of carotid bifurcation and branching pattern of external carotid artery

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Detailed knowledge of various anatomy is important for design of surgical treatment, especially in selection between carotid endarterectomy and carotid stenting. The knowing of variation of branching pattern of external carotid artery may prevent hypoglossal nerve injury during ligating in the neck and head regions.

The external carotid artery has eight named branches distributed to head and neck. The superior thyroid, lingual and facial arteries arise from its anterior surface, the occipital and posterior auricular arteries arise from its posterior surface and the ascending pharyngeal artery arises from its medial surface. The maxillary and superficial temporal arteries are its terminal branches within the parotid gland. In the carotid triangle the hypoglossal nerve winds round the lower sternomastoid branches of the occipital artery and crosses superficial to the internal carotid, external carotid and pass in to digastric triangle. This nerve is common injured during surgeon intervention in the region of carotid triangle.

Aim

To summarize the data on subject of common carotid artery bifurcation and branching pattern of external carotid artery to show the clinical importance of such information in surgical treatment.

Materials and methods

The literature analyzing of PubMed, Google Scholar, Scopus database including studies published last 8 years.

Results

The studies showed the position of carotid bifurcation at C3-C4 intervertebral disk level or the superior border of thyroid cartilage (50-60% right side and 40-55% left side) (Fig.1). The common carotid artery may bifurcate higher than usual, at the level of C2 (2,3-10% both sides). The hypoglossal nerve and mandibular branch of facial nerve are injured in 5,2% cases with high carotid bifurcation level.

The strongest indications for carotid artery stenting instead of carotid endarterectomy are high carotid bifurcation, operated neck for other reasons and restenosis after previous endarterectomy.

The low carotid bifurcation (lower than C5-level, in 3,5-7,5% cases) is very rare and has not received a lot of attention from surgeons.

3) bilateral maxillofacial trunk was reported in a few cases; 4) thyrolingual trunk was observed in 2,5% cases; 5) occipitoauricular trunk—in 12,5% cases; 6) in a few cases—arising of ascending pharyngeal artery from carotid artery bifurcation instead of posterior aspect of external carotid artery were observed.

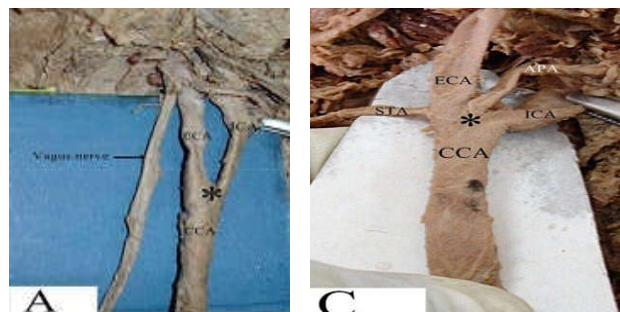


Fig.2 –Branching pattern of left common carotid artery :A-bifurcation of the common carotid artery(CCA) into the internal carotid artery(ICA) and external carotid artery(ECA); C-trifurcation of the common carotid artery(CCA) into the internal carotid artery(ICA),external carotid artery(ECA) and superior thyroid artery (STA).

The branching pattern of external carotid artery is a key landmark for exposure and appropriate placements of cross-clamps on the carotid arteries. The branches of carotid artery located in carotid triangle are also the key landmarks for adequate dissection of the carotid arteries and should be identified before cross-clamps are placed and arteriotomy is performed. The presence of a high common carotid artery bifurcation can show to surgeons that hypoglossal nerve is lie very close and is more vulnerable (Fig.3). Preoperative documenting of the level of the carotid bifurcation may prevent the risk of iatrogenic injury.

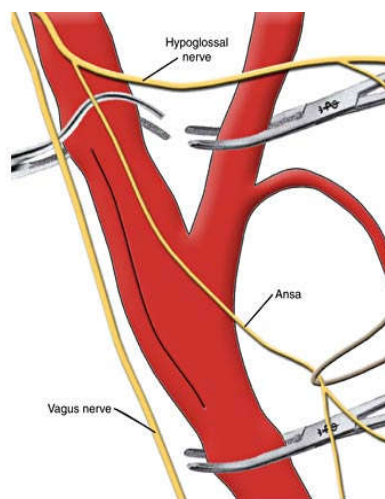


Fig.3 –The relationship between carotid bifurcation(not high level) and hypoglossal nerve.



Fig. 1 – Computer tomography of carotid bifurcation the level C3- C4. ICA –internal carotid artery; ECA –external carotid artery; 3D – reconstruction of the cervical part of the column.

The clinically-relevant variations to be noted in the studies are high origin and anomalous course of the facial artery, superior thyroid artery arising as a branch of common carotid artery and direct glandular branches to the parotid glands. The anomalous course of the lingual and facial arteries, as well as the variations in the origin of the superior thyroid artery, could be of interest to neck and head surgeons.

In the studies on origin anomalies, it was reported that superior thyroid, lingual and facial arteries are common originated from common carotid artery. In another case the same arteries were originated from external carotid artery while the maxillary, superficial temporal and occipital arteries arose from the internal carotid artery.

The branching pattern of external carotid artery shows some variations : 1) the external carotid artery may be absent bilaterally or unilaterally; 2) linguofacial trunk was reported in 20% cases ;

Conclusion

Anatomical knowledge of the origin, course, branching pattern of the external carotid artery, as well as the level of bifurcation of the common carotid artery, can be useful for diagnostic and interventional vascular procedures such as endarterectomy, stenting and embolization in head and neck region.

Consideration of this important variations is mandatory to accurate ultrasonographical correlation.