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Acute Bilateral Ophthalmoplegia Due to Vertebrobasilar Dolichoectasia: A Report of Two Cases

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Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
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Conflict of interest: None declared

Case series
Patient: Male, 52 • Female, 68
Final Diagnosis: VBD
Symptoms: Ophthalmoplegia
Medication: —
Clinical Procedure: —
Specialty: Neurology

Objective: Unusual clinical course

Background: Vertebrobasilar dolichoectasia (VBD) is a complex progressive arterial disease characterized by dilation, elongation, and tortuosity of the vertebral and basilar arteries, and may be congenital or acquired. VBD may lead to progressive compression of the brainstem, cranial nerve abnormalities, and intracranial hemorrhage, but may also be associated with arterial thrombosis, with ischemic stroke as the most common clinical outcome.

Case Report: Two cases of VBD are presented, both with acute bilateral ophthalmoplegia and cranial nerve palsies, and vertebrobasilar arterial thrombosis that resulted in ischemic stroke.

Conclusions: VBD is a complex arterial disease with a variety of clinical manifestation, with bilateral ophthalmoplegia being a rare presentation. Clinical management of VBD is a challenge as there are no current management guidelines. Therefore, clinical management of cases of VBD should be individualized to balance the risks and benefits of treatment options for each patient.

MeSH Keywords: Aneurysm • Ophthalmoplegia • Stroke

Full-text PDF: https://www.amjcaserep.com/abstract/index/idArt/904395

Background

Vertebrobasilar dolichoectasia (VBD) is a complex progressive arterial disease characterized by elongation, dilation, and tortuosity of the vertebral and basilar arteries [1–3]. The exact prevalence of VBD is unknown, but estimates range from 0.06% to 5.8% of the population [4,5].

Definitions of the VBD have varied between studies. However, the basilar artery is usually considered to be elongated if it lies lateral to the clivus or dorsum sellae, and is considered to be dilated if the diameter exceeds 4.5 mm [2,4,6–8]. Clinical manifestations of VBD vary widely, but ischemic stroke is the most common presentation, followed by progressive compression of the brainstem and cranial nerves and intracranial hemorrhage [3,4,6].

Two cases of VBD are presented, both with acute bilateral ophthalmoplegia and cranial nerve palsies, and vertebrobasilar arterial thrombosis that resulted in ischemic stroke.

Case Reports

Case 1

A 52-year-old man with a history of hypertension and headaches presented with sudden vertigo, diplopia, left-sided facial droop, left face, arm, and leg numbness, unsteady gait, and vomiting. Using the 15-item National Institutes of Health Stroke Scale (NIHSS) to measure stroke-related neurological deficit, his NIHSS score was 9 (out of a possible maximum score of 24) (*https://stroke.nih.gov/resources/scale.htm*). Neurological examination showed a horizontal conjugate gaze paresis to the left, restricted adduction of the left eye, and nystagmus of the right eye with abduction, consistent with a left-sided 'one-and-a-half' syndrome (or lateral gaze palsy in one direction with internuclear ophthalmoplegia in the other direction, usually due to pontine infarction).

Stroke workup included computed tomography (CT) imaging of the head (Figure 1), which showed central pontine and left cerebellar infarcts with a large hyperdense focus in the right cerebellopontine angle, consistent with thrombus within a tortuous, dilated basilar artery. Magnetic resonance imaging (MRI) of the brain showed abnormal diffusion restriction involving the pons and the inferior left cerebellar hemisphere involving the left posterior inferior cerebellar artery territory (Figure 2).

