Article published online: 2023-03-31

Cerebellar Ischemic Stroke Secondary to Rotational Non-Dominant Vertebral Artery Occlusion (RVAO): A Rare Complication Following Supratentorial Surgery

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AJNS 2023;18:206–209.

Abstract

Non-traumatic vertebrobasilar stroke syndrome is rare. Many etiological mechanisms have been described over the years, with the dynamic occlusion of one vertebral artery following head rotation (RVAO) being one of them. We report the case of a patient undergoing surgery for supratentorial metastasis, who postoperatively developed a cerebellar ischemic stroke secondary to RVAO. Postoperative imaging showed a right hypoplastic VA; so, a transient occlusive mechanism was thought to be responsible for the postoperative cerebellar stroke. Although rare, RVAO can occur following head rotation during patient positioning for neurosurgical procedures.

Keywords

- complications
- ischemia
- neurosurgery
- rotational vertebral artery occlusion
- stroke

Introduction

Non-traumatic vertebrobasilar stroke syndrome[1] is a rare clinical entity that could be caused by the dynamic occlusion of one vertebral artery following head rotation (rotational vertebral artery occlusion, RVAO). The clinical impact that a transient occlusion of a vertebral artery can cause, ranges from a totally asymptomatic condition to clinically relevant ischemic stroke within the affected vascular territory (2.4% of cases).[2] Besides clinical suspicion, imaging diagnostic tools include magnetic resonance angiography (MRI angiography), computed tomography angiography (CT angiography), ultrasonography, and catheter angiography. Treatment is usually conservative—neck immobilization, aspirin—with an overall good prognosis.[2] When visible on MRI, the ischemic zone usually appears to be located at the level of the lower portions of one cerebellar hemisphere, in a predominantly mesial region, as per the involvement of the terminal vascular territory of the posterior inferior cerebellar artery (PICA).

Because the syndrome's first reports, many etiological mechanisms have been described over the years.[2–4] However, to date, there are no previous reports of RVAO related to head rotation during patient positioning for neurosurgical procedures.

In this article, we report the peculiar case of a patient undergoing surgery for a supratentorial tumor, who postoperatively developed a cerebellar ischemic stroke secondary to a transient RVAO.

article published online
March 31, 2023

DOI https://doi.org/10.1055/s-0043-1763527.
ISSN 2248-9614.

Thieme Medical and Scientific Publishers Pvt. Ltd., A-12, 2nd Floor, Sector 2, Noida-201301 UP, India

Case Report

A 51-year-old female patient with double brain metastasis from uterine cancer was admitted to our hospital. Physical examination revealed a right hemiparesis. No significant past medical history, including clinical signs suggesting vertebral artery occlusive syndromes (i.e., diplopia, vertigo, dizziness) or deep vein thrombosis, was reported. Body mass index (BMI) was 27.9. Preoperative imaging included magnetic resonance imaging (MRI) with gadolinium, which showed a double metastatic lesion within the left rolandic region with no signs of cerebellar ischemic lesions (►**Fig. 1A**–**D**), and a whole-body (neck, thoracic, and abdominal) contrast-enhanced CT scan to rule out the presence of any other cancerous location. Surgical treatment was planned. The patient gave written consent for the procedure and the use of her data for scientific research. Under general anesthesia, the patient was set in a supine position with the head fixed in a three-pin skull clamp. The head was rotated 30° to 35° contralaterally to the lesion, lifting the left shoulder to favor neck rotation. Surgery was performed with the aid of a neuronavigation system, and intraoperative neurophysiological monitoring, consisting of free-run electromyography (EMG), somatosensory evoked potentials (SSEPs), and motor-evoked potentials (MEPs). No major perioperative complication occurred. Postoperatively, the patient developed a severe paresis of the right lower limb, which progressively improved during hospitalization. Postoperative MRI was performed within the first 24 hours after surgery. The exam showed the radical resection of the two tumoral masses, with no complications related to the surgical field. However, in diffusion-weighted sequences (DWI), a signal restriction was found within the right cerebellar paravermian region, within the vascular territory of one of the terminal branches of the right PICA (►**Fig. 1E, F**). This finding, although clinically asymptomatic, was consistent with an ischemic stroke occurring during the neurosurgical procedure. A complete stroke workup was then performed, including a CT angiography with 3-dimensional reconstruction that ruled out any significant vascular occlusion, but only a right hypoplastic VA (►**Figs. 2**, **3**). Moreover, bone window reconstruction of the cervical spine did not reveal any presence of focal stenoses or foraminal osteophytes.

