

Review began 06/06/2022
Review ended 06/08/2022
Published 06/11/2022

© Copyright 2022

Mao et al. This is an open access article distributed under the terms of the Creative Commons Attribution License CC-BY 4.0., which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Arterial Dissection of an Anomalous Right Vertebral Artery Arising From the Right Common Carotid Artery Associated With an Acute Right Middle Cerebral Artery Stroke

Allen Mao¹, Hoang D. Duong²

1. Diagnostic Radiology, HCA Florida North Florida Hospital, Gainesville, USA 2. Interventional Neuroradiology, HCA Florida North Florida Hospital, Gainesville, USA

Corresponding author: Allen Mao, allenmaomd@gmail.com

Abstract

In rare cases, the right vertebral artery can have its origin from the right proximal common carotid artery. This anatomical variant can be incidental, but if trauma to the vertebral artery occurs, there can be devastating neurological deficits. Our patient was an adult female who initially presented with new-onset left arm weakness and dysarthria. After a CT angiogram and ultrasound imaging were performed, she was found to have an acute right middle cerebral artery (MCA) stroke in association with dissection of the anomalous right vertebral artery. The patient underwent urgent mechanical thrombectomy in the right MCA and thrombolysis in cerebral infarction (TICI) grade 3 recanalization was successfully achieved. The patient made a complete recovery with no neurological sequelae. A follow-up CT angiogram after six months showed resolution of the dissection and restored patency of the right vertebral artery.

Categories: Neurology, Radiology, Anatomy

Keywords: middle cerebral artery (mca), dissection, vertebral artery, stroke, mca

Introduction

The anomalous origin of the right vertebral artery from the right proximal common carotid artery (CCA) is an extremely rare anatomical variant, which, in most cases, is incidental. The incidence of this anomaly is higher when there is an aberrant right subclavian artery [1]. We highlight the hospital course of a patient who presented with an acute right middle cerebral artery (MCA) stroke in association with dissection of the anomalous right vertebral artery.

Typically, the right vertebral artery originates from the right subclavian artery and ascends posterior to the right internal carotid artery through the transverse foramina of the cervical spine [2]. It has numerous branches, the largest of which is the posterior inferior cerebellar artery, which supplies a portion of the cerebellum and merges with the contralateral vertebral artery to continue as the basilar artery [2]. Injury to the vertebral arteries would normally lead to posterior circulation symptoms such as visual disturbances and gait problems. However, when the right vertebral artery arises from the right CCA instead and is injured, a massive stroke can occur, leading to contralateral hemiparesis and speech deficits [3].

Case Presentation

Our patient is a 36-year-old female with a past medical history of right-sided migraines and frequent chiropractor neck manipulations who presented with acute left arm weakness and dysarthria. She reported that her symptoms first began during a routine gym workout after performing glute-ham developer sit-ups, where her head was whipping back and forth. After this exercise, she could not stand, and her trainer noticed her left arm was lagging and her speech was slurred.

She was immediately sent to the emergency room for further workup. The patient was given an intravenous tissue plasminogen activator (tPA) within the 4.5-hour window of symptom onset. CT perfusion imaging revealed an ischemic penumbra volume of 35 ml in the distribution of the posterior M2 division of the right MCA. CT angiography of the head and neck confirmed occlusion of the corresponding M2 branch and an incidental finding of an aberrant right vertebral artery arising from the right proximal CCA, which appeared to be severely stenosed in its proximal cervical segment (Figure 1). There was also an aberrant right subclavian artery arising directly from the aortic arch distal to the left subclavian artery and traversing posterior to the trachea and esophagus (Figure 2). Intraluminal thrombus in the right vertebral artery likely related to an underlying dissection was visualized on color Doppler sonography (Figure 3).