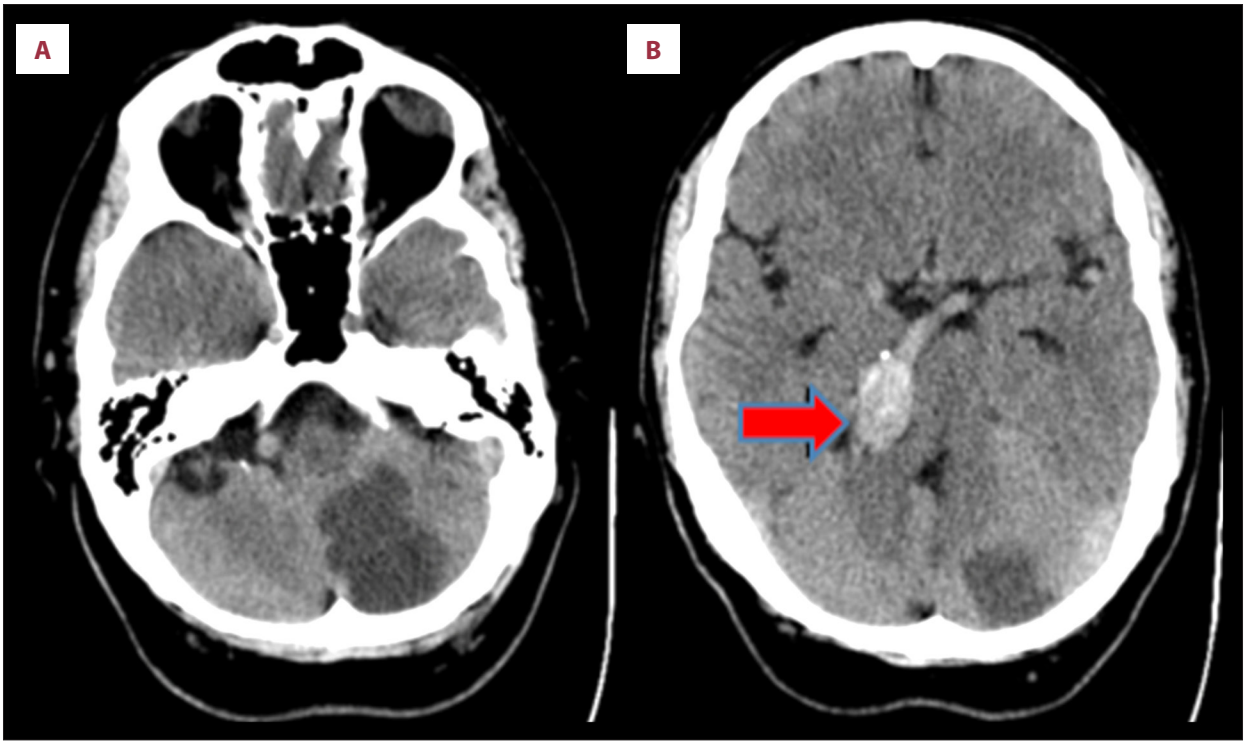

Figure 1. Case 1. Head computed tomography (CT). The head computed tomography (CT) image shows a pontine and left cerebellar infarct (**A**). A large, hyperdense, ovoid focus is present in the right cerebellopontine angle, displacing the pons and the middle cerebellar peduncle to the left, consistent with thrombus within the tortuous dilated right basilar artery (red arrow) (**B**).

