VARIATION IN THE BRANCHING PATTERN OF ARCH OF AORTA - A CASE REPORT
Tanvi Mahajan1 Bhosgikar Anup2 Ashwini Kumar Waghmare3 N. G. Mulimani4

ABSTRACT:
The aortic arch is a continuation of the ascending aorta, being located in the superior mediastinum. The most common branching pattern of the aortic arch (AA) in humans comprises of three great vessels; first, the brachiocephalic trunk (BCT), then the left common carotid artery (LCCA) and finally the left subclavian artery (LSA). These branches may branch from the beginning of the arch or the upper part of the ascending aorta by varying distances between them. Variations in the branching pattern of the aortic arch range from differences in the distance between origins of different branches to number of branches. Variant aortic arch branching pattern may occur with different embryological mechanisms. We report on a variant aortic arch branching in approximately 48 year old Indian male cadaver during dissection practice. Here, the left vertebral artery was seen originating directly from the arch of aorta, between the origin of left common carotid and left subclavian artery. This anatomical and morphologic variation in the arch of aorta and its branches are significant for diagnostic and surgical procedures in the thorax, head and neck regions.

KEY WORDS: Brachiocephalic trunk, Common carotid artery, Subclavian artery, Vertebral artery.

INTRODUCTION:
Aortic arch is a continuation of ascending aorta and is originated at the upper border of second right sternocostal joint. The arch first ascends diagonally back and to the left over the anterior surface of the trachea, then back across its left side and finally descends to the left of fourth thoracic vertebral body, continuing as the descending aorta. It ends level with the sternal end of the second, left costal cartilage. The aortic arch lies wholly in the superior mediastinum. The summit of the arch is usually about 2.5cm below the superiosternal border. Three branches arise from the convex aspect of the arch, leave in the following succession from right to left: brachiocephalic trunk (BCT), left common carotid artery (LCCA) and left subclavian artery (LSA) [1]. The Aortic Arch is formed in the ventral and dorsal area as a pair and six arches between the aorta are formed at initial period of gestation. Changes involved in the Aortic Arch system such as regression, retention, or reappearance result in the variations in branching pattern of aortic arch.[2]

CASE REPORT:
During routine dissection of undergraduates in the Department of Anatomy, N.K.J. Ayurvedic Medical College and P.G. Centre Bidar, it was observed that the arch of the aorta had four branches arising from its upper surface. In addition to the three common branches, which were mentioned above, the convex surface of the aortic arch was giving origin to the left vertebral artery which was located between the origins of the left common carotid and the left subclavian arteries. No other congenital variations were found. The further course, branching and termination pattern of these arteries (brachiocephalic trunk, left common carotid, vertebral and left subclavian arteries) were normal.

Fig 1: Normal branching pattern of aortic arch, showing 3 branches i.e. BCT, LCA, and LSA.
AA includes ischemic problems which can be caused by during vascular surgery. Complication of open surgery of the preoperative assessment and adequate preparations, procedures in the thorax and neck. Despite accurate SVC: Superior vena cava), LVA: Left vertebral artery, and LSA: Left subclavian artery, (BCT: Brachiocephalic trunk, LCA: Left common carotid artery, and LSA.

Fig 2: Aortic arch showing four branches i.e. BCT, LCA, LVT, and LSA.

(BCT: Brachiocephalic trunk, LCA: Left common carotid artery, LVA: Left vertebral artery, and LSA: Left subclavian artery, SVC: Superior vena cava)

DISCUSSION:
The anatomic and morphologic variations of the AA and its branches are significant for diagnostic and surgical procedures in the thorax and neck. Despite accurate preoperative assessment and adequate preparations, unexpected and sometimes unsuccessful situations can occur during vascular surgery. Complication of open surgery of the AA includes ischemic problems which can be caused by unrecognized variation of the vascular anatomy. [3]

The true value of detecting anomalous origins is in the diagnostic gain before vascular surgeries of supraaortic arteries, as variations of the branches of the aortic arch are likely to occur as a result of the altered development of certain branchial arch arteries during the embryonic period of gestation.

In the present case, there was a direct origin of the left vertebral artery from the upper surface of the aortic arch and it was located between origins of the left common carotid and left subclavian arteries. The mode of development of this type of branching pattern suggests that it might be due to increased absorption of embryonic tissue of the left subclavian artery between the origin of the aortic arch and the vertebral artery may be the reason for such direct origin of the left vertebral artery from the aortic arch. The usual pattern of branches of the arch of the aorta is present in approximately 65% [1] of people. The frequency of such variation is found in 5% - 8% [1][4][5] of all cases.

The presence of anomalous arch vessels has considerable impact on AA reconstruction technique and cerebral protection methods when the separated graft technique is adopted to perform total arch replacement. Some anomalous aortic branches, as the left vertebral artery (LV), are difficult to diagnose preoperatively as it is often obscured by other larger arch branches, making its preoperative detection considerably more difficult. They are most often discovered intra-operatively, hence it is necessary to take special precaution while the arch branches are dissected and exposed. [6]

Diagnosis of a cerebrovascular injury may be based on a wrong assumption that the vertebral artery (VA) is occluded by simply lying outside the region of interest during non-invasive studies, such as computerized tomography angiography (CTA), Magnetic Resonance Angiography (MRA), or Doppler sonography. [7] Therefore, it appears that the true value of detecting anomalous arch vessels is in the diagnostic gain before planning an AA surgery or endovascular interventions.

Even though the branching patterns of the aortic arch are considered to be variants of some deviations from the commonest pattern of development, there were not any noticeable signs of anatomical pathology associated with those variations. These variations have to be taken into consideration by surgeons when they are planning surgical or diagnostic interventions involving the aortic arch 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.

CONCLUSION:
The wide spectrum of variations in the anatomical arrangement of human aortic arch and its branches offer valuable information to catheterize aortic arch and its branches for safely performing the endovascular surgery. These anatomical and morphologic variations in the arch of aorta and its branches are significant for diagnostic and surgical procedures in the thorax, head and neck regions.

REFERENCES:

Cite this article as: Tanvi Mahajan, Bhosgikar Anup, Ashwini Kumar Waghmare, N. G. Mulimani. Variation in the Branching Pattern of Arch of Aorta - A Case Report. J of Ayurveda and Hol Med (JAHM); 2014;2(7):37-38.

Source of support: Nil, Conflict of interest: None Declared