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Case Report

Endovascular treatment for posterior inferior cerebellar artery aneurysm with vertebral artery stenosis: The critical role of diagnosing osteophyte compression

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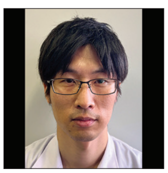

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ABSTRACT

Background: Vertebral artery (VA) stenosis can be caused by several factors, including arteriosclerosis, arterial dissection, and mechanical compression. Symptomatic vertebrobasilar insufficiency caused by VA stenosis due to mechanical compression associated with head rotation is well-known as Bow Hunter's syndrome. However, an accurate diagnosis of asymptomatic osteophyte compression-induced nonrotational VA stenosis is difficult. We report a case of left posterior inferior cerebellar artery aneurysm with severe left VA stenosis, treated with stent-assisted coil embolization following appropriate diagnosis.

Case Description: A 72-year-old female patient was found to have severe asymptomatic VA stenosis at the V2 segment (C4–5 level of the cervical spine) on cerebral angiography. Osteophyte compression-induced VA stenosis was suspected, which was confirmed by cone-beam computed tomography. The VA stenosis improved by flexing the neck and fixing the head position, following which the endovascular treatment was successfully completed.

Conclusion: The site of the VA stenosis is critical in determining the etiology. Atherosclerotic VA stenosis often occurs at the origin of the artery or V4 segment, whereas bony compression-induced stenosis is more likely to occur at the V2 segment. Diagnosis and appropriate management of VA stenosis is based on determining the site.

Keywords: Aneurysm, Bow-Hunter's syndrome, Neuroendovascular, Osteophyte, Rheumatoid arthritis, Vertebral artery stenosis

INTRODUCTION

Vertebral artery (VA) stenosis can be caused by intrinsic wall disorders, such as atherosclerosis or dissection, as well as extrinsic factors, such as mechanical compression by osteophytes.[9] Symptomatic vertebrobasilar insufficiency due to VA stenosis associated with head rotation is known as Bow-Hunter's syndrome (BHS) or rotational VA syndrome,[7] and it is relatively easy to infer the pathology from head rotation and clinical symptoms. However, osteophyte compression-induced asymptomatic VA stenosis without head rotation can be challenging to diagnose. Here, we present a case of a left posterior inferior cerebellar artery (PICA) aneurysm with the left VA stenosis, in which accurate determination of the pathology allowed for safe treatment. We discuss the key points for accurately determining the etiology and consequent pathology of VA stenosis.

CASE PRESENTATION

A 72-year-old female patient with a medical history of hypertension, cervical spondylosis, and rheumatoid arthritis (RA) was found to have a *de novo* PICA aneurysm during follow-up imaging of asymptomatic multiple cerebral aneurysms at another hospital. The aneurysm showed a tendency to enlarge over several months, and she was referred to our hospital for treatment. No significant neurological deficits were observed in the patient. Cerebral angiography from the referring hospital showed severe stenosis at the left V2 segment (C4–5 level of the cervical spine, Figure 1a. In addition, an aneurysm measuring 4.2 × 3.2 mm was found in the dome and 3.0 mm in the neck in the cranial loop of the left PICA [Figure 1b]. Given the tendency of the PICA aneurysm to enlarge, we decided to proceed with endovascular treatment. An approach from the right VA to the left PICA aneurysm was considered; however, there was severe kinking at the origin of the right VA. In addition, the angle of the VA union was relatively steep [Figure 1c]. Furthermore, due to the branching angle of the left PICA from the left VA [Figure 1d], guiding the microcatheter from the right VA to the left PICA across the VA union was considered difficult. Even if an approach from the right VA to the left PICA were possible, the factors mentioned above would impair the maneuverability of the microguidewire and microcatheter, making stent-assisted coiling from the right VA risky. Therefore, we opted to use an approach involving the left VA.