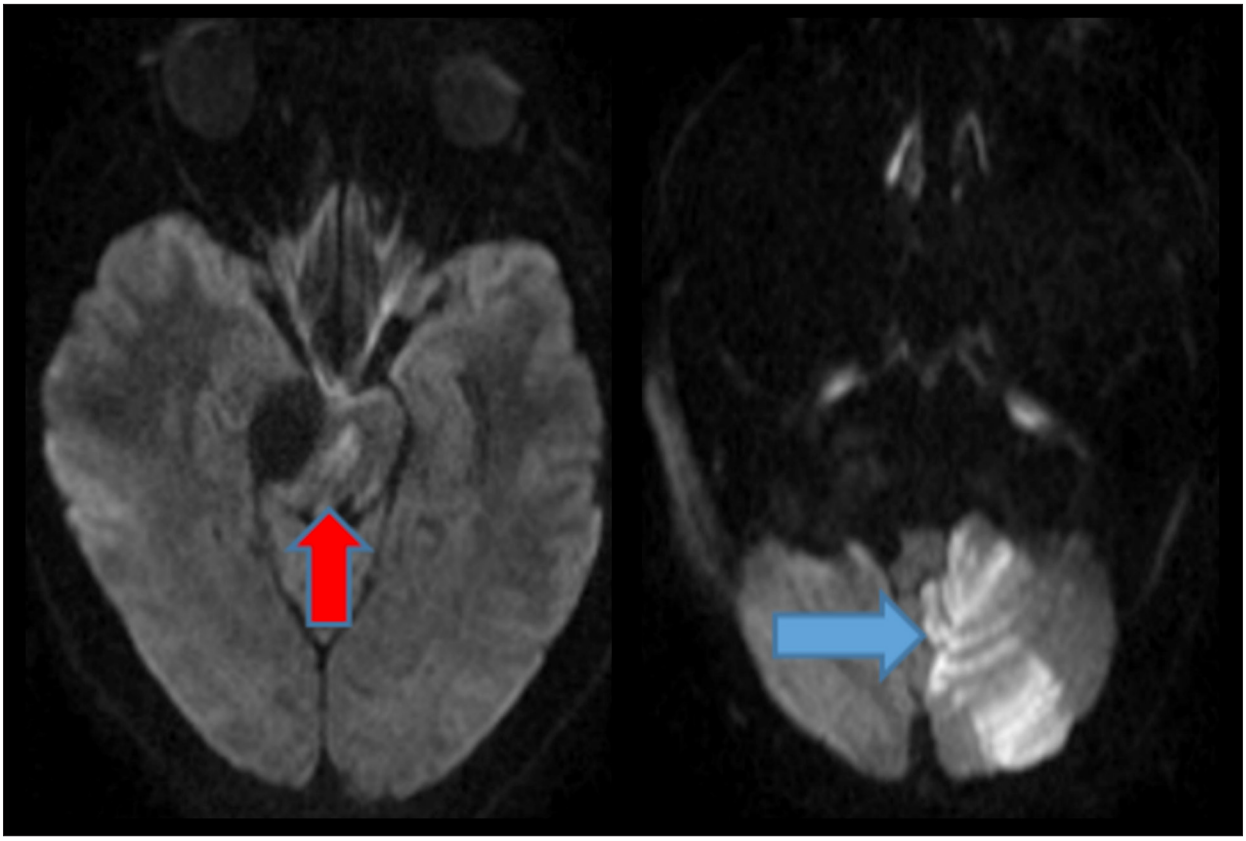

Figure 2. Case 1. Brain magnetic resonance imaging (MRI). Diffusion-weighted magnetic resonance imaging (MRI) shows a central pontine infarction (red arrow) and a left cerebellar infarction (blue arrow).

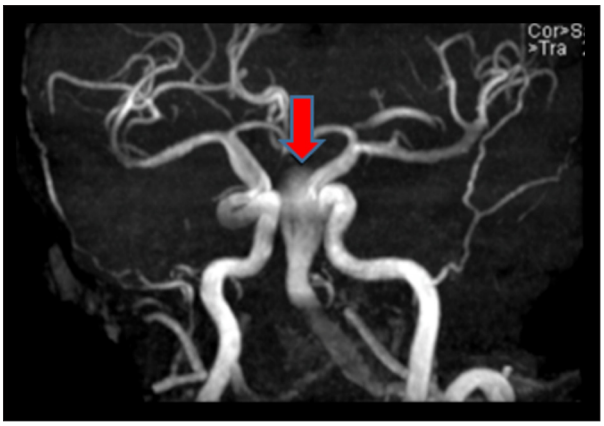

Figure 3. Case 1. Head and neck magnetic resonance angiography (MRA). Head and neck magnetic resonance angiography (MRA) shows a tortuous and dilated vertebrobasilar system, more severe on the left compared with the right. There is a fusiform aneurysmal dilatation of the tortuous basilar artery, consistent with thrombus, due to partial lack of enhancement along the basilar artery anteriorly (red arrow).

Head and neck magnetic resonance angiography (MRA) confirmed a diagnosis of vertebrobasilar dolichoectasia (VBD) and thrombus within the dilated basilar artery (Figure 3). Findings from the electrocardiogram (ECG) were normal, and an echocardiogram showed an ejection fraction of 50%, with impaired relaxation of the left ventricle and no evidence of a patent foramen ovale. No genetic testing was performed on this hospital admission. The patient was not considered to be a suitable candidate for intravenous thrombolysis because he presented beyond the recommended period for thrombolysis to be effective in acute ischemic stroke. He was treated with an intravenous heparin infusion and transitioned to long-term oral anticoagulation with warfarin.

Case 2

A 68-year-old woman presented with diplopia. Examination showed a dense right homonymous hemianopia, left oculomotor nerve palsy with ptosis, right head tilt and vertical eye deviation consistent with left trochlear nerve palsy, and limited abduction of her right eye (Figure 4), as well as right dysmetria (inability to judge distance and scale), and ataxia. Her NIHSS score was 4.

