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Fourth branch of arch of aorta and its clinical implication



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ABSTRACT

In human beings the most common branching pattern of the aortic arch was its division into three great vessels ie the brachiocephalic trunk, left common carotid artery and the subclavian artery. The vertebral arteries arise from the superior aspect of the first part of the subclavian artery. In present case, a left vertebral artery arose from the aortic arch as fourth branch was found. The diameter of left vertebral artery at its origin was 6 mm as compared to the right vertebral artery, which has diameter of 3.5 mm at its origin. In this case left sixth dorsal intersegmental artery might have persisted as first part of vertebral artery hence left vertebral artery arising from arch of aorta. Knowledge of the variations in branching pattern of the aortic arch is important in the diagnosis of intracranial aneurysm after subarachnoid haemorrhage.

Keywords:

Aortic arch; left vertebral artery; fourth branch of aortic arch; variation; dissection

Introduction:

In human beings the most common branching pattern of the aortic arch was its division into three great vessels i.e. the brachiocephalic trunk, left common carotid artery and the subclavian artery. This pattern occurs in 65-80% of the cases¹. The vertebral arteries arise from the superior aspect of the first part of the subclavian artery. This artery takes a vertical posterior course to enter into the foramen transversarium of sixth cervical vertebra. The segment of the artery from its origin at subclavian artery to its respective foramen transversarium is called the pretransverse or prevertebral segment [1,2].

The variation in origin and course of left vertebral artery and its importance in cerebral disorders clinically and surgically has been described. Its importance in head and neck surgery, angiography and arterial dissection has also been mentioned in the literature [3, 4].

In this case report, I am presenting a left vertebral artery as fourth branch of the aortic arch in a 65 year old male cadaver. I am going to discuss embryological, clinical and surgical implications of this artery.

Case Report:

During the dissection of the thorax region of 65 year male cadaver for MBBS batch 2014/15 at Dr. Navodaya Medical College, Raichur, (India), a left vertebral artery arose from the aortic arch as fourth branch was found (figure 1 & 2).

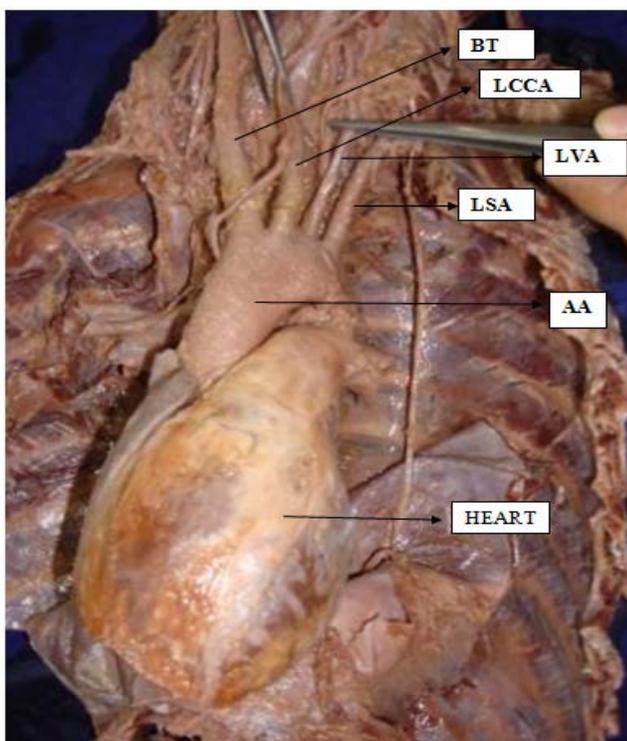


Figure 1 - Showing arch of aorta along with heart and its branches.

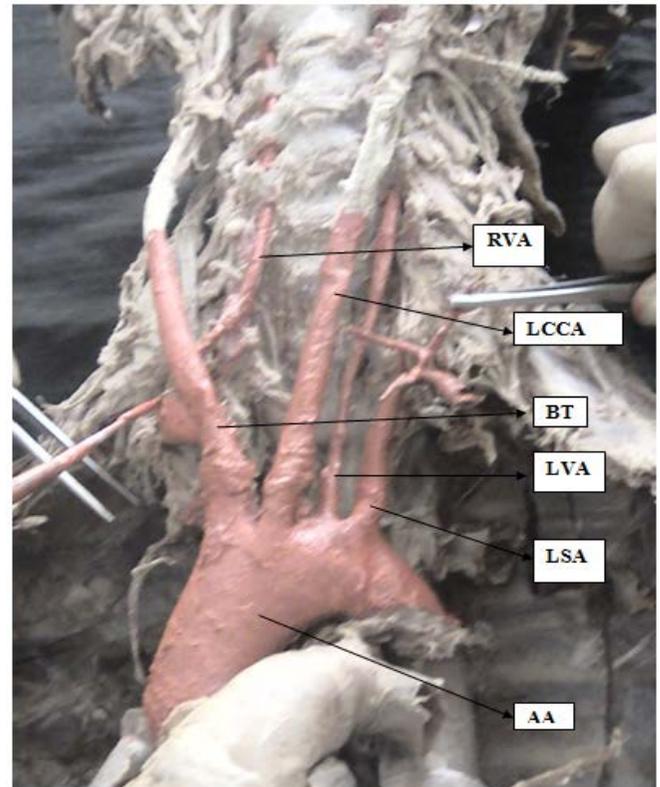


Figure 2 - Showing colored photograph of arch of aorta and its branches.

