

## Case Report

# Agenesis of Distal Segment of Right Vertebral Artery: A Case Report

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### Abstract

A case is being reported in which the basilar artery was formed only by the left vertebral artery. This was detected incidentally in a female on a non contrast magnetic resonance angiogram. The right vertebral artery arose as a direct branch of the right subclavian artery but terminated blindly at the level of second cervical vertebra. The left vertebral artery which contributed to the formation of basilar artery continued as left posterior cerebral artery while right posterior cerebral artery was seen as a continuation of right posterior communicating artery. The knowledge of variations of the vertebrobasilar arterial complex is important to Clinicians, Radiologists and Surgeons operating on the great vessels and its branches, particularly vascular surgeons dealing with vertebral artery in order to prevent a vascular catastrophe.

**Keywords:** Basilar artery, development, anomaly, intersegmental, proatlantal, vertebral, artery

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### Introduction

The origin of the vertebral artery from the first part of the subclavian artery to the foramen transversarium of sixth cervical vertebra is the first segment of vertebral artery (V1 segment). From the foramen transversarium of sixth cervical vertebra to the foramen transversarium of atlas is the second segment of vertebral artery (V2- segment). The artery comes out of foramen transversarium of atlas, winds round the posterior aspect of lateral mass and runs on the superior surface of atlas (V3 segment). Finally, the V3 segment of vertebral artery passes deep to the arched free lower margin of the posterior atlanto-occipital membrane and pierces the dura and arachnoid mater between the atlas and occipital bone to enter the cranial cavity through the foramen

magnum and continues as the fourth segment of vertebral artery (V4 segment). The right and left vertebral arteries then join to form the basilar artery.

Anatomical variations of the vertebral artery are known to occur due to its abnormal development process (1, 2, 3). Aberrant right vertebral artery is an extremely rare anomaly (4, 5). Review of literature reveals publication of only few case reports to date (6, 7).

Therefore, the need to discuss a variation of the right vertebral artery detected accidentally on a non contrast MR angiogram was felt essential. Understanding the variations of vertebral artery is of immense importance to anatomists, endovascular interventionists and radiologists.

## Case Report

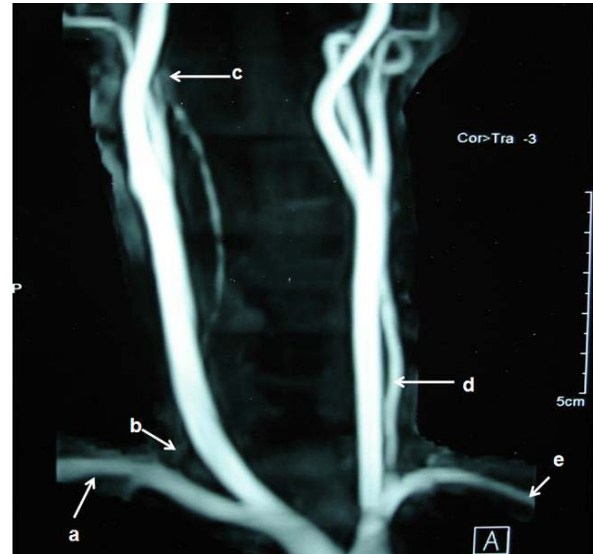
A 36-years-old female was brought to the emergency room with altered sensorium, headache, vomiting, slurred speech, vertigo, tinnitus, pain in the left upper jaw and blindness of the left field of vision. Since last three decades, the patient had complained of frequent attacks of headache which were relieved by vomiting. Few years back, she had vertigo with headache which lasted for a month. X-ray skull and MRI brain were done for this complaint. Occipitalisation of first cervical vertebra was noted on the radiograph of the skull but MRI brain appeared normal. The period between this episode and the recent one was asymptomatic.

MRI brain and MR angiogram were performed for the present complaint. MRI brain revealed atlanto-axial dislocation with cerebellar infarction and MRI angiogram showed that both the vertebral arteries were arising normally from subclavian artery (Fig.1). They entered through their respective foramen transversarium of the 6<sup>th</sup> cervical vertebra. The left vertebral artery had a normal course and continued as basilar artery (Fig.2). The right vertebral artery terminated blindly at the level of second cervical vertebra (Fig.1). The basilar artery was therefore, formed only by the left vertebral artery and it continued as left posterior cerebral artery. On the right side, the right posterior cerebral artery was formed by right posterior communicating artery (Fig.2). The diameter of the right and left vertebral arteries were 2 mm and 4 mm respectively.

