

ANATOMICAL VARIATIONS IN THE ORIGIN OF BRACHIOCEPHALIC TRUNK AND LEFT COMMON CAROTID ARTERY FROM THE ARCH OF AORTA: A CADAVERIC STUDY

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ABSTRACT

Background: The most common branching pattern observed is separate origination of three branches springing from the arch of aorta: the brachiocephalic trunk, left common carotid artery and left subclavian artery. Knowledge of anatomical variations in the origin of brachiocephalic trunk and left common carotid artery from the arch of aorta are important in avoiding surgical and accidental injuries during aortic instrumentation, thoracic and neck surgeries.

Materials and Methods: This study is based on dissections performed on 60 properly embalmed human cadaver specimens obtained from Department of Anatomy, JJM Medical College, Davangere. The anatomical variations in the origin of brachiocephalic trunk and left common carotid artery from the arch of aorta were observed.

Results: The origin of brachiocephalic trunk and left common carotid artery as separate branches from the arch of aorta was observed in 48 specimens (80%). The common trunk for both brachiocephalic trunk and left common carotid artery was present in 12 specimens (20%).

Conclusion: The results in this study provide significant information vital for anatomists, cardiovascular surgeons and radiologists.

KEY WORDS: Arch of Aorta, Common Trunk, Brachiocephalic Trunk, Left Common Carotid Artery.

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INTRODUCTION

The aorta is the main arterial trunk of systemic circulation. For descriptive purposes it is divided into the ascending aorta, the arch of aorta, and the descending aorta. Three branches usually arise from the arch's convex superior aspect, the brachiocephalic trunk (BCT), left common carotid artery (LCCA) and left subclavian artery (LSA) [1].

Study of the branching pattern of arch of aorta is of considerable significance, due to repeated

intervention by intervention cardiologists and cardiothoracic surgeons [2]. The arch of aorta is also an important site of endovascular repair [3]. The anomalous origins and distribution of the large branches of the arch could cause changes in cerebral hemodynamics that might lead to cerebrovascular catastrophes⁴. The aim of present study was to observe the origin of brachiocephalic trunk and left common carotid artery from the arch of aorta, incidence of its variations and its clinical significance.

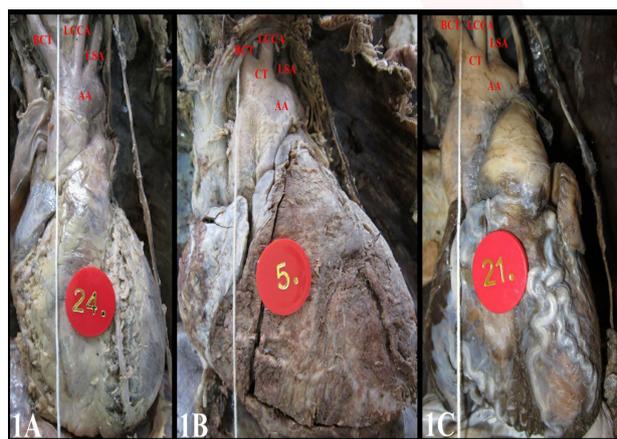
MATERIALS AND METHODS

Sixty properly embalmed human cadaver specimens belonging to south Indian origin were dissected to expose structures in superior mediastinum during routine undergraduate dissection in department of anatomy, JJM Medical College, Davangere, India. The arch of aorta was dissected with proper care to identify its branches namely; brachiocephalic trunk, left common carotid artery and left subclavian artery. Variations in the origin of brachiocephalic trunk and left common carotid artery from the arch of aorta were observed and photographs were taken with digital camera.

RESULTS

The usual pattern of three major branches; the brachiocephalic trunk (BCT), left common carotid artery (LCCA) and left subclavian artery (LSA) arising independently from the arch were observed in 48 specimens (80%) [Figure 1A]. The common trunk for both brachiocephalic trunk and left common carotid artery was present in 12 specimens (20%). [Figure 1B, 1C].

Fig. 1: Photographs showing variations in the origin of brachiocephalic trunk and left common carotid artery from the arch of aorta. 1A: Usual pattern of origin of brachiocephalic trunk and left common carotid artery as separate branches. 1B and 1C: common trunk for the origin of both brachiocephalic trunk and left common carotid artery.



DISCUSSION

Among the most important considerations in the study of the vascular system are its significant variations. Although many of them cause no disturbance in the functions of the body, they may be of great importance to the surgeon. Many of the variations are due to different modes of

transformation of the primary vessels of the branchial arches, during embryonic period of gestation [5]. An analysis of variation in branches from 1000 aortic arches by Anson in 1963, showed 65% with usual pattern; in 27% left common carotid and the brachiocephalic trunk had a common trunk; in 2.5% the four arteries branched separately from the arch. The remaining 5% showed a great variety of patterns [1]. In present study, origin of brachiocephalic trunk and left common carotid artery as separate branches was seen in 80%; in 20% brachiocephalic trunk and the left common carotid had a common trunk. This finding was nearly similar to that of Haifa A. Alsaif and Wafaa S. Ramadan [15], Suresh et al [14] where 83% had origin of brachiocephalic trunk and left common carotid artery as separate branches and 17% had common trunk of origin for both brachiocephalic trunk and left common carotid artery. Various studies have documented different incidences of this variation in different population (Table 1).

Table 1: Incidence of variation in the origin of brachiocephalic trunk and left common carotid artery from the arch of aorta in different populations.

Study	Population	Origin of BCT and LCCA as separate branches in %	Common trunk for BCT and LCCA in %
Adachi 1928 [8]	Japanese	89	11
Nelson and Sparks 2001 [9]	Japanese	98.9	1.1
Gupta and Sodhi 2003 [10]	Indian	92.5	7.5
Nayak, Pai, Prabhu et al. 2006 [11]	Indian	95.2	4.8
Suresh, Ovchinnikov and Mc Rae 2006 [12]	Trinidadian	83.4	16.6
Shin, Chung, Shin et al. 2008 [2]	Korean	92	8
Ogengo, Olabu et al. 2010 [13]	Kenyan	74.3	25.7
Natsis, Tsitouridis, Didagelos et al. 2009 [14]	Greek	85	15
Haifa A. Alsaif and Wafaa S. Ramadan 2010 [15]	Saudi Arabia	83	17
Bhattarai and Poudel 2010 [16]	Nepalese	89	11
Present study	South Indian	80	20

The present study on South Indian population may provide adequate information on anatomical variations in the origin of brachiocephalic trunk and left common carotid artery from the arch of aorta for safely performing endovascular surgery. These variations have to be taken into consideration by surgeons when they are planning surgical or diagnostic interventions involving arch of aorta and its branches. Surgeons must be aware of possible variations of the major arteries and be able to identify them. Correct identification of these vessels is very important for appropriate invasive

techniques in order to achieve desired objectives and to avoid major complications especially during vascular surgery. The anatomical variations in the origin of brachiocephalic trunk and left common carotid artery from the arch of aorta are significant for diagnostic and surgical procedures in the thorax and neck [6, 7].

CONCLUSION

The present study on South Indian population provides considerable information on the origin of brachiocephalic trunk and left common carotid artery from the arch of aorta. The variation in the origin of brachiocephalic trunk and left common carotid artery from the arch of aorta was at par with the studies in other population of the world. These variations should be considered during aortic angiography, aortic instrumentation, supraaortic thoracic surgeries and head and neck surgeries.

Conflicts of Interests: None

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