PICA aneurysms: case report and review of the literature

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PICA aneurysms: case report and review of the literature

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Images courtesy of St Vincent's Medical Center, New York.

Introduction

An aneurysm is defined as a localised dilation of a blood vessel secondary to disease or weakening of the vessel wall. Studies by radiographic and autopsy series on 10 to 15 million people have shown the prevalence of intracranial saccular aneurysms to be about 5% in the United States.[1] Intracranial aneurysms commonly occur at bifurcations and branching points of the large arteries of the Circle of Willis. Approximately 85% of intracranial aneurysms develop in the anterior part of the Circle of Willis, with the remaining 15% found in the vertebrobasilar system. The majority of aneurysms are discovered after an episode of subarachnoid haemorrhage (SAH).[2]

The case

A 67-year-old woman presented to the emergency department with sudden onset of severe headache, nausea, and vomiting. Her symptoms started approximately four hours prior to presentation. She had no other abnormal neurological signs or symptoms. The patient denied any significant medical or surgical history. An initial noncontrast head CT revealed a diffuse SAH, predominantly in the basilar cistern and parasellar regions. There was mild hydrocephalus without brain herniation. The patient remained stable and neurologically intact. A CT angiogram of the neck and brain revealed an aneurysm of the posterior inferior cerebellar artery (PICA) at its origin from the right vertebral artery. The patient was admitted to the neurosurgical ICU for close monitoring. The aneurysm was clipped 24 hours later following a left suboccipital approach. The patient was later discharged from hospital with a favourable outcome.

Discussion

Aneurysms of the PICA are rare and represent 0.5-3% of all intracranial aneurysms.[3] They have a higher incidence of intraventricular haemorrhage and secondary hydrocephalus than do other intracranial aneurysms.[4] Most PICA aneurysms are located at the vertebral artery–proximal PICA junction, where the PICA branches off from the vertebral artery. Distal PICA aneurysms are frequently associated with arterial–venous malformations, and hence it is believed that congenital factors are involved in the development of distal PICA aneurysms.[2,5]
Aneurysm formation is probably the result of multiple factors affecting the respective arterial segment and its local environment. The pathogenesis of aneurysms can be explained by applying the Law of Laplace, which implies that the wall tension in arteries is proportional to the pressure multiplied by the radius of the artery. Thus, if you increase the pressure (systemic hypertension) on the walls, the tension will increase. Furthermore, if there is any ischaemia in the vessels supplying the arterial wall, the furthest ends of the wall are weakened first, allowing for increased dilation due to the increased tension inside. Too much pressure inside or weakening of the walls due to disease or ischaemia can lead to the rupture of the wall, causing severe haemorrhage. Saccular aneurysms are the most common cause of SAH, followed by fusiform and mycotic.[1] Saccular aneurysms are defined as aneurysms with very thin or absent tunica media, as well as absent or fragmented internal elastic lamina, the combination of which allows for thin-walled protrusions capable of rupturing.[5] In contrast, a fusiform aneurysm involves the dilation or enlargement of the entire vessel wall, often due to atherosclerosis. Lastly, mycotic aneurysms result from infective endocarditis releasing an emboli leading to infection at a localised area of an artery.[6]

FIGURE 1: Initial noncontrast CT showing diffuse subarachnoid blood, most prominent in the basilar cistern. Acute SAH appears dense (white) on a noncontrast study. There is also associated mild hydrocephalus, with dilation of the temporal horns of the lateral ventricles.