The endovascular procedure was performed under general anesthesia. The left distal radial artery was punctured from the anatomical snuff box, and a 5 Fr guiding sheath (5Fr. FUBUKI Dilator Kit 100 cm; Asahi, Aichi, Japan) was inserted and guided to the left V1 segment. VA angiography showed stenosis at the C4–5 level. Considering the atypical nature of atherosclerotic stenosis, we suspected compression by osteophytes and performed cone-beam computed tomography (CT). Cone-beam CT showed that the osteophyte at C4–5 was protruding ventrally and mechanically compressed the VA [Figure 2a and b]. To relieve the VA stenosis caused by the osteophyte, the patient's neck was flexed, and the head was fixed. Angiography of the left VA in the flexed head position showed improvement in stenosis [Figure 2c]. With improvement in the VA stenosis, we were able to guide the guiding sheath distal to

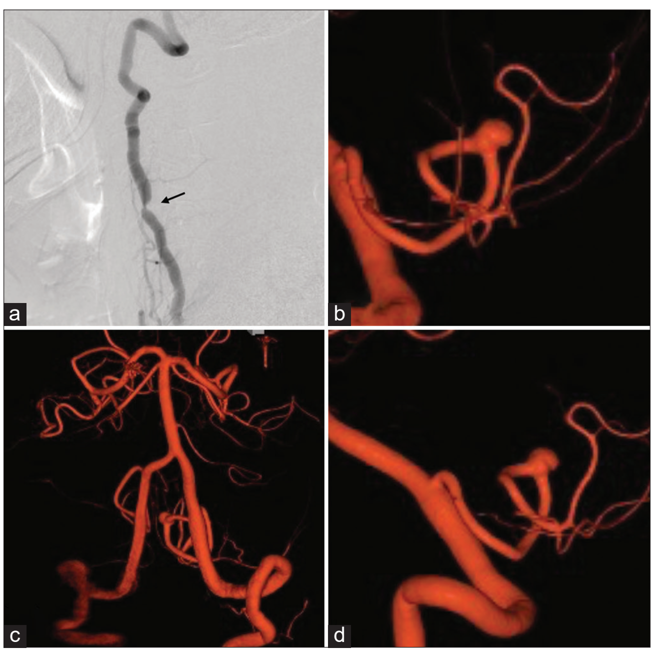

Figure 1: Preoperative angiography findings. (a) Angiography of the left vertebral artery (VA) in the lateral projection (extracranial) shows severe stenosis at the C4–5 level (arrow). (b) The working angle three-dimensional view of the left VA shows an aneurysm at the cranial loop of the left posterior inferior cerebellar artery. (c) Angiography of the left VA in the anteroposterior projection (intracranial) shows a relatively steep angle of the VA union. (d) Angiography of the left VA in the lateral projection shows the left PICA branching cranially from the left VA.

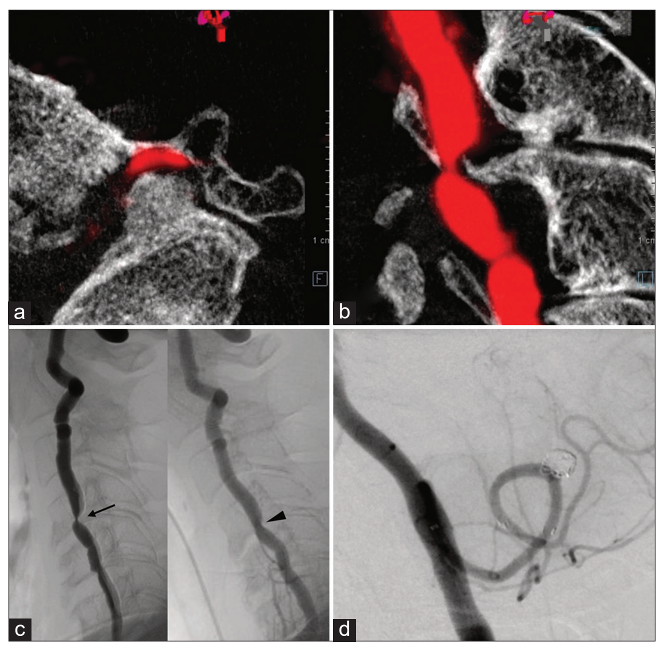

Figure 2: Intraoperative computed tomography and angiography findings. (a) Sagittal and (b) axial cone-beam computed tomography images show osteophyte compression-induced left vertebral artery (VA) stenosis at the C4–5 level. (c) Angiography of the left VA with slight neck extension shows stenosis of the VA (left panel, arrow); however, the stenosis improves when the neck is flexed (right panel, arrowhead). (d) Postoperative angiography of the VA shows complete obliteration of the aneurysm.

