

A VARIANT BRANCHING PATTERN OF THE ARCH OF AORTA: A CASE REPORT

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ABSTRACT

The aortic arch is a continuation of the ascending aorta, being located in the superior mediastinum. In this case report the left common carotid artery was seen originating from the arch of aorta and the left vertebral artery directly from the arch of the aorta proximal to the origin of the left subclavian artery. Variations of the branches of aortic arch are due to alteration in the development of certain branchial arch arteries during embryonic period. Knowledge of these variations is important during four vessel angiography, aortic instrumentation, or supra aortic thoracic, head and neck surgery.

KEY WORDS: Arch of aorta, Brachiocephalic trunk, Vertebral artery, Subclavian artery.

INTRODUCTION

The aortic arch is a continuation of the ascending aorta, being located in the superior mediastinum. Its origin is slightly to the right and is in level with the upper border of the 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 the fourth thoracic vertebral body and continues as the descending thoracic aorta. It ends level with the sternal end of the second left costal cartilage. Three branches, the brachiocephalic trunk, left common carotid artery and left subclavian artery usually branch from the aortic arch. These branches may branch from the beginning of the arch or the upper part of the ascending aorta by varying distances between them. The brachiocephalic trunk later divides into right common carotid artery and right subclavian artery. Variations in the branching pattern of the aortic arch range from differences in the distance between origins of different branches to number of branches [1,2]. Reported variations in the aortic arch branching pattern include left common carotid artery originating from the brachiocephalic trunk; right common carotid artery and right subclavian artery originating individually from the aortic arch [2,3]. Additionally, left common carotid artery and left subclavian artery may have a common origin in the form of the left brachiocephalic trunk from the aortic arch. The left vertebral artery may also arise between the left common carotid artery and left subclavian artery [4]. Most of the anomalies of the arch of aorta and its branches are due to altered development of primitive aortic arches of the embryo during the early gestation period [5]. In this case report, we present a variant of aortic arch branching pattern where the left common carotid artery was seen to arise from the root of the brachiocephalic and the left vertebral artery from the arch of the aorta proximal to the origin of the left subclavian artery. We discuss their embryological, clinical and surgical implications.

CASE REPORT

The present report describes anomalies in branching of the aortic arch identified in a adult male cadaver during dissection classes for medical undergraduates in the Department of Anatomy J.L.N. Medical College Ajmer. From the records, he had no past medical history suggestive of cardiovascular disease. The cause of death was non-cardiovascular disease. The cadaver was formalin-fixed. After removal of the anterior thoracic wall, fat tissue and the pericardium covering the ascending aorta and the great vessels, we found the left common carotid artery originating from the root of the brachiocephalic trunk. This artery then crossed the trachea anteriorly from left to right and then entered the left side of the neck (Figure 1).

In addition, the left vertebral artery was observed to arise from the arch of the aorta proximal to the origin of the left subclavian artery. The further course, branching and termination pattern of these arteries (brachiocephalic trunk, left common carotid, vertebral and left subclavian arteries) were normal. None of the laboratory or radiological investigation detected this variation prior to death.

DISCUSSION

Three classical branches spring from convex aspect of the aortic arch: the brachiocephalic trunk, left common carotid artery and left subclavian artery [1]. This branching pattern is the most common accounting for about 65% of aortic arch branching pattern. However, variation in the aortic arch branching pattern has been reported widely [2,6,7].

Anson's observation from 1000 aortic arches found a 65% of the usual pattern, a 25% of the four large arteries branching separately, the remaining 5% showed a great variety of patterns, the most common being symmetrical right and left brachiocephalic trunks [2]. Other variations include the left vertebral artery arising between the left common carotid and the subclavian. More rarely, the common carotid artery may be absent on one or both sides, the external and internal carotid arteries arising separately, or both carotids and one or both vertebrals may be separate branches [1,8].

The left common carotid artery varies in origin more than the right. The vertebral artery is classically described as first branch of ipsilateralsubclavian artery. However, multiple variations in the origin of the vertebral artery have been reported in the literature, the most frequent variant (2.4-5.8%) is the left vertebral artery arising directly from the aortic arch between the left common carotid artery and left subclavian artery [9].

Variation in the distance between origin of these vessels has also been reported, the most frequent being approximation of the left common carotid artery to the brachiocephalic trunk. Developmental anomalies in aortic arch branching pattern arise from unusual patterns of development of the embryonic aortic arch system of the pharyngeal arches, such that there may be persistence of aortic arches that normally disappear or disappearance of parts that normally persist [10].

Several kinds of uncommon defect occur when arches persist instead of becoming obliterated or vice versa. The proximal part of the third aortic arch normally gets extended and absorbed into the left horn of aortic sac. If it gets absorbed into the right horn of the aortic sac, it can lead to anomalies where the left common carotid artery arises from the brachiocephalic trunk. Origin of vertebral arteries from the aorta suggests that part of the aortic arch arises from the left

7th inter-segmental arteries or there was increased absorption of embryonic tissue of the left subclavian artery between origin of aortic arch and the vertebral artery [10]. These two scenarios could explain the findings in the case described in this study.

CONCLUSION

Although anomalous origins of the aortic arch branches are merely anatomic variants, knowledge of variations in the branching pattern of the aortic arch is of great importance in patients who have to undergo four vessel angiography, aortic instrumentation, or supra aortic thoracic, head and neck surgery [11]. It has been reported that anomalies of the aortic arch branching pattern could lead to cerebral abnormalities by altering the pattern of flow in cerebral vessels [12]. In addition, knowledge of abnormal branches originating from the aortic arch is also important in the diagnosis of intracranial aneurysms following subarachnoid haemorrhage [3]. A variant of origin and course of a great vessel arising from the aortic arch is of great clinical value, because lack of knowledge of these variations may cause serious surgical complications during procedures occurring in the superior mediastinum and the root of neck.

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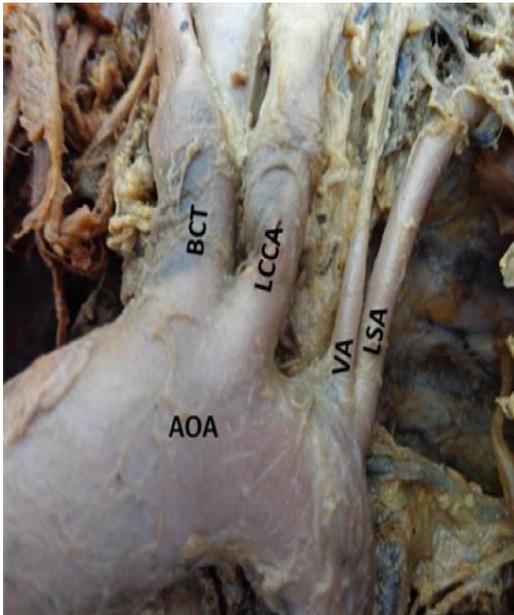


Figure: 1



Figure: 2

Left Vertebral artery (VA) arising directly from Arch of Aorta (AOA),
Brachiocephalic trunk (BCT), Left common carotid artery (LCCA), Left subclavian artery (LSA)

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