Discussion

Several mechanisms of VA occlusion have been reported in the literature, with RVAO being one of them and, also, one of the most uncommon. In 1967, Husni et al described a series of 23 patients who developed a symptomatic stroke due to RVAO.[5] Interestingly, in 22 out of 23 cases, the VA on one side was found to be hypoplastic compared with the contralateral. Since then, many case reports and small case series have been published regarding the rotational etiology of a VA occlusion and stroke.

According to a recent literature review,[2] the most common site of VA dynamic occlusion was the C1-C2 level, followed by the craniocervical junction and the lower subaxial cervical vertebrae. Regarding treatment strategies, conservative management with antiplatelets was the most reported option, even though neck immobilization, endovascular treatment, cervical decompression, and cervical fusion have been described as well, the latter with a relatively favorable outcome.

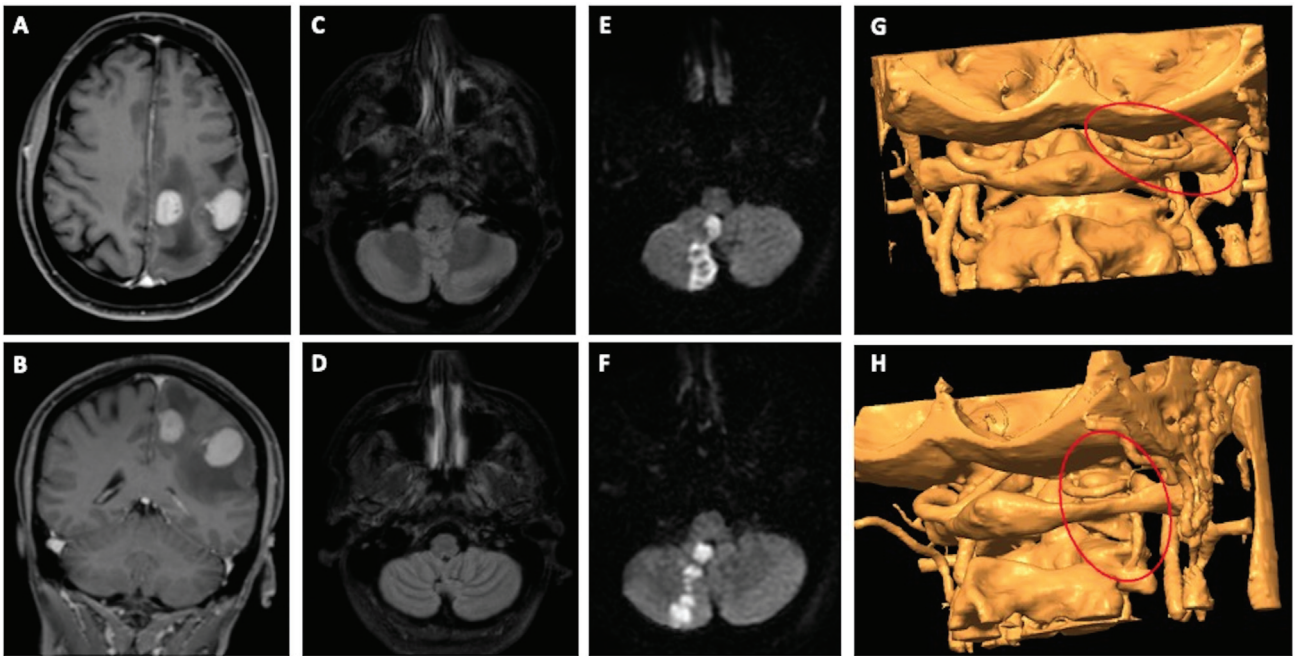

Fig. 1 (**A**, **B**) Preoperative T1 post-contrast MRI sequences showing the double metastasis within the left rolandic region. (**C**, **D**) As can be seen in DWI sequences, no preoperative cerebellar ischemic signs were observable. (**E**, **F**) The postoperative MRI revealed a right paravermian ischemic stroke, as can be seen in DWI sequences. (**G**, **H**) Three-dimensional reconstructions of the preoperative neck contrast-enhanced CT scan, showing the right hypoplastic VA (*red circle*).