A head CT head showed a large dilated basilar artery with focal aneurysmal dilatation, which was also confirmed by confirmed by

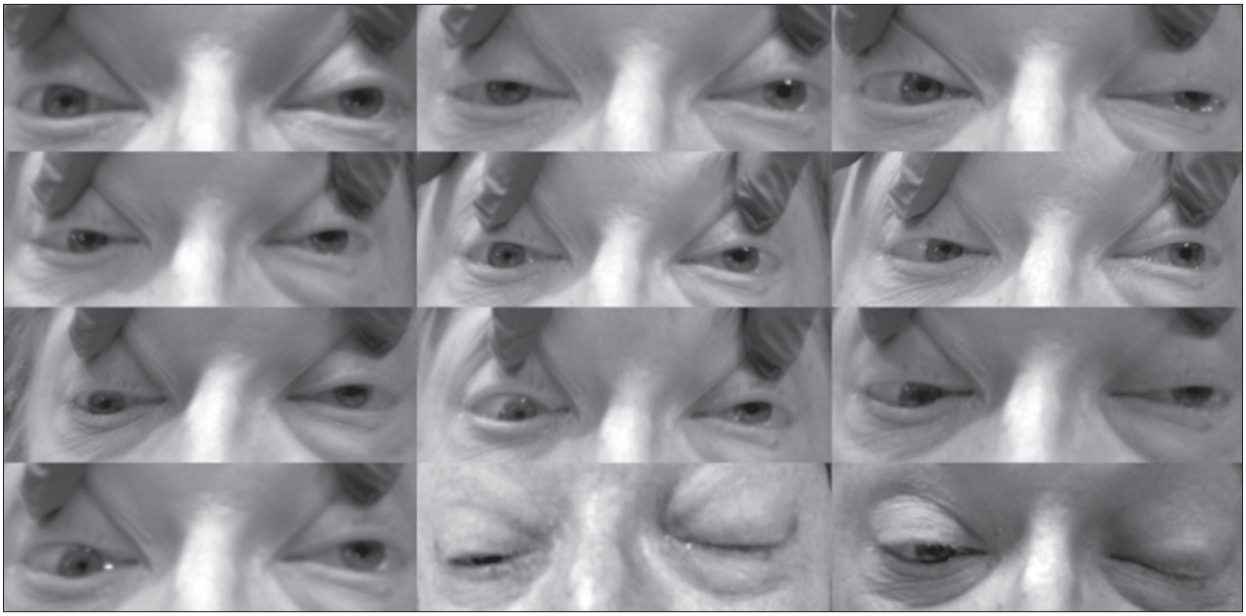

Figure 4. Case 2. Left and right cranial nerve palsies. Clinical findings in Case 2 include a dense right homonymous hemianopia; left oculomotor nerve palsy with ptosis; right head tilt and vertical eye deviation consistent with left trochlear nerve palsy; limited abduction of the right eye; bilateral ptosis (left more than right); left oculomotor nerve palsy; and left trochlear nerve palsy.

