CASE REPORT

Left Vertebral Artery Arising from the Aortic Arch, an Incidental Finding During Imaging: A Case Report

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Abstract

The vertebral arteries normally originate from the subclavian arteries. These arteries ascend through the transverse foramina of the cervical vertebrae (typically entering at the C6 level) to supply the posterior circulation of the brain. Anatomical variations in vertebral artery origin are uncommon.

Case report: A rare anatomic variation of the aortic arch was identified in a 63-year-old male during an evaluation of a vascular pathology with computed tomography angiography (CTA). The CTA demonstrated the left vertebral artery (LVA) arising directly from the aortic arch instead of originating from the left subclavian artery. The patient had no symptoms attributable to this vertebral artery anomaly, and no intervention was performed. This case report highlights the importance of recognizing a left vertebral artery arising from the arch for surgical or endovascular planning. This case report describes the abnormal LVA and discusses the embryological basis, imaging findings, and clinical implications of this anomaly.

Keywords: Vertebral artery; Computed tomography; Angiography; Variations

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Introduction

The vertebral arteries normally originate from the subclavian arteries (1). These arteries ascend through the transverse foramina of the cervical vertebrae (typically entering at the C6 level) to supply the posterior circulation of the brain. Anatomical variations in vertebral artery origin are uncommon. The variant left vertebral artery (LVA) arises directly from the aortic arch between the left common carotid artery and the left subclavian artery (2). This variation results in a "four-vessel" aortic arch configuration, with the LVA as an additional branch of the arch. A recent large meta-analysis found an arch origin of the LVA in approximately 4.8% of cases, making it the most common vertebral artery anomaly (3). Recognition of a vertebral artery variant is important because, although usually benign and asymptomatic, it can have clinical and surgical significance. Unawareness of an anomalous vertebral artery during procedures in the neck or superior mediastinum may lead to inadvertent injury with potentially serious consequences. In this report, we present an incidental case of an LVA arising from the aortic arch and discuss the embryologic development and implications of this variation.

Case Presentation

A 63-year-old male undergoing evaluation for a vascular pathology had no neurologic complaints, neck pain, vertigo, or any symptoms suggestive of vertebrobasilar insufficiency. As part of the workup, a contrast-enhanced computed tomography angiogram of the aortic arch and supra-aortic vessels was performed (Figure 1). This imaging revealed an anomalous origin of the left vertebral artery directly from the aortic arch between the left common carotid artery and the left subclavian artery. The abnormal LVA had a diameter similar to a normally originating vertebral artery. The remaining arch branching pattern was normal. The right vertebral artery originated from the right subclavian artery in the usual fashion. No other vascular anomalies were noted on the scan.

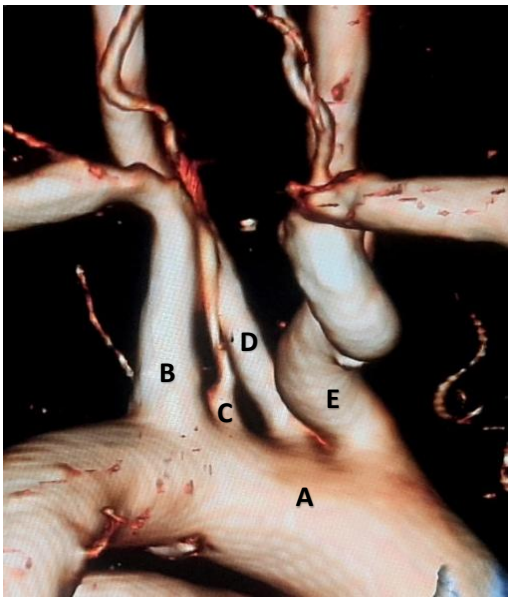

Figure 5: CT Angiography demonstrating aortic arch and its branches from posterior aspect. A - Aortic Arch, B - Left Brachiocephalic Trunk, C – Left Vertebral Artery, D - Left Common Carotid Artery, E - Right Brachiocephalic Trunk

Discussion

Anomalous origin of the left vertebral artery from the aortic arch is an infrequent vascular variant. Previous autopsy series has indicated a prevalence of between 2.4% and 5.8% (5). Imaging studies report a comparable prevalence, with a systematic review of over 32,000 vertebral arteries demonstrating a direct aortic arch origin of the left vertebral artery in approximately 4.8% of cases (3). In normal embryologic development, the aortic arch develops between the 2nd and 7th weeks of gestation from six paired branchial arches that arise and regress sequentially, as classically described in Rathke's diagram. The first, second, and fifth arches regress, with remnants forming the maxillary and stapedial arteries, while the third, fourth, and sixth arches give rise to the major aortic branches i.e. the carotid arteries, definitive aortic arch, pulmonary arteries, and ductus arteriosus. The ventral aorta forms the truncus arteriosus (later dividing into the ascending aorta and main pulmonary artery), the dorsal aortae fuse into a single trunk, and the seventh intersegmental

artery contributes to the subclavian arteries (4). The vertebral arteries form from longitudinal anastomoses of the cervical intersegmental arteries, and the seventh intersegmental artery usually gives rise to the subclavian artery and vertebral arterial origin (1). The embryological basis for a direct aortic origin of the left vertebral artery is thought to be a failure of the embryonic connections on the left side: specifically, persistence of the sixth cervical intersegmental artery with absent or incomplete formation of the normal connection to the seventh segmental artery can lead to the left vertebral artery remaining attached to the aortic arch (6). This variant occurs because the left vertebral artery develops directly from the dorsal aorta (which later forms part of the aortic arch) rather than branching from the left subclavian artery. One proposed explanation is excessive resorption of the embryonic segment that normally gives rise to the proximal left subclavian artery, resulting in the vertebral artery retaining an independent origin from the aortic arch (7). The result is an aortic arch with four branches: in most cases the LVA arises between the left common carotid and left subclavian arteries (8). In many individuals, an arch-origin LVA is an incidental finding and does not produce symptoms. Majority of patients with aberrant vertebral origins were asymptomatic, with only about 5.5% of cases having symptoms possibly attributable to the anomaly (1). CTA and MRA are reliable modalities for delineating the origin and course of vertebral arteries (4). The index case had no symptoms attributable to the vertebrobasilar circulation. However, there can be clinical implications, such as a failure to recognize an anomalous VA origin leading to misinterpretation. Further during imaging procedures involving the aortic arch or the subclavian arteries clinicians must account for anomalous branch vessels. Failure to recognize these variations can result in accidental injury and ligation during open surgical procedures. In addition, during endovascular interventions, failure to recognize the LVA originating from the arch can result in occlusion of the vessel, by a stent.

Conclusion

LVA arising directly from the aortic arch represents a rare vascular anomaly. This case underscores the importance of identifying such variants on imaging studies. Even in an asymptomatic patient, recognizing an anomalous origin of the vertebral arteries has significant clinical value. It prevents misdiagnosis and guides clinicians in planning safe surgical or endovascular procedures in the neck and mediastinum.

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