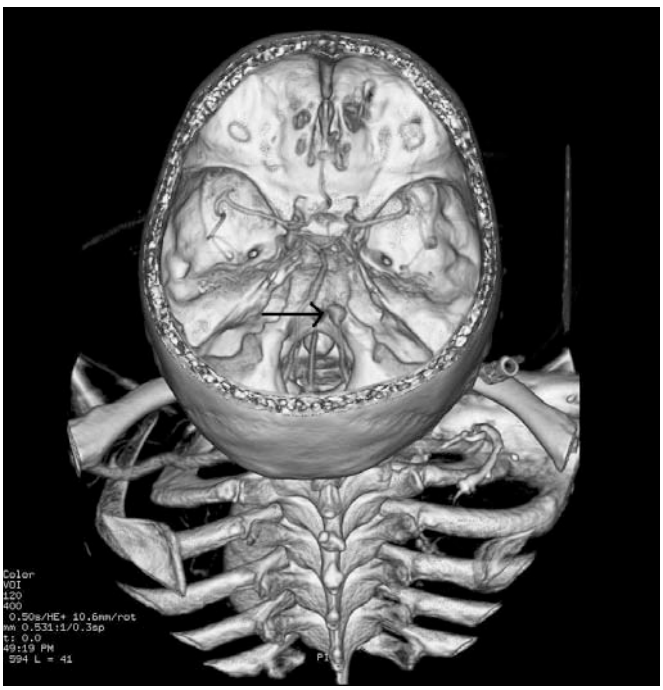

FIGURE 2: 3D reconstruction of a head CT angiogram demonstrates a saccular aneurysm at the right distal vertebral artery at the origin of the right PICA. The aneurysm points posteriorly and slightly superiorly, and measures 7mm in length with a 6mm neck. The aneurysm is irregular in shape, consistent with recent bleeding.

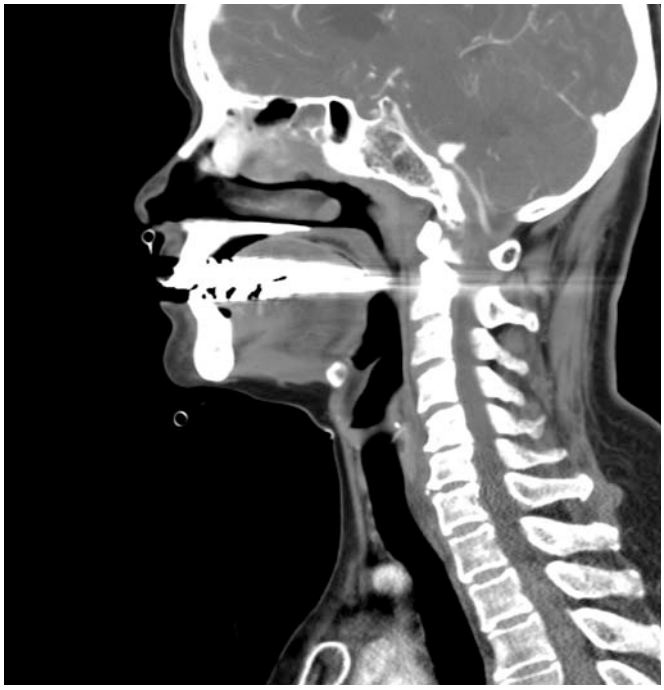

FIGURE 3: Sagittal view.

Ruptured PICA aneurysms present similarly to other intracranial aneurysms. The most common presentation is that of an acute SAH. Unlike the other types, however, PICA aneurysms have a greater likelihood of causing intraventricular haemorrhage into the fourth ventricle and into the aqueduct of Sylvius, which can also lead to hydrocephalus. The most common presentation starts with a headache, typically described as "the worst headache of my life". The presentation of a PICA aneurysm results from interrupted blood supply to several different areas of the brain. A variety of focal neurological signs, such as bilateral palsy of the abducent nerve, truncal ataxia, and mild hemiparesis, have been associated with PICA aneurysms. It is likely that this is due to the anatomical location of the artery and its neighbouring structures, which include cranial nerves VII, VIII, IX, and X. If the haemorrhage results in an infarct at the medulla oblongata, this is results in lateral medullary syndrome or Wallenberg's syndrome, which presents with neurological symptoms as above with difficulty swallowing and with occasional uncontrollable hiccoughs.[7-10]

An initial noncontrast head CT will reveal an SAH in the posterior fossa, which is often associated with ventricular dilation. There may also be the presence of intraventricular haemorrhage. A CT angiogram (CTA) of the neck and brain will demonstrate a saccular or fusiform dilation of the involved portion of the PICA. A transfemoral carotid angiogram is considered the gold standard for diagnosis, but a CTA is an acceptable alternative and has the advantage of being noninvasive.[9,11]

FIGURE 4: Axial view.

