

**ORIGINAL RESEARCH**

# Anatomical variations of the brachiocephalic artery and their clinical relevance

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### ABSTRACT

**Background:** This study was conducted to assess the Anatomical variations of the brachiocephalic artery and their clinical relevance. **Material and methods:** An observational, cross-sectional, descriptive, as well as retrospective investigation was conducted. A 64-slice CTA was utilized to obtain the images. With a window range of WW:600–650 and WL:170–225, 0.625 mm width slices, 0.53:1 mm/rot pitch, and a field of view of 22 to 23 cm, the CTA settings were rotation 0.4 s helicoidal acquisition, 20 mm detector covering, and 120 kV. The sample size was 50. For statistical analysis, the SPSS Version 24.0 program for Windows 10 was used. Each measurement parameter's mean as well as standard deviation were found on their own. The significance of the differences in each measurement parameter between men and women for each morphometric parameter was assessed using the Mann Whitney U test; a result of  $p \leq 0.05$  was considered significant. **Results:** The thyroid and cricoid cartilages were found to be 2.9 and 3.65 cm, on average, from the free edge of the BCT. The free edge was found to be less than 1 cm from the cricoid cartilage in 39 investigations, however in 3 patients the BCT was found to be greater than this level by a mean of 7.6 mm, with 1 of these cases reaching the thyroid cartilage. **Conclusion:** In this population, high position BCT is highly prevalent. Because of the possible risk of complications, patients should be evaluated prior to any local operations.

**Keywords:** anatomy, variations, brachiocephalic artery.

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### INTRODUCTION

The brachiocephalic trunk (BCT), also known as the “anonymous artery” constitutes the first branch that emerges from the aortic arch.<sup>1,2</sup> The BCT at the level of the right sternoclavicular joint, typically divides into the right subclavian artery (RSA) and the right common carotid artery (RCCA).<sup>3,4</sup> However, there are several documented anatomical variations of the origin and the trajectory of the BCT and it is probable that novel variations may be detected since the existing literature is quite restricted.<sup>5,6</sup>

Such anatomical variations are of paramount clinical significance since they constitute major risk-factors of accidental hemorrhage when performing tracheotomy, surgeries of the thyroid and parathyroid glands, in the tumor excision of the neck and invasive radiology as well.<sup>7,8</sup>

This study was conducted to assess the Anatomical variations of the brachiocephalic artery and their clinical relevance.

### MATERIAL AND METHODS

An observational, cross-sectional, descriptive, as well as retrospective investigation was conducted. A 64-slice CTA was utilized to obtain the images. With a window range of WW:600–650 and WL:170–225, 0.625 mm width slices, 0.53:1 mm/rot pitch, and a field of view of 22 to 23 cm, the CTA settings were rotation 0.4 s helicoidal acquisition, 20 mm detector covering, and 120 kV. The sample size was 50. For statistical analysis, the SPSS Version 24.0 program for Windows 10 was used. Each measurement parameter's mean as well as standard deviation were found on their own. The significance of the differences in each measurement parameter between men and women for

each morphometric parameter was assessed using the Mann Whitney U test; a result of  $p \leq 0.05$  was considered significant.

## RESULTS

**Table 1: Brachiocephalic trunk Vertebral level.**

Vertebral body	Origin (%)
C7	0.1
T1	0.9
T2	15.9
T3	60.2
T4	25.0

The thyroid and cricoid cartilages were found to be 2.9 and 3.65 cm, on average, from the free edge of the BCT. The free edge was found to be less than 1 cm from the cricoid cartilage in 39 investigations, however in 3 patients the BCT was found to be greater than this level by a mean of 7.6 mm, with 1 of these cases reaching the thyroid cartilage.

## DISCUSSION

The brachiocephalic artery, brachiocephalic trunk, or more commonly referred to clinically as the innominate artery, is one of the three great vessels of the aortic arch that supplies blood to the head, neck and upper extremities. Specifically, the artery goes on to form the right subclavian artery, which provides blood to the right upper extremity, and the right common carotid artery, which is one of the main arteries supplying blood to the head and neck.

The innominate artery is of particular clinical significance not only due to its vital role in providing much of the blood to the superior aspect of the body but also due to anatomic variations that are numerous and not at all uncommon. These variations can often lead to malformations that may require surgical correction early on, primarily due to tracheal and/or esophageal compression.<sup>9</sup>

This study was conducted to assess the Anatomical variations of the brachiocephalic artery and their clinical relevance.

In this study, the thyroid and cricoid cartilages were found to be 2.9 and 3.65 cm, on average, from the free edge of the BCT. The free edge was found to be less than 1 cm from the cricoid cartilage in 39 investigations, however in 3 patients the BCT was found to be greater than this level by a mean of 7.6 mm, with 1 of these cases reaching the thyroid cartilage.

**Chakravarthi KK et al (2014)**<sup>10</sup> evaluated the anatomical variations of the brachial artery and its morphology, embryogenesis and clinical implications. In an anatomical study 140 upper limb specimens of 70 cadavers (35 males and 35 females) were used and anatomical variations of the brachial artery have been documented. Accessory brachial artery was noted in eight female cadavers (11.43%). Out of eight cadavers in three cadavers (4.29%) an unusual bilateral accessory brachial artery arising from the axillary artery and it is continuing in the

forearm as superficial accessory ulnar artery was noted. Rare unusual variant unilateral accessory brachial artery and its reunion with the main brachial artery in the cubital fossa and its variable course in relation to the musculocutaneous nerve and median nerve were also noted in five cadavers (7.14%). Such anatomical variations of brachial artery and its terminal branches with their relation to the surrounding structures are not reported in the modern medical literature. An awareness of such a presence is valuable for the surgeons and radiologists in evaluation of angiographic images, vascular and reconstructive surgery or appropriate treatment for compressive neuropathies.

**Jasso-Ramírez NG et al (2021)**<sup>11</sup> classified height positions of the BCT and report their prevalence in a Mexican population. A retrospective, descriptive, observational, and cross-sectional was performed using computed tomography angiography (CTA) of adult (> 18 years of age) patients, without gender distinction, of Mexican origin. Measuring techniques were standardized using the suprasternal notch to analyze linear and maximum heights, linear and curved lengths, and the vertebral origin and bifurcation levels of the BCT. A total of 270 CTA had been obtained (66.7% men and 33.3% women). A high position of BCT was present in 64.81% (n 175/270). The mean linear medial height was  $0.58 \pm 1.91$  cm, the maximum height of the free edge was  $3.85 \pm 2.04$  cm, side length of the midline at the maximum height of the free edge was  $1.46 \pm 2.59$ , linear length  $3.72 \pm 0.70$ , and a curve length  $3.99 \pm 0.79$ . The BCT origin was most predominant at the T3 (57.9%) and T4 (27.0%) vertebral levels, with the bifurcation at T2 (57.9%) and T1 (36.2%). There is a high prevalence of high position BCT in their population. Patients should be assessed before any procedures in the area, due to the potential risk of complications.

## CONCLUSION

In this population, high position BCT is highly prevalent. Because of the possible risk of complications, patients should be evaluated prior to any local operations.

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