How to cite this article

Mao A, Duong H D (June 11, 2022) Arterial Dissection of an Anomalous Right Vertebral Artery Arising From the Right Common Carotid Artery Associated With an Acute Right Middle Cerebral Artery Stroke. Cureus 14(6): e25850. DOI 10.7759/cureus.25850

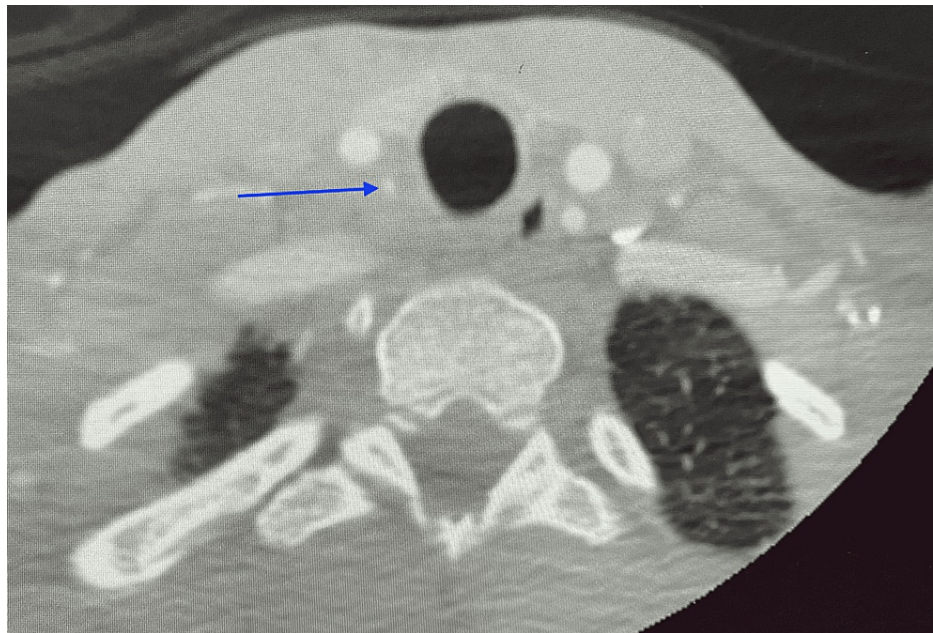


FIGURE 1: CT angiogram of the head and neck showing aberrant right vertebral artery

CT angiogram of the head and neck showed an occlusion of the corresponding M2 branch and an incidental finding of an aberrant right vertebral artery arising from the right proximal common carotid artery, which appeared to be severely stenosed in its proximal cervical segment (blue arrow).