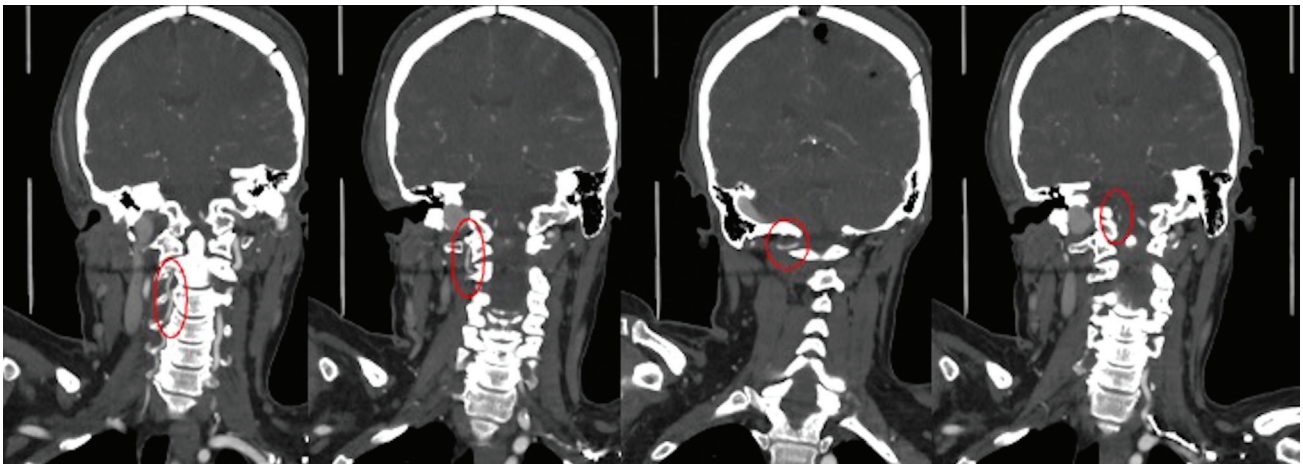

Fig. 2 Postoperative CT angiography showing the right hypoplastic VA (*red circle*, coronal views).