V2. Next, a microguidewire (CHIKAI 14; Asahi Intecc, Tokyo, Japan) was advanced distally to the aneurysm in the PICA cranial loop, followed by a microcatheter (Excelsior XT-17 Microcatheter; Stryker, Kalamazoo, MI, USA). An intermediate catheter (GuidePost; Tokai Medical Products Inc., Aichi, Japan) was guided to the PICA. Subsequently, a microstent (Neuroform Atlas 3 × 21 mm, Stryker) was deployed to cover the aneurysm neck via a microcatheter. Using the transcell technique, the microcatheter was positioned within the aneurysm. A platinum coil (Target 360 ultrasoft, 5 × 8 cm, Stryker) was deployed first, and five coils were serially inserted to obliterate the aneurysm [Figure 2d].

The patient's postoperative course was uneventful, and no new neurological symptoms developed. One week after treatment, the patient was discharged without complications. The aneurysm has not recurred for 3 months following the treatment.

DISCUSSION

BHS is caused by the mechanical compression of the VA during neck rotation, although there are few reports of VA stenosis occurring during neck extension.[4,6] In this case, mild neck extension presented as VA stenosis caused by compression by the cervical osteophytes, and endovascular treatment was performed to resolve the stenosis through neck flexion. This is the first report of endovascular treatment of a PICA aneurysm with VA stenosis caused by mechanical compression by cervical osteophytes. In this case, the stenosis could easily be misdiagnosed as an atherosclerotic lesion; however, the level of VA stenosis was a distinguishing feature. VA stenosis most commonly occurs at the origin (V1) and within the intracranial portion (V4),[1] and atherosclerosis-induced stenosis is typically found at the origin.[2] In contrast, osteophyte compression-induced stenosis more frequently affects C1–2, C4–5, and C5–6,[5,10] making the level of stenosis crucial for an accurate determination of the etiology and pathogenesis. In addition, a history of RA is a key factor in the diagnosis of VA stenosis. Although rare, there are case reports of BHS associated with RA, and reviews have indicated that 80% of cases occur in the V3 segment and 20% in the V2 segment.[3] Furthermore, a study evaluating VA abnormalities in patients with RA using magnetic resonance angiography reported a 19.1% incidence of VA stenosis and a 6–8.5% incidence of occlusion, as opposed to a 2% incidence of stenosis in healthy individuals.[11] In addition, another study using dynamic duplex ultrasonography reported a 6% incidence of positional VA occlusion in patients with RA.[8] Therefore, in addition to the level of stenosis, a history of RA is an important extrinsic factor for suspected VA stenosis. Therefore, caution should be exercised when fixing the head position during neuroendovascular treatment in patients with a history of RA.

Misdiagnosing this case as VA stenosis due to arteriosclerosis and performing inappropriate interventions, such as percutaneous transluminal angioplasty or stent placement, could have increased the risk of balloon fragmentation or arterial dissection. Moreover, as the stenosis was caused by osteophyte compression, these procedures would not have resulted in improvement. In this case, the VA stenosis was located at C4–5, making atherosclerotic stenosis unlikely. Using cone-beam CT, we identified a relationship between the cervical bone and VA, leading to a diagnosis of osteophyte compression-induced VA stenosis. Correct diagnosis allowed us to alleviate the stenosis by flexing the head facilitating access through the left VA.

CONCLUSION

We performed stent-assisted coil embolization of a left PICA aneurysm associated with left VA stenosis. When VA stenosis is present, the cause could be inferred from the lesion level. If mechanical compression by osteophytes is identified as the cause, adjusting the position of the head can facilitate the smooth execution of endovascular treatment.

Ethical approval

The Institutional Review Board approval is not required.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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