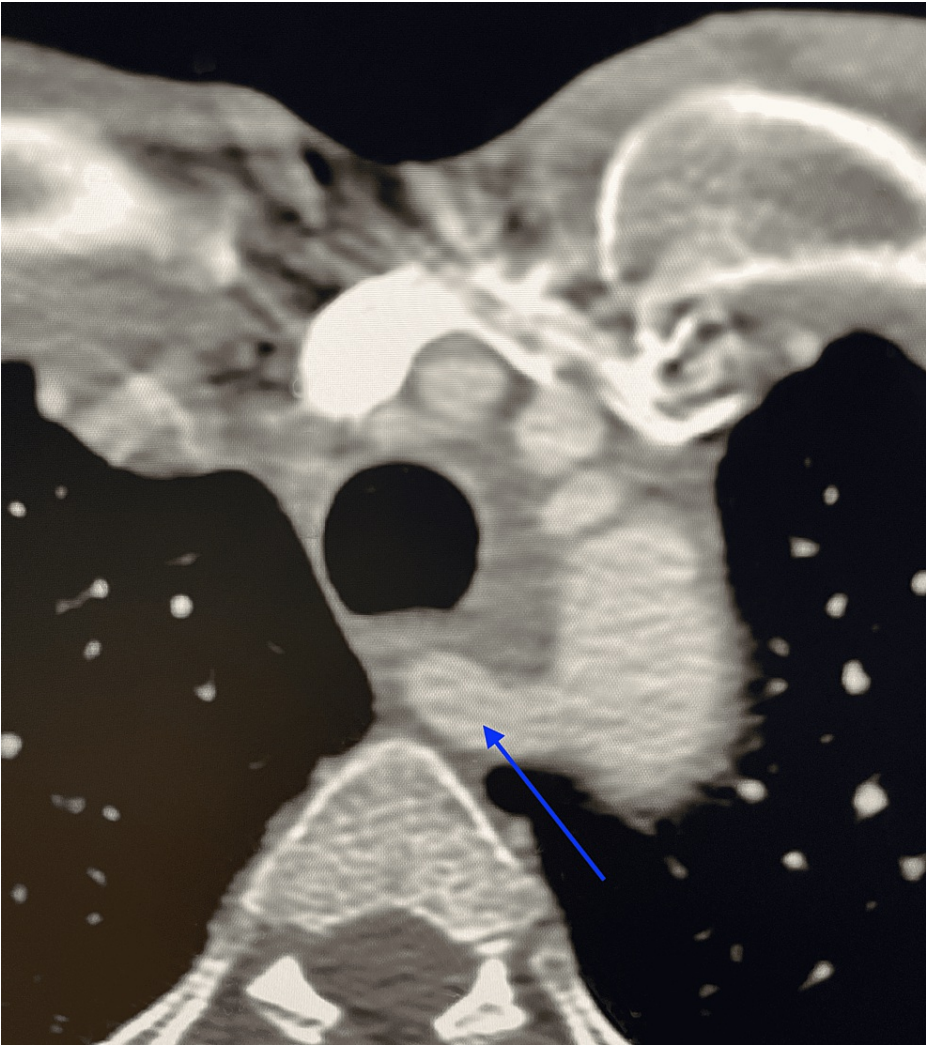


FIGURE 2: CT angiogram of the head and neck showing aberrant right subclavian artery

CT angiogram of the head and neck showed an aberrant right subclavian artery (blue arrow) arising directly from the aortic arch distal to the left subclavian artery and traversing posterior to the trachea and esophagus.

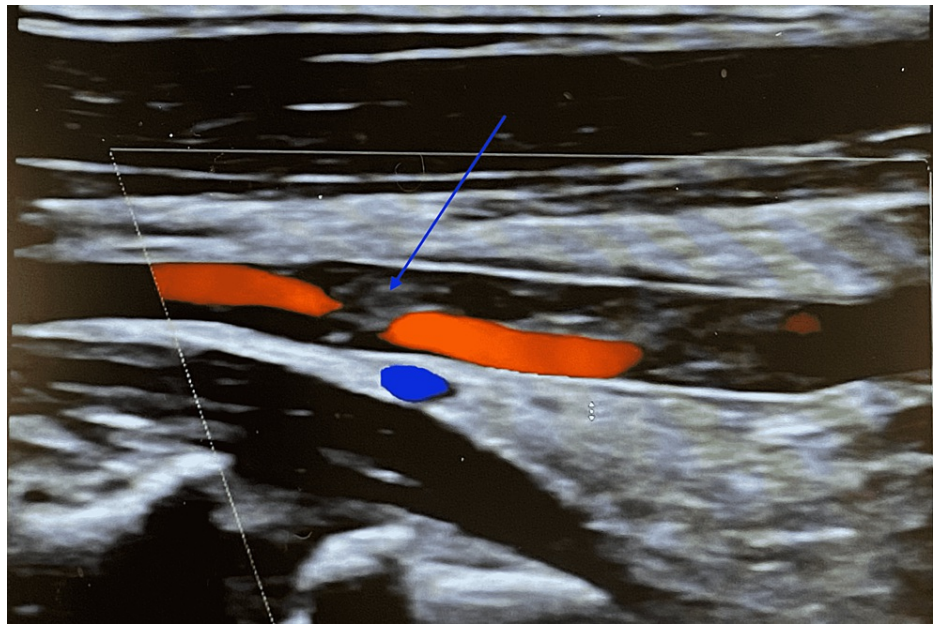


FIGURE 3: Color Doppler ultrasound of the right vertebral artery

Color Doppler ultrasound showed an intraluminal thrombus (blue arrow) in the right vertebral artery, likely related to an underlying dissection.

The patient underwent successful emergent mechanical thrombectomy in the right MCA with extended thrombolysis in cerebral infarction (eTICI) grade 3 recanalization (Figure 4). She made a full recovery with no residual neurologic deficits. A follow-up MRI of the brain showed a small right basal ganglia infarct with no hemorrhagic conversion. The patient was subsequently placed on systemic anticoagulation and a catheter angiogram six weeks later showed spontaneous resolution of thrombus in the right vertebral artery with moderate residual stenosis (Figure 4). A follow-up CT angiogram of the head and neck was performed four months after the catheter angiogram, which showed resolution of the dissection and restored patency of the right vertebral artery (Figure 5). After extensive workup including a negative hypercoagulability panel, there was no other cause for the MCA stroke other than the dissection of the anomalous right vertebral artery. Although a clear cause-and-effect relationship cannot be confirmed, the dissection of the right vertebral artery is likely related to the patient's right MCA stroke. The constellation of neck trauma, clinical symptoms, and CT angiography/angiogram/ultrasound findings led to the diagnosis of a right MCA stroke likely secondary to a dissection of an anomalous right vertebral artery.

