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Morphological characteristics of the external carotid artery

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ABSTRACT

The morphological characteristics at the level of the bifurcation of the common carotid artery were studied on 46 cases, finding that the most frequent, in 52.17% of cases, the common carotid bifurcation appear as the letter “V”, with two possible variations: a wide “V”, in 43.48% of cases and narrow “V” in 8.7% of cases. In 30.43% of cases, the two carotids showed an ascending traject, united for 1-2 cm up to their crossing; in 13.04% of the cases the two arteries were superimposed, the external located anteriorly. In only in two cases on the right side (4.35% of cases and 8.33% of right samples) we found a peculiar aspect of a “U” shaped bifurcation. Regarding the caliber of the external carotid artery, we found that in 43.33% of the cases the external carotid artery had a similar diameter to the internal carotid, also in 43.33% of the external carotid artery have a higher caliber than internal one and the remaining 13.33% of the cases, the external carotid artery had a smaller diameter than the internal one, with all cases on the left (16.67% of left carotid arteries).

The caliber of the right external carotid artery was between 4 to 5.6 mm and the one of the left was between 3.6 to 5 mm. When the external carotid was more voluminous than the internal, the differences were 0.5 to 1.2 mm and when the internal carotid was more voluminous than the external, the differences were smaller, 0.2 to 0.8 mm. In relation to the common carotid, the external carotid had a smaller caliber from 0.6 to 1.1 mm.

Regarding the external carotid traject, most commonly,

from the bifurcation of the common carotid, the external carotid artery showed a vertical trajectory, in 50% of cases; in 40% of cases, the traject was oblique superomedially and in 6.67% of cases the external carotid artery described a curve with the convexity facing laterally, with all cases on the right (11.76% of right carotid arteries); in 3.33% of cases, both on the left (7.69% of the left carotid arteries), the external carotid artery traject described an inverted italic “S”.

Keywords: external carotid, morphology

Introduction

The carotid bundle rises vertically from the base of the neck to the base of the skull, dividing at the level of the fourth cervical vertebrae, thus allowing to describe a common carotid artery prior to the bifurcation, an internal carotid artery that continues the path and enters the skull, supplying its content and an external carotid artery, distributed to the face and the neck [1,2,3,4,5,6]. The common carotid bifurcation is at level of the fourth cervical vertebra or the intervertebral disc C3-C4, the big cornu of the hyoid bone or the superior cornu of the thyroid cartilage [1,2,3,4,5,6]. [7] describes cases of high bifurcation of the common carotid (between vertebrae C2-C3) while [8] describes a case of low bifurcation, next to the vertebra C6 probably the lowest level quoted in the literature. The external carotid artery passes successively through the lower portion of the retro-styloid space (posterior sub-

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parotidian) and the parotid lodge, within the middle of glandular parenchyma [1,2,3,4,5,6]. At the passage from the retro-styloid space to the parotid lodge it pierces the inferior portion of the styloid septum into the inferior part of the prestylo-hyoidian triangle, specifically between the stylo-hyoid muscle laterally and the stylo-hyoid ligament medially. It ends posterior to the mandibular ramus, into the parotid gland, bifurcating into the superficial temporal and maxillary arteries. The external carotid artery gives six collateral branches: the superior thyroid, ascending pharyngeal, lingual, facial, occipital and posterior auricular arteries [1,2,3,4,5,6].

Materials and methods

The study was performed on a total of 80 cases, represented by the human cadavers and CT angiography, performed on a computer GE LightSpeed VCT64 Slice CT Scanner. We evaluated the morphological characteristics of the bifurcation of the common carotid artery, the external carotid caliber and trajet. The studied aspects are described as compared to common and internal carotid arteries, on the right and on the left.

Results

The morphological characteristics of the bifurcation of the common carotid were studied on 46 cases of which 24 cases were on the right side (52.17% of cases) and 22 cases on the left (47.83% of cases). We found most frequently in 24 cases (52.17% of cases), that the common carotid bifurcation appears as the letter “V”, 12 cases for the right common

carotid artery (50% of right ones) and also 12 cases arteries for the left common carotid artery (54.55% of the left ones). This pattern showed two variations: in 20 cases (43.48% of cases) the bifurcation described a wide “V”, while in 4 cases (8.7% of cases) the “V” was narrow, with closer arms (Figure 1).

Figure 1 - Bifurcation of the right common carotid in wide “V”, lower than the bifurcation of the left common carotid in narrow “V”

In 14 cases (30.43% of cases), the two carotids, external and internal, showed an ascending trajet, next one to another for about 1-2 cm, up to their crossing, with 8 cases on the right (33.33% of right arteries) and 6 cases on the left (27.27% of the left arteries). In 6 cases (13.04% of cases) at the bifurcation, the two arteries were superimposed with the external carotid artery anteriorly, 2 cases on the right (8.33% of right arteries) and 4 cases on the left (18.18% of the left arteries). In only two cases, both on the right side (4.35% of all cases and 8.33% of right cases) we met a particular aspect of a “U” shaped bifurcation, with the internal carotid passing horizontally towards laterally for a distance of about 3 mm, then vertically, up to the crossing with external carotid (Figure 2).

Figure 2 - A "U" shaped bifurcation of the common carotid, with the internal carotid passing horizontally towards laterally for a distance of about 3-4 mm, then vertically. The caliber of the external carotid at origin is equal with the one of the internal carotid.