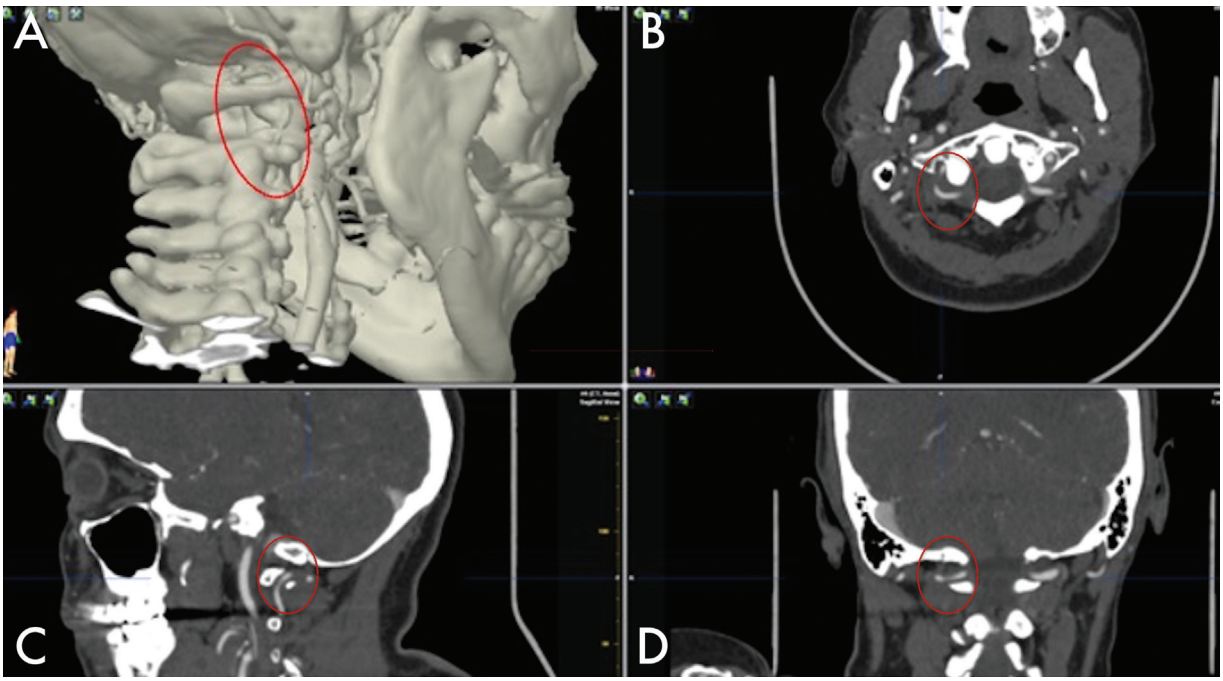

Fig. 3 (**A**) 3D reconstruction of the postoperative CT angiography (iPlan, BrainLAB). The right hypoplastic VA is enlightened at the V3–V4 passage, just above the sulcus of and before its entrance into the intracranial space (*red circle*). (**B–D**) Axial, sagittal, and coronal reconstructions at the level of the right hypoplastic V3-V4 passage (*red circles*), which is particularly evident in (**C**) and (**D**).

To our knowledge, however, there are no reports regarding RVAO following patient positioning for surgical procedures.

The ideal patient positioning should follow the principles of a correct balance between surgical comfort and the minimization of the risks to which the patient could be exposed due to the positioning itself. As for the supine position, a rotation of the head up to 45 degrees can be well tolerated by the patient.

We described the case of a 51-year-old female patient who underwent surgery for a double left frontal metastasis from uterine cancer. The patient was set in a supine position, and the head was rotated 30° to 35° contralaterally to the lesion, a degree of rotation that is usually well tolerated. Vital parameters were normal during the whole procedure, and intraoperative neurophysiological monitoring did not show any sign of alert referable to ischemic damages. Postoperative imaging showed a right hypoplastic VA compared with the contralateral (►**Fig. 2**), a finding that was also depicted after a careful review of the preoperative whole-body contrast-enhanced CT imaging (►**Fig. 1G,H**). Any other type of pathological finding (i.e., vertebral dissection or significant occlusions, transverse foraminal stenosis, or cervical osseous abnormalities) were ruled out. Given the patient's right-sided head rotation, a transient occlusive mechanism of the right VA was then thought to be responsible for the postoperative cerebellar stroke.

In 2010, Saito et al described a case of cerebral infarction due to an artery-to-artery embolism related to RVAO.[4] We suggest that a similar mechanism could have occurred in our case. In fact, following head rotation, the right non-dominant hypoplastic VA might have undergone transient kinking, thus favoring the formation of a small thrombotic neoformation, that could have embolized to a terminal branch of the PICA during surgery.

Conclusion

Although exceptionally uncommon, RVAO can occur following head rotation during patient positioning for neurosurgical procedures. In this setting, preoperative imaging (i.e., MRI with gadolinium) can help the surgeon identify the presence of any extracranial vascular–anatomical variation, thus allowing for a safe positioning that must be tailored on a case-by-case basis.

Ethical Approval

The patient was treated in accordance with the principles of the Helsinki Declaration, and the Local Ethics Committee.

Informed Consent

The patient gave her written informed consent for both surgery and the use of her data for scientific purposes.

Conflict of Interest

None declared.

References

1 Go G, Hwang SH, Park IS, Park H. Rotational vertebral artery compression: Bow Hunter's syndrome. J Korean Neurosurg Soc 2013;54(03):243–245. Doi: 10.3340/jkns.2013.54.3.243
2 Bukhari MK, Alghamdi SA. Ischemic stroke secondary to dynamic vertebral artery stenosis: case report and review of the literature. Cureus 2021;13(12):e20167. Doi: 10.7759/cureus.20167
3 Sakamoto Y, Kimura K, Iguchi Y, et al. An embolic bow Hunter's stroke associated with anomaly of cervical spine. Neurology 2011;77(14):1403–1404. Doi: 10.1212/WNL.0b013e31823152f9
4 Saito K, Hirano M, Taoka T, et al. Artery-to-artery embolism with a mobile mural thrombus due to rotational vertebral artery occlusion. J Neuroimaging 2010;20(03):284–286. Doi: 10.1111/j.1552-6569.2008.00309.x
5 Husni EA, Storer J. The syndrome of mechanical occlusion of the vertebral artery: further observations. Angiology 1967;18(02):106–116. Doi: 10.1177/000331976701800205