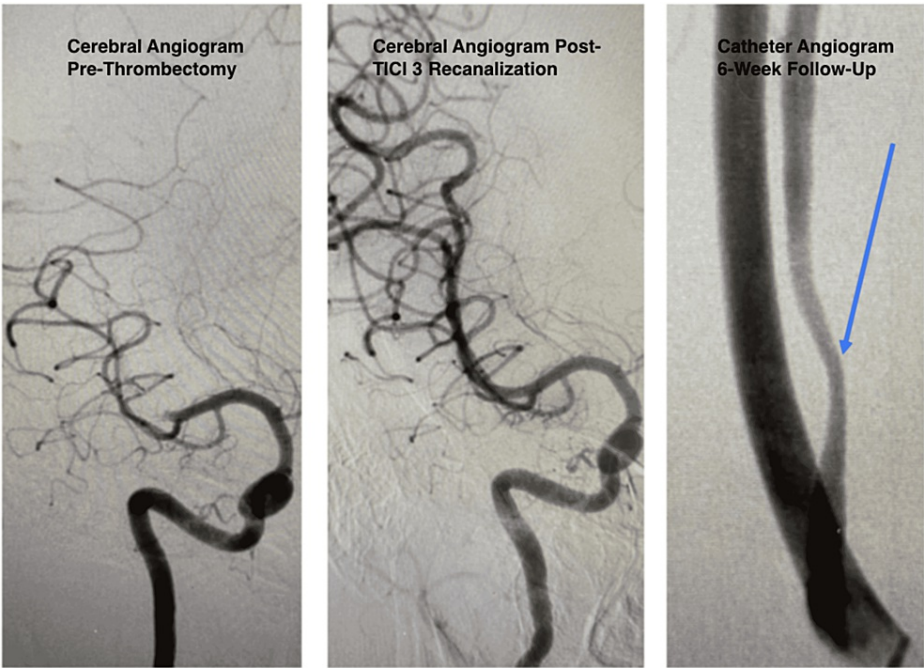


FIGURE 4: Cerebral angiogram pre-thrombectomy, post-thrombolysis in cerebral infarction (TICI) grade 3 recanalization, and at six-week follow-up

The patient underwent successful emergent mechanical thrombectomy in the right middle cerebral artery with extended thrombolysis in cerebral infarction (eTICI) grade 3 recanalization. She was subsequently placed on systemic anticoagulation and a follow-up catheter angiogram done six weeks later showed spontaneous resolution of thrombus in the right vertebral artery with moderate residual stenosis (blue arrow).

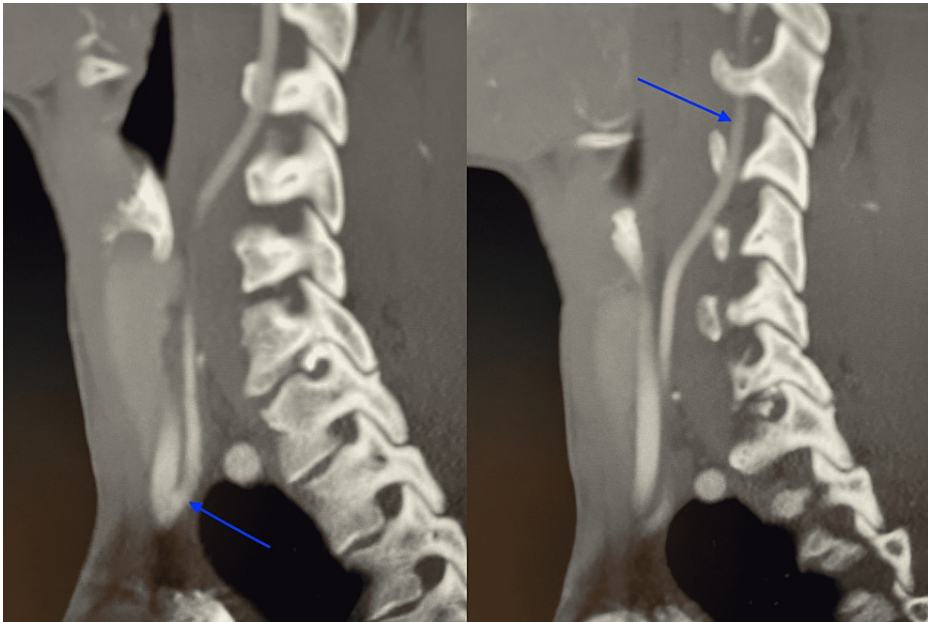


FIGURE 5: Follow-up CT angiogram of the head and neck showing restored patency of the right vertebral artery

A follow-up CT angiogram of the head and neck performed after four months showed resolution of the dissection and restored patency of the right vertebral artery (left arrow). The right vertebral artery can be seen traversing through the transverse foramina of the cervical spine (right arrow).