In 60 cases we studied the caliber of the external carotid artery at origin, 36 cases on the right external carotid artery (60% of cases) and 24 cases of left external carotid artery (40% of cases) (Figure 3).

Figure 3 - Right external carotid artery with a caliber of 5.2mm at origin; above the origin of the superior thyroid artery the caliber is 4.5mm

We found that in 26 cases (43.33% of cases) the external carotid artery had a caliber equal to the one of the internal carotid artery, 14 cases were on the right side (38.89% of right carotid arteries) and 12 cases on the left (50% of left carotid arteries). Also in 26 cases, the external carotid artery showed a diameter greater than the internal one, with 22 cases on the right (61.11% of the right carotid arteries) and 4 cases on the left (16.67% of the left carotid arteries). In the remaining 8 cases (13.33% of cases), the external carotid artery had a diameter smaller than the internal one, all cases being on the left (16.67% of left carotid arteries).

The caliber of the right external carotid artery was between 4 to 5.6 mm while the caliber of the left external carotid artery was between 3.6 to 5 mm. When the external carotid was more voluminous than the internal one, the differences were 0.5-1.2 mm, and when the internal carotid was more voluminous than the external, the differences were smaller, 0.2 to 0.8 mm. In relation to the common carotid, the external carotid showed a smaller caliber from 0.6 to 1.1 mm.

The trajectory of the external carotid artery was assessed on 60 cases, 34 right external carotid arteries (56.67% of cases) and 26 left (43.33% of cases). Most commonly, from the bifurcation of the common carotid artery, the external carotid shows a vertical trajectory, in 30 cases (50% of cases), 14 cases on the right (41.18% of the right carotid arteries) and 16 cases on the left (61.54% of left carotid arteries). In 24 cases (40% of cases), the external carotid arteries were oblique supero-medially, 16 cases on the right (47.06% of right carotid arteries) and 8 cases on the left (30.77% of left carotid arteries). In 4 cases (6.67% of cases), all on the right side (11.76% of right carotid arteries), the external carotid artery described a curve with the convexity oriented laterally and in 2 cases (3.33% of cases), both on the left (7.69% of the left carotid arteries), the external carotid artery described a double curve, with the aspect of an inverted italic "S" (Figure 4). At the origin the external carotid artery may cover all or part of the internal carotid artery, which is located on a posterior plane, or, in cases when its size is smaller than the internal carotid artery, it may be placed on its anterior face.

Figure 4 - Right external carotid artery with a vertical trajectory, crossed posteriorly by the internal carotid that shows an inverted italic “S” around the external. The right external carotid is larger than the left one. The left external carotid artery is oblique supero-laterally, initially on the anterior face of the internal, which is larger

Discussions

According to [4,9,10,11], from the bifurcation of the common carotid artery, the external carotid describe a vertical trajet for about 2 cm, an aspect that we encountered in 50% of cases. According to [2,3,5,12], the initial portion of the external carotid artery up to the level of the crossing with the internal carotid showed a supero-lateral trajet, an aspect that we encountered in 40% of cases. The other two trajet patterns that we described (curved with lateral convexity and italic “S”) were not found as quoted in the studied literature.

The anterior crossing of the internal carotid artery by the external may occur after the origin of some of its collateral branches while its terminal

bifurcation occurs laterally to the internal carotid. In these cases, the collateral branches of the external carotid detach very close one to another, an aspect signaled by [7] that describes an unusual ramification of the right external carotid artery: at its origin starts the superior thyroid artery and immediately above emerges the lingual, facial and occipital arteries; the posterior auricular artery starts from the occipital artery. This anomaly was unilateral, without being accompanied by other vascular anomaly. A similar case found by us, showed some collateral branches of the external carotid emerging below the cross of the two carotids (Figure 5).

Figure 5 - Left external carotid artery with vertical traject, crosses the internal one after giving birth to the occipital artery; the occipital artery crosses anteriorly the internal carotid, both passing laterally

Regarding the caliber of the external carotid artery, we've found it between 4 to 5.6 mm on the right and from 3.6 to 5 mm on the left, so right-left differences between 0.4 to 0.6 mm. According to [5,9,10,11], the caliber is about 8 mm while [13] gives an equal caliber with the internal carotid artery, sometimes smaller. [14], working on human fetuses, found an average difference between the right and left carotid of 0.02 mm in males and a difference of 0.19 mm in females. Also [14] finds a similar average

difference between the calibers of the external and internal carotids (0.92) in males on both sides of the body and in females a difference of 0.86 mm on the right and 1.02 mm on the left side. Between the caliber of the internal and the external carotid (14) found in males a mean difference of 0.8 mm on the right and of 0.79 mm on the left side. In females the difference on the right was 0.79 mm (less only by 0.01 mm from males) and 0.71 mm on the left (less with 0.08 mm to males). [15] found in fetuses an average difference between the right and the left carotid arteries of 1.19 mm in females and a difference of 0.93 mm in males and an average difference between external and internal carotids size of 1.19 in females, while males showed a difference of 0.93 mm. Between the calibers of the common carotid and the external carotid, [15] found an average difference of 0.56 mm both in males and females.

Conclusions

The study shows a significant variability of the terminal bifurcation of the common carotid and also of the caliber and trajet of the external carotid, noticing a frequent right-left asymmetry; rarely, they showed similar characteristics. The statistical differences between our results and existing data in the consulted literature are due primarily to the total number of studied cases and also to the working methods.

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