

Anomalous Origin of Bilateral Vertebral Arteries with Intracranial Aneurysm

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Abstract

Vertebral arteries are usually paired major arteries of the neck. Typically, they originate from the subclavian arteries coursing superiorly along each side of neck, merging within the skull to form basilar arteries. Different variant anatomy including asymmetry, complete or partial duplication, fenestration and variable origin have been explained in the literature. We have a case report of 54 year old gentle man who presented with acute headache and vomiting in our institute. CT angiogram revealed left posterior cerebral artery aneurysm causing subarachnoid hemorrhage. DSA further revealed bilateral vertebral arteries arising from the common carotid artery and left PCA aneurysm.

Keywords: Vertebral arteries, asymmetry, hemorrhage.

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INTRODUCTION

In normal aortic arch anatomy the right subclavian artery arises from the brachiocephalic trunk and the left subclavian artery arises as the last branch from the aortic arch. Vertebral artery originates from the superior surface of the proximal part of the subclavian artery medial to the scalenus anterior muscle. It is the largest and most constant branch of subclavian artery, both in origin and distribution. Variation in the origin of vertebral artery is a congenital anomaly that develops during embryonic development. Multiple variations in the vertebral artery origin have been reported in literature. We report a rare case of aberrant right subclavian artery with bilateral vertebral arteries arising from CCA and left PCA aneurysm.

CASE REPORT

A 54-year-old male patient presented with acute headache and vomiting. CT scan of the brain with CT angiogram revealed left posterior cerebral artery aneurysm causing subarachnoid hemorrhage. A further diagnostic DSA of bilateral carotid and vertebral arteries was performed through right femoral artery by Seldinger's technique using 5 F Judkins right coronary catheter. Multiple supra-aortic arterial anomalies were detected. First, an aberrant right subclavian artery

arising from the posterior aspect of the arch of aorta distal to the origin of left subclavian (Fig-1); second, the right common carotid artery arising from arch of aorta (Fig-2) with the right vertebral artery arising from the right common carotid artery (Fig-1) coursing superiorly and entering the right foramen transversarium of C 5 vertebra and third, left vertebral arising from the left common carotid artery (Fig-1) coursing superiorly and entering the left foramen transversarium of C 5 vertebra. The anatomical relationship of rest of the arch vessels were found to be normal. Intracranial study revealed an aneurysm arising from the P2 segment of left posterior cerebral artery with dimensions 8x5 mm and a wide neck of 3mm (Fig-3a). The fundus of aneurysm was directed laterally. Atherosclerotic changes were seen in bilateral vertebral and carotid arteries. The posterior cerebral artery aneurysm was treated with balloon assisted coil embolisation. Post procedure angiogram showed complete exclusion of aneurysm with normal distal flow (Fig-3b).

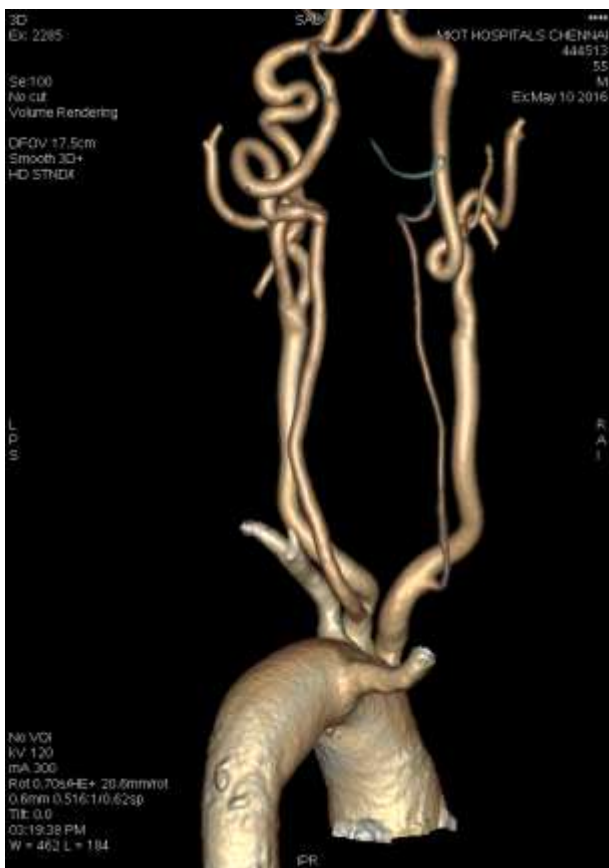


Fig-1: 3D Reconstruction of CT angiogram showing the origin of right subclavian artery from the posterior aspect of arch of aorta distal to the origin of left subclavian and the vertebral arteries arising from the common carotid arteries



Fig-2: 3D Reconstruction of CT angiogram showing the origin of right common carotid artery from the arch of aorta

DISCUSSION

Anatomical variations in the origin of vertebral artery is uncommon. Two variants with higher frequency are 1. Left vertebral artery originating from the arch of aorta between the left common carotid and left subclavian artery with an incidence of 2.4-5.8%. 2. Right vertebral artery arising from common carotid artery with associated retroesophageal right subclavian artery (RERSA) [1].