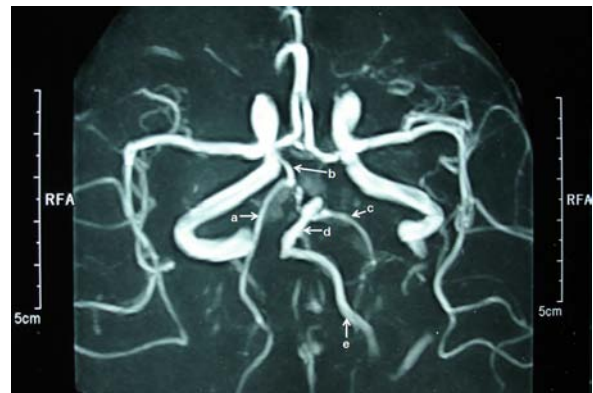
## Discussion

Development of the vertebral artery is unique since it develops by the union of many segmental arteries (1, 3, 4, 8). Hence, a number of malformations and anomalies are known to occur involving the vertebral arteries. Some of them are pathological, while others are just accidental anatomic or angiographic findings.

Development of the vertebral artery begins at 12.5 to 16-mm stage of embryo (about 32 days old embryo) and is completed by 40 days (4). Cervical intersegmental arteries branch off from the primitive dorsal aortae. These cervical intersegmental arteries are linked up by longitudinal anastomoses. Cervical intersegmental arteries then regress except for the seventh cervical intersegmental artery. The proximal portion of the subclavian artery, including the point of origin of vertebral artery (V1) is formed by the seventh cervical intersegmental artery. The longitudinal anastomoses of the cervical intersegmental arteries form the second part of



**Figure: 1:** MR non contrast angiogram showing (a) Right subclavian artery (b) Right vertebral artery arising from right subclavian artery (c) Right vertebral artery terminating blindly at C<sub>2</sub> vertebra (d) Left vertebral artery arising from left subclavian artery (e) Left subclavian artery.



**Figure: 2:** MR non contrast angiogram showing (a) Posterior cerebral artery is the continuation of posterior communicating artery on the right side (b) Right posterior communicating artery (c) Left posterior cerebral artery (d) Basilar artery formed by the left vertebral artery (e) Only left vertebral artery is present intracranially.

vertebral artery (V2). An embryonic vessel, the proatlantal artery (ProA), develops between the most caudal presegmental artery (hypoglossal artery) and the first cervical intersegmental artery. Therefore, the ProA runs along with the first cervical nerve root (C1) between the occipital bone and the atlas. Before the development of third and the fourth part of vertebral artery, basilar circulation is supplied by transient anastomoses of the second part of vertebral artery with ProA. The spinal branch (radicular artery of C1) of ProA divides into ventral and dorsal radicular branches. The ventral branch follows the anterior root

of C1 till antero-lateral aspect of the spinal cord and divides into ascending and descending rami. Later, these fuse with their counterparts to form the basilar and anterior spinal arteries respectively. The spinal branch of the ProA and its ventral radicular component remains prominent in adult and forms the distal segment of definitive vertebral artery (3).

The right vertebral artery ended blindly at the level of second cervical vertebra in the case discussed. This likely reflects that on the right side the longitudinal anastomosis between first and second cervical intersegmental arteries, anastomosis between this longitudinal anastomosis and proA and the proA itself that would have given rise to distal part of V2 and V3, V4 segments of the definitive vertebral artery respectively, did not develop in this case.

Hypoplasia of the vertebral artery is diagnosed when the diameter is 2mm or less (9). The diameter of the right vertebral artery was 2 mm in the case discussed, suggesting that the right vertebral artery was hypoplastic in the present case.

In about 15% of the healthy population, one vertebral artery makes little contribution to the flow of basilar artery. Lesser degrees of asymmetry are also frequently encountered. In approximately 50% of the population, the left vertebral artery is dominant; the right vertebral artery is dominant in 25% and in the remaining 25% the two vertebral arteries are of same calibre (10). Left vertebral artery was larger than the right one in the case studied (L: R = 4 mm: 2 mm), suggesting that in the present case the left vertebral artery was dominant.

With the development imaging techniques and given the range of endovascular and surgical interventions available today, an extensive knowledge of the size, position and extent of vertebral arteries has become extremely important. Anatomists, Radiologists and Endovascular interventionists must be aware of the variations of vertebral arteries in order to identify them correctly and to alleviate their anxiety if any one of the vertebral arteries is not seen during intracranial operations.

### Conclusion

Right vertebral artery was not only hypoplastic but also there was agenesis of its distal segment. Knowledge of such a variation of vertebral artery is of importance to Anatomists, Endovascular Interventionists and Radiologists.

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