Discussion

In most cases, the paired vertebral arteries directly arise from the respective subclavian arteries and supply the brainstem and cerebellum [3]. Vertebral artery dissection is a result of blood entering the media through a tear in the intima of the vertebral artery and would lead to posterior circulation symptoms such as dizziness, visual disturbances, and gait problems [3].

However, our patient had an extremely rare anatomic variant with an anomalous right vertebral artery originating from the right proximal CCA. With neck manipulation from chiropractor therapy and vigorous exercise, she suffered a vertebral artery dissection and subsequent right MCA stroke leading to a left hemiparesis and speech deficits.

Variations in vertebral artery origin are all considerably rare but have been reported more commonly on the left side [4]. The most common anomaly overall is a four-vessel arch with a direct origin of the left vertebral artery off the aorta, which occurs in approximately 6% of the population [5]. Anomalous origins of the right vertebral artery can be divided into three types: aortic origin (0.05% incidence), common carotid/brachiocephalic origin (0.18-0.37%), and dual origin (0.04-0.4%) [6]. The common carotid/brachiocephalic origin is usually associated with an aberrant right subclavian artery arising directly from the aortic arch distal to the left subclavian artery and traversing posterior to the trachea and esophagus, which was seen in our patient [6]. When there is an associated aberrant right subclavian artery, the incidence of an anomalous right vertebral artery arising from the right CCA is much higher at 9.8% [1].

Conclusions

The clinical entity of an anomalous right vertebral artery arising from the CCA with an aberrant right subclavian artery has been previously reported. It is usually an incidental finding on imaging; however, we present an interesting patient with right vertebral artery dissection in association with right MCA stroke. Although a clear cause-and-effect relationship cannot be confirmed, the dissection of the right vertebral artery is likely related to the patient's right MCA stroke. Follow-up CT angiogram can be considered to monitor for disease progression or if symptoms reoccur.

Additional Information

Disclosures

Human subjects: Consent was obtained or waived by all participants in this study. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

Acknowledgements

This research was supported (in whole or in part) by HCA Healthcare and/or an HCA Healthcare affiliated entity. The views expressed in this publication represent those of the author(s) and do not necessarily represent the official views of HCA Healthcare or any of its affiliated entities. The authors have declared that they have no conflict of interest. This article has not been previously submitted to other publications or presented at a conference or meeting.

References

1. Nalamada K, Chitravanshi N, Duffis EJ, Prestigiacomo CJ, Gandhi CD: Anomalous origin of the right vertebral artery from the right common carotid artery associated with an aberrant right subclavian artery. *J Neurointerv Surg.* 2013, 5:e34. [10.1136/neurintsurg-2011-010229](https://doi.org/10.1136/neurintsurg-2011-010229)
2. Mitchell J: The vertebral artery: a review of anatomical, histopathological and functional factors influencing blood flow to the hindbrain. *Physiother Theory Pract.* 2005, 21:23-36. [10.1080/09593980590911570](https://doi.org/10.1080/09593980590911570)
3. Taydas O, Sakci Z, Ogul H: Anomalous origin and course of right vertebral artery with aberrant right subclavian artery. *J Craniofac Surg.* 2021, 32:e278-9. [10.1097/SCS.00000000000007174](https://doi.org/10.1097/SCS.00000000000007174)
4. Britt TB, Agarwal S: Vertebral Artery Dissection. StatPearls Publishing, Treasure Island, FL; 2022.
5. Tokuyama K, Kiyosue H, Baba H, Asayama Y: Anomalous origin of the right vertebral artery. *Appl Sci.* 2021, 11:8171. [10.3390/app11178171](https://doi.org/10.3390/app11178171)
6. Yuan SM: Aberrant origin of vertebral artery and its clinical implications. *Braz J Cardiovasc Surg.* 2016, 31:52-9. [10.5935/1678-9741.20150071](https://doi.org/10.5935/1678-9741.20150071)