An anomalous origin of the right vertebral artery is divided into three categories: first, those originating directly from the aorta; second, those arising from the carotid or brachiocephalic arteries; and third, those with duplicate origins [1]. In most cases described in the literature, an anomalous origin of the right vertebral artery is asymptomatic [7].

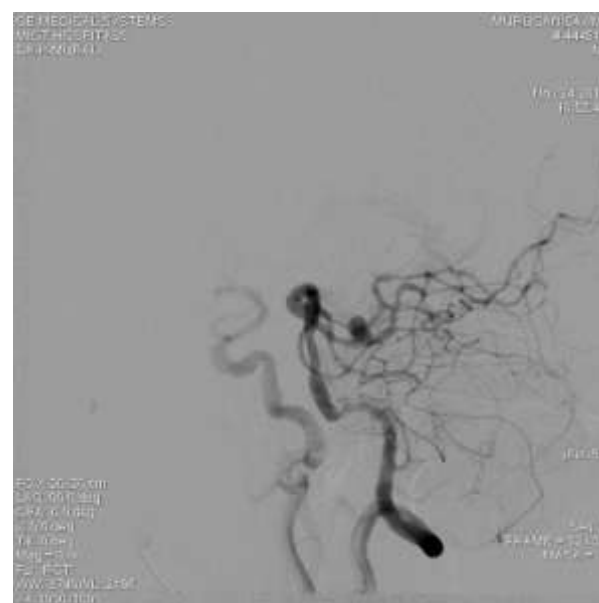


Fig-3a: DSA showing aneurysm arising from the P2 segment of left posterior cerebral artery

A RERSA is a relatively common anomaly of the aortic arch with an incidence of 0.5% [2]. Most of the cases are asymptomatic; only 10% of adults with this anomaly have symptoms of dysphagia lusoria due to extrinsic compression on the posterior aspect of the thoracic oesophagus [6]. Tsai *et al.*, analyzed the pattern and prevalence of vertebral artery anomalies in 102 patients with retroesophageal right subclavian artery (RERSA). They reported that 13.7% of RERSAs had right vertebral arteries that originated from the right common carotid and 28.6% of them had a concomitant left vertebral artery anomaly, that is, the left vertebral artery originated as the third branch of the aortic arch [3]. Anomalous origin of bilateral vertebral arteries from common carotid arteries with associated RERSA and intracranial aneurysm as in our case is extremely rare.

Bernardi and Dettori suggested that anomalous origin of large aortic arch vessels can cause changes in cerebral hemodynamics [4]. Foutrakis GN *et al.*, investigated the hemodynamics related to intracranial saccular aneurysm formation using finite element models and found that the pressures and shear stresses that develop along the outer (lateral) wall of a curved artery and at the apex of an arterial bifurcation create a hemodynamic state that promotes saccular aneurysm formation [5]. However, until now there has been no evidence to suggest that an anomalous vertebral artery origin predisposes individuals to adverse cerebrovascular events.



Fig-3b: DSA post coil embolisation showing complete occlusion of the aneurysm with normal distal flow

The development of the vertebral artery usually starts when the embryo is at the 7-mm stage and is complete by the 14- to 17-mm stage [8]. At the 7-mm stage, seven cervical intersegmental arteries (CIAs) appear, originating from each of the paired dorsal aortae [8]. A longitudinal anastomosis develops between the

CIAs when the embryo reaches the 10- to 12-mm stage [8]. At the 14- to 17-mm stage, the horizontal parts of the first six CIAs disappear and the remaining seventh CIA becomes part of the subclavian artery. The longitudinal anastomosis persists as the vertebral artery [8]. These processes of development result in the normal origin of the vertebral artery from the subclavian artery. Failure of involution in one of the first six CIAs (i.e., a persistent CIA) causes a variety of abnormal origin of the vertebral artery [11]. The persistence of CIA in the upper (first or second) intersegmental arteries, results in an anomalous origin of the vertebral artery from the internal or external carotid artery [11] and in the lower (third through sixth) intersegmental arteries results in an anomalous origin of the vertebral artery from the common carotid artery or the aortic arch [11].

If the right vertebral artery arises from the C6 intercostal artery, with obliteration of the longitudinal anastomosis between the C6 and C7 intercostal artery, and the obliteration of the right dorsal aorta occurs proximal to the C7 intercostal artery origin, the origin of the right subclavian artery is moved to the left (A. lusoria) [12].

CONCLUSION

Visualization of the supraaortic arteries is essential before proceeding with any vascular surgery or interventional procedures in the neck or intracranial location. If the vertebral arteries are not visualized in the site of normal anatomical origin, anomalous origin should be suspected and the various possible sites should be looked for.

ABBREVIATIONS

- VA-Vertebral artery.
- CCA-Common carotid artery
- PCA-Posterior cerebral artery
- SA-Subclavian artery
- RERSA-Retro-oesophageal right subclavian artery
- CIA-Cervical intersegmental artery
- CT-Computed Tomography
- DSA-Digital subtraction angiography

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