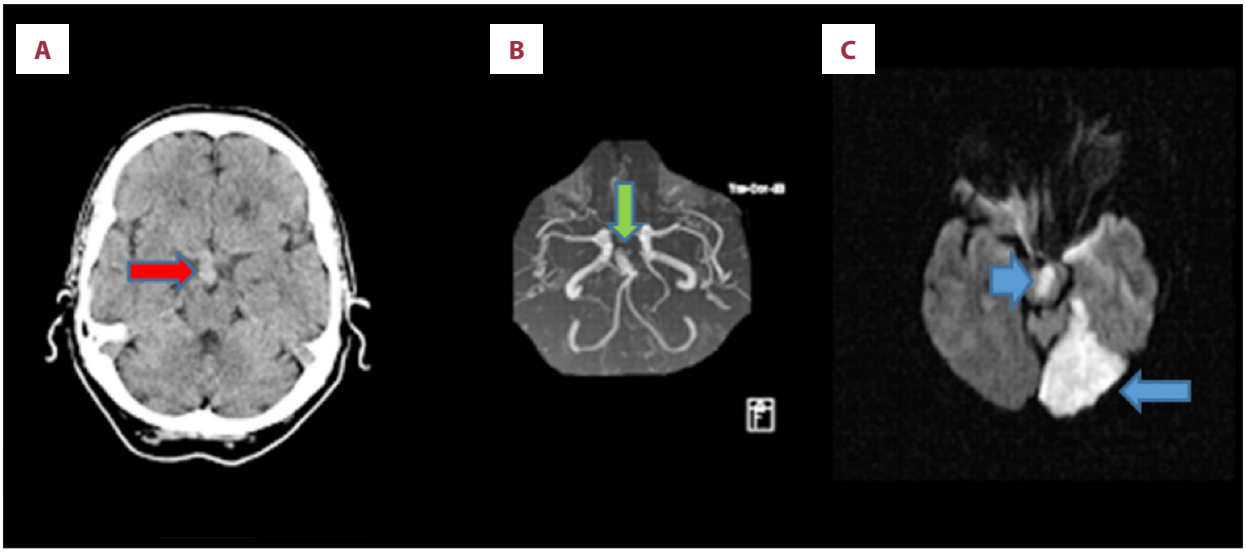

Figure 5. Case 2. Head computed tomography (CT), intracranial magnetic resonance angiography (MRA), and diffusion weighted imaging (DWI) of a basilar artery aneurysm, left midbrain stroke, and occipital lobe infection (stroke). (**A**) Head computed tomography (CT) image shows a basilar artery aneurysm (red arrow). (**B**) Intracranial magnetic resonance angiography (MRA) shows a basilar artery aneurysm (green arrow). (**C**) Diffusion weighted imaging (DWI) (blue arrows) shows a left midbrain infarction (stroke) and occipital lobe infarction (stroke).

MRA. MRI showed left midbrain and occipital infarcts (Figure 5). The patient was treated initially with low-dose aspirin of 81 mg per day and had an endovascular coil inserted to treat the basilar artery aneurysm (Figure 6). Follow-up examination showed resolution of her left-sided ptosis, but residual left oculomotor and left trochlear cranial nerve palsies remained (Figure 7).

Discussion

The cause of vertebrobasilar dolichoectasia (VBD) and the factors that promote its development are still unclear. It was long believed that atherosclerosis was the main cause, primarily because the disease tends to occur in older men, who also have

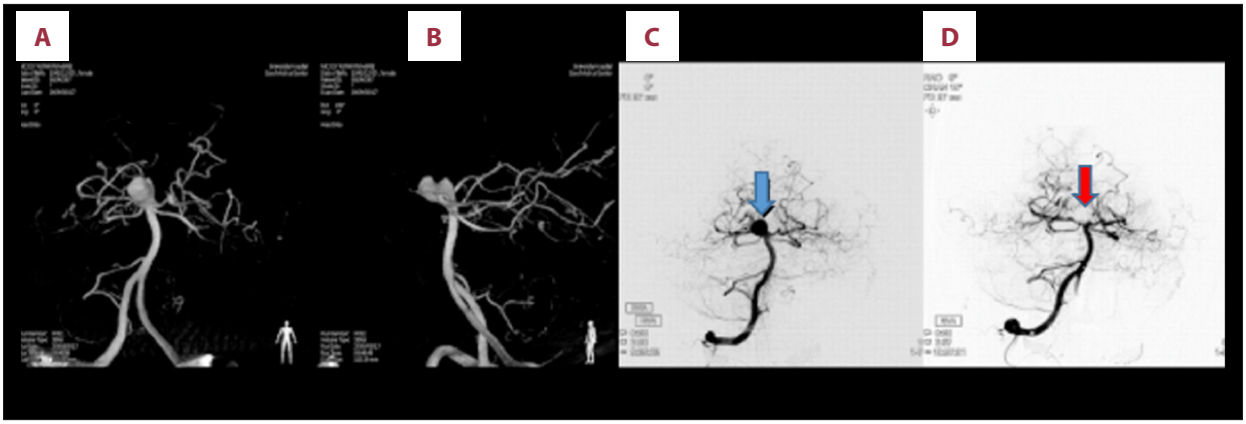

Figure 6. Case 2. Computed tomography (CT) angiogram. (**A–C**) A thrombosed basilar artery aneurysm is shown (blue arrow). (**D**) The basilar artery is shown following endovascular insertion of the coil (red arrow).

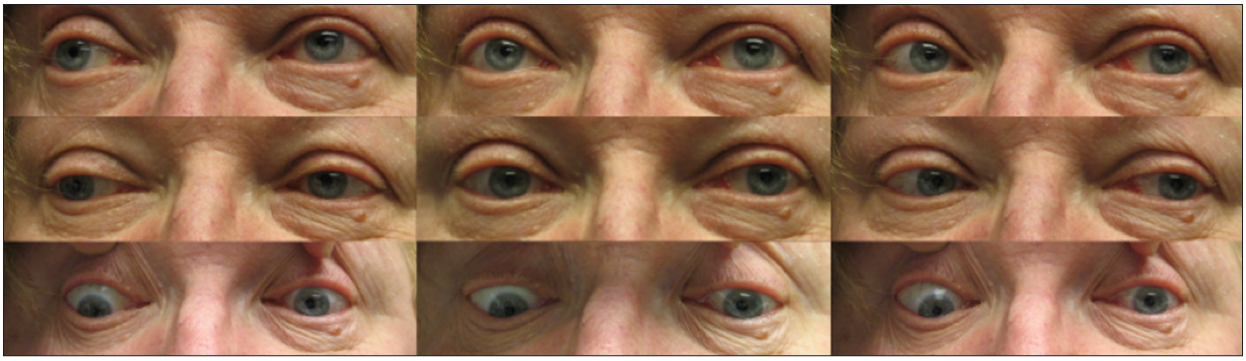

Figure 7. Case 2. Residual left oculomotor and left trochlear cranial nerve palsies. Follow-up examination after insertion of the coil into the basilar artery shows resolution of left-sided ptosis, with residual left oculomotor nerve palsy and left trochlear nerve palsy.

hypertension and hyperlipidemia [9]. However, histopathological examination of dolichoectatic arteries has demonstrated microscopic features that are very different from those seen in atherosclerosis, and include fragmentation of the internal elastic lamina, and thinning of the tunica media [4,10–12]. In contrast, in atherosclerotic lesions, there is typically thickening of the intima [4,13]. Other studies have also shown no convincing association between dolichoectasia and atherosclerosis [14]. The emerging view is that VBD may develop from both hereditary and acquired factors [4]. Hereditary factors that have been linked to VBD include autosomal dominant polycystic kidney disease [3,4,15], Pompe disease [16], Fabry's disease [3,4,17], Marfan's syndrome, and Ehlers-Danlos syndrome [3,4,17]. The development of VBD may also occur following infections, including syphilis [18], varicella-zoster [19], and human immunodeficiency virus infection and acquired immune deficiency syndrome (HIV/AIDS) [20]. Regardless of the cause, the development of VBD is now believed to progress over time, with intimal hyperplasia and neovascularization followed by intramural hemorrhage and thrombosis, recanalization of organized thrombus, and recurring hemorrhage, with hypertension as a possible driving factor in the development of VBD [13].

Patients with VBD can present with a wide variety of symptoms, although there are three main clinical complications that include ischemic stroke, brainstem and cranial nerve compression, and intracranial hemorrhage. Passero and colleagues, in a prospective study of 156 patients with VBD followed for an average of 11.7 years, reported ischemic stroke in 37.8%, brainstem and cranial nerve brainstem compression in 19.9%, and intracranial hemorrhage in 13.5% of patients studied [21]. The cause of ischemic stroke is usually due to intravascular thrombus formation in the dolichoectatic vessel occurring due to alteration in blood flow [17]. Thrombosis may result in occlusion of perforating arteries due to thrombo-emboli and occlusion of distal arteries, such as the posterior cerebral artery [1,7,10,17,22]. Because the pons is supplied by paramedian perforating arteries, when the basilar artery becomes increasingly elongated and tortuous, these arteries can become distorted and occluded, leading to pontine infarction [1,7,10,17,22]. The cerebral infarcts, in the study reported by Passero and colleagues, were in the brainstem (41%), followed by the posterior cerebral artery territory (29%), thalamus (22%), and cerebellum (2%) [21].

The pressure effects of VBD can also directly compress the brainstem and cranial nerves, most commonly the trigeminal nerve and facial nerve, resulting in trigeminal neuralgia and hemifacial paralysis [23,24]. Less commonly, VBD can compress the abducens nerve [25], the trochlear nerve [26], and the oculomotor nerve [27]. Compression of the lower brainstem can lead to nystagmus [28], tinnitus [29], hoarseness, and difficulty in swallowing [30]. Intracranial hemorrhage is less common than thrombosis in VBD, although when it occurs, it can be severe and life-threatening. It has been hypothesized that layered thrombus formation reinforces the thinned arterial wall, providing vessel wall stability and thereby lowering the risk of hemorrhage [31]. Conversely, poorly controlled hypertension and treatment with antiplatelet or anticoagulant medications appear to increase the risk of cerebral hemorrhage in patients with VBD [32].