The cadaver belongs to the Indian population. The origin of left vertebral artery was to the right side of the left common carotid artery. The left vertebral artery related to the stellate ganglion and ventral rami of cervical spinal nerves posteriorly. Thoracic duct arched anterior to it before it enters foramen transversarium of sixth cervical (C6) vertebra. The right vertebral artery originated from superior aspect of first part of subclavian artery and traversed medially to scalenus anterior and longus colli behind the common carotid artery. It was also related to the stellate ganglion and ventral rami of seventh and eighth cervical spinal nerves before entering into the foramen transversarium of sixth cervical (C6) vertebra. In this case report; the left vertebral artery varied in its origin. The diameter of left vertebral artery at its origin was 6 mm as compared to the right vertebral artery, which has diameter of 3.5 mm at its origin. The length of left vertebral artery was 10.6 cm and that of right vertebral artery was 8.1 cm. The diameter of vertebral arteries was measured with the help of spreading caliper. The length of vertebral arteries was measured with the help of thread and scale

Discussion

In diagnostic practice; it is very important to detect the anomalous origins of the branches of the aortic arch before vascular surgeries of supra-aortic arteries. These variations are

likely to occur and make impact in these surgeries. These variations are due to the altered development of certain brachial arch arteries during the embryonic period of gestation 5. If the critical variations of branches of the arch of aorta not recognized at surgery; there may be fatal consequences [6]. Congenital cardiac defects and coronary arterial abnormalities were associated with the angiographic detection of common origin of brachiocephalic trunk and left common carotid artery. When planning the palliative or corrective procedures, and assessing the potential benefit of the surgical repair over the long term; it is necessary to understand the pathophysiological effects of such a defect [7]. Vascular remodeling within the aorta results in a loss of structural integrity with consequent aneurysm formation [8].

Normally the first part of vertebral artery develops from proximal part of dorsal branch of seventh cervical intersegmental artery proximal to postcostal anastomosis. The second part develops from longitudinal communications of the postcostal anastomosis. The proximal parts of intersegmental arteries are exposed to longitudinal tension and bending due to caudal shifting of the aorta resulting in retarded blood flow and abnormal connections between longitudinal channels (vertebral artery) and subclavian artery or aorta [3,9].

In present case, we found left vertebral artery arose from the aortic arch as fourth branch. In this case left sixth dorsal intersegmental artery might have persisted as first part of vertebral artery hence left vertebral artery arising from arch of aorta.

Bhattarai C and Poudel PP studied 85 cadavers at Manipal College of Medical Sciences, Pokhara, Nepal over a period of three years. They found variations in 17 cadavers (20 %). Common origin of the brachiocephalic trunk and left common carotid artery was found in 11 cadavers (12.9 %). Direct origin of left vertebral artery from arch of aorta was found in 6 cadavers (7.0 %) 6. Siva Kumar GL et al described case of 55 year old cadaver. In this case, they found an unusual common trunk for brachiocephalic trunk and left common carotid artery. Brachiocephalic trunk was trifurcated into right vertebral artery, right common carotid artery and right subclavian artery. Left vertebral artery was seen to arise from arch of aorta [10].

The anomalous branching pattern of the aortic arch can alter the cerebral haemodynamics, which in turn can lead to cerebral abnormalities. In aortic arch surgeries, these anomalous branches should be detected prior to the surgery. The ligation of the common carotid artery may lead to complications in the posterior cranial fossa blood supply if the vertebral artery originates from the carotid artery or through its branches [10, 11].

Conclusion

Knowledge of the variations in branching pattern of the aortic arch is important in the diagnosis of intracranial aneurysm after subarachnoid haemorrhage. Clinicians and surgeons should be aware of aortic arch variations. Early identification of these vascular anomalies through diagnostic interventions is crucial in order to avoid complications during heart and vascular surgeries. Thus we conclude that it is important to be aware of this type variation in the origin and course of left vertebral artery as it might have serious implication in surgical and angiographic procedures.

Competing interests

Authors declare that they don't have any competing interest.

Authors' contribution

Dr. Rashmi N. Gitte, Ms. Chenna Reddy Ganji and Dr. Vishal M. Salve took part in data collection and writing the manuscript. Final manuscript is accepted by all authors for publication.

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