

Anomalous Right Vertebral Artery Originating from the Aortic Arch Distal to the Left Subclavian Artery: a Case Report and Review of the Literature

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Abstract

Objective—Present a case report of an anomalous origin of the right vertebral artery originating from the aortic arch distal to the left subclavian along with a review of cases reported to date in the literature.

Methods—Provide background information on this rare anomaly, present the case report, review the literature using PubMed, summarize previously reported cases to date, and discuss the underlying embryologic development of this anomaly along with its significance.

Results—We report a 54-year-old man presenting with a subarachnoid hemorrhage referred for diagnostic cerebral arteriography who was found to have an anomalous origin of the right vertebral artery originating from the aortic arch distal to the left subclavian artery in conjunction with a bovine arch. We also report 13 previously reported cases along with their other associated variant anatomy.

Conclusions—Based upon our present case and previously documented cases to date, this anomaly is a rare finding. An understanding of aberrant anatomy and its embryologic basis is paramount to avoiding inadvertent vascular injury during diagnostic cerebral angiography. Therefore, this abnormality must be considered if selective vertebral artery catheterization is difficult or unsuccessful.

Introduction

Anomalous origin of the right vertebral artery originating from the aortic arch distal to the left subclavian artery is a rare anomaly. Although this is typically an incidental finding, association with arteriovenous malformations or cerebral aneurysms have been noted previously [1]. A total of 13 case reports with this specific anomaly have been documented in the literature to date [2]. We report a 54-year-old man presenting with a subarachnoid hemorrhage who was found on diagnostic arteriography to have a bovine arch and an aberrant right vertebral artery originating from the distal aortic arch. In addition, we present a review of previously reported cases to date along with basic embryological mechanisms for this specific anomaly.

Case Presentation

A 54-year-old man presented after acute onset of headache. At the same time, he had slipped on some ice. The patient had a noncontrast CT head at an outside hospital revealing a Hunt and Hess grade 3, Fisher grade 4 subarachnoid hemorrhage with intraventricular hemorrhage.

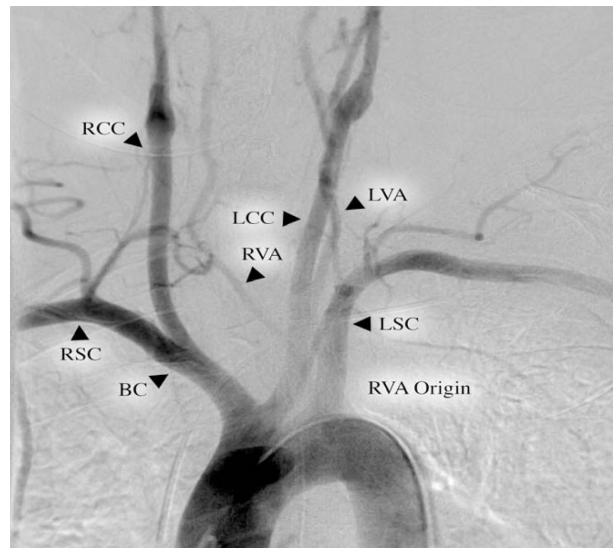


Figure 1. Diagnostic aortogram showing aberrant origin of right vertebral artery.



Figure 2. CTA arch sagittal projection showing the origin of the right vertebral artery distal to the left subclavian.

CTA head was negative for a vascular lesion. The patient was emergently transferred to our hospital for further diagnostic work-up and treatment. Upon arrival to our hospital, the patient required emergent external ventricular drain (EVD) placement and intubation due to a deterioration in his mental status. The patient was urgently taken for cerebral arteriography. Angiography was negative for a vascular source; however, an incidental anomalous origin of the right vertebral artery was found.

An aortogram was performed revealing a bovine arch and an anomalous origin of the right vertebral artery arising from the aortic arch distal to the left subclavian artery (Fig. 1). CTA of the aortic arch was performed to further characterize this anomalous finding (Figs. 2 and 3). The prevertebral segment of the right vertebral artery was located in the retroesophageal and retrotracheal areas. Follow-up cerebral angiography 1 week later failed to demonstrate a vascular etiology for his subarachnoid hemorrhage.

Discussion

Numerous variations occur in the branching vessels that arise from the aorta. Typically, the vertebral artery is the first branch arising from the ipsilateral subclavian artery. Multiple anomalous origins of both right and left vertebral artery have been reported previously in the literature [1]. The most common anomaly is the left vertebral artery origin of the aortic arch between the left common carotid artery and left subclavian artery. In a previously reported autopsy series, the origin of the left vertebral artery directly from the aortic arch between the left common carotid artery and left subclavian artery was seen in 2.4% to 5.8% of cases [2]. Anomalous origin of the right vertebral artery is a more rare entity and is divided into the following three categories: those originating from the aorta, those originating from the carotid arteries or brachiocephalic artery, and those of duplicated origin [5]. Only 13 cases of an anomalous origin of the right vertebral artery of the aortic arch distal to the left subclavian artery have been reported in the literature to date (Table 1).

Understanding this anomaly requires a knowledge of embryologic mechanisms of vascular development. The

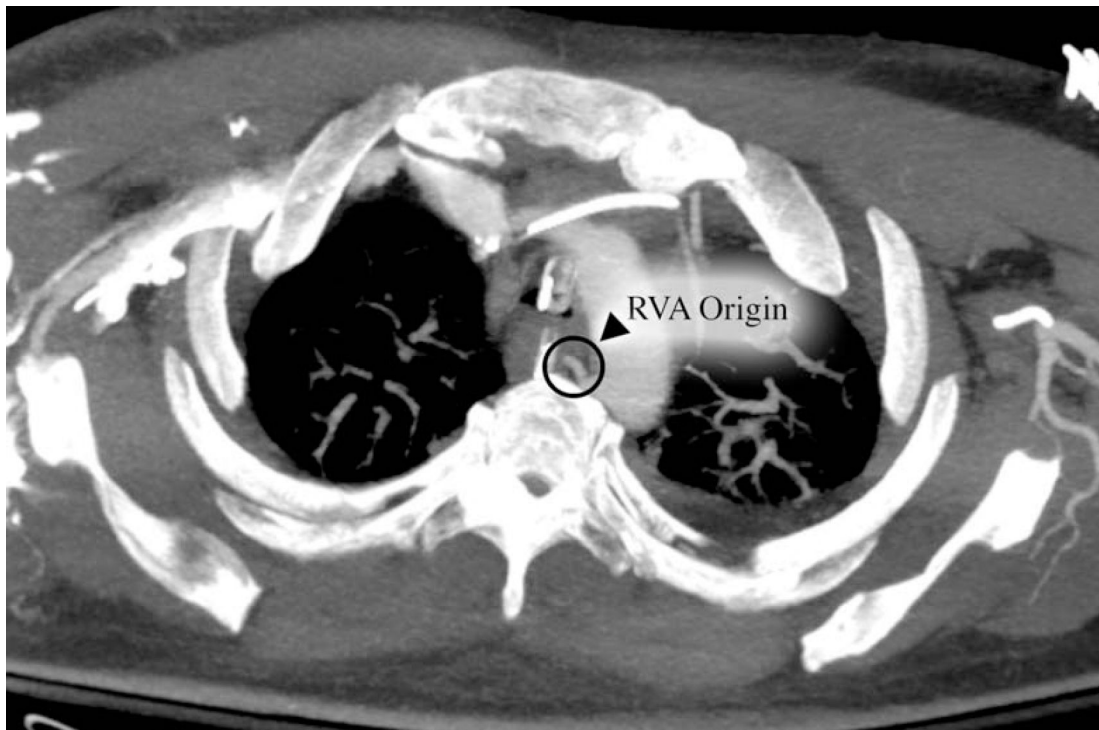


Figure 3. CTA arch axial projection showing the prevertebral segment of the right vertebral artery was located in the retroesophageal and retrotracheal areas.

Table 1. Reported cases in the literature to date

Author	Year published	Associated imaging findings
Lie TA [1]	1968	None
Newton TH [1]	1974	None
Argenson C [1]	1980	None
Sakamoto H [1]	1980	None
Stoesslein F [1]	1982	Coarctation of aorta
Schwarzacher SW [1]	1989	None
Takagi T [1]	1992	None
Leimke AJ [1]	1999	None
Karcaaltincava M [3]	2003	Bilateral aortic arch origin of vertebral arteries
Goray VB [7]	2005	Bilateral aortic arch origins of vertebral arteries
Dabus G [6]	2010	None
Baek SH [7]	2014	None
Present case	2015	Bovine arch

right subclavian artery develops partially from the caudal portion of the right primitive dorsal aorta just before the confluence of the left dorsal aorta. The intersegmental arteries obliterate with the exception of the seventh which continues and becomes the proximal right subclavian artery. This gives origin to the vertebral artery. The vertebral artery is formed further by the development of the intercostal longitudinal anastomosis that links the cervical intersegmental arteries. An aberrant right vertebral artery originating from the arch distal to the left subclavian artery implies a persistence of the proximal dorsal aorta on the right side with segmental regression of the dorsal aorta between the sixth and seventh intersegmental arteries. The right vertebral artery is the only

branch to remain connected to the persistent proximal dorsal aorta and arises distal to the left subclavian artery if the right subclavian artery originates from the seventh intersegmental artery normally [1].

In the majority of the previous cases described in the literature, there were no symptoms or clinical findings relevant to this anomaly. In our case, this was an incidental finding as well and no vascular lesion was identified as the cause of his subarachnoid hemorrhage. The significance of understanding this aberrant anatomy is paramount though to avoiding inadvertent vascular injury during diagnostic cerebral angiography. Therefore, this abnormality must be considered if selective vertebral artery catheterization is difficult or unsuccessful.

References

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