The two patients presented in this report both had clinical features of bilateral ophthalmoplegia, which is an unusual presentation in VBD. The first patient had infarction of the dorsal pontine tegmentum, which would have affected the paramedian pontine reticular formation (PPRF), the internuclear fibers of the left medial longitudinal fasciculus (MLF), and the ipsilateral abducens nucleus. As a result of the loss of the PPRF, the lateral gaze center, he developed an ipsilateral horizontal conjugate gaze paresis to the side of the cerebral lesion. Because the infarct also affected the internuclear fibers of the ipsilateral MLF, he was unable to adduct his ipsilateral eye. This combination of clinical findings was first described by Fisher in 1967 and has been referred to as the 'one-and-a-half' syndrome [33–35].

The second patient had an infarct of the left medial midbrain involving both the cerebral peduncle and dorsal tegmentum, affecting the left oculomotor nerve and left trochlear nerve as well as the descending supranuclear fibers for horizontal gaze destined for the right PPRF. These fibers descend through the medial cerebral peduncle where they then decussate to the opposite side. Therefore, a lesion in the medial cerebral peduncle can result in a contralateral horizontal gaze paresis, as in this patient, although adduction of the left eye was also affected by the concomitant left oculomotor nerve palsy. This combination of neurological signs is referred to as the peduncular Foville syndrome [36].

Treatment of patients with VBD can be challenging, and there are no evidence-based clinical guidelines for the management of ischemic stroke in the setting of VBD. Treatment with antiplatelet agents and anticoagulants, including warfarin, have been used when there is evidence of intravascular thrombus [3,32]. However, because mechanical distortion of perforator vessels also contributes to stroke, it is unlikely that antiplatelet and anticoagulant therapy will be very effective. Also, no difference in outcome has been demonstrated between treatment with antiplatelet agents and anticoagulants, although clinical studies undertaken so far have been non-controlled and too small to result in any meaningful conclusions [3,37].

The first of the two patients in this report was treated with intravenous heparin and then transitioned to warfarin for long-term anticoagulation. The second of the two patients in this report was treated with endovascular coil insertion of the basilar artery aneurysm. In a recent study of 53 large intracranial arterial aneurysms that produced symptoms by exerting both a mass effect and by associated thrombosis, three aneurysms were in the basilar tip, and two were in the vertebral arteries. The basilar tip aneurysms were all successfully treated with intravascular coils, while the vertebral artery aneurysms were treated with parent-vessel occlusion [38]. Parent-vessel occlusion has been one of several approaches aimed at reducing blood flow through the posterior circulation [39]. Some clinical reports have shown the progression of VBD despite occluding both vertebral arteries [40]. Finally, the use of flow-diverting stents [41,42], or overlapping stent or coil-assisted stent reconstruction have been recently reported, with varying degrees of success [43,44]. All of these invasive treatment approaches require experienced neurosurgical operators because of the inherent risk of brain stem stroke [45].

Conclusions

Vertebrobasilar dolichoectasia (VBD) is a complex progressive arterial disease that can lead to a wide array of symptoms, including ischemic stroke, brainstem and cranial nerve compression, and intracranial hemorrhage. Although previously reported, ophthalmoplegia is uncommon in patients with VBD, and bilateral ophthalmoplegia is exceedingly rare, especially with the 'one-and-a-half' syndrome, oculomotor and trochlear nerve palsies, and peduncular Foville syndrome. Both patients with VBD described in this report had brainstem strokes, one in the pons and the other in the midbrain. Anticoagulation treatment was chosen for the first patient as he had clear evidence of layered intravascular thrombus, which made an endovascular treatment approach too high-risk. The second patient had more focal dilatation of her distal basilar artery, making this amenable to endovascular coil occlusion. These two cases have shown that the management of patients with symptoms resulting from VBD should be individualized and that treatment requires a careful balancing of the risks and benefits of treatment, with close follow-up.

Conflict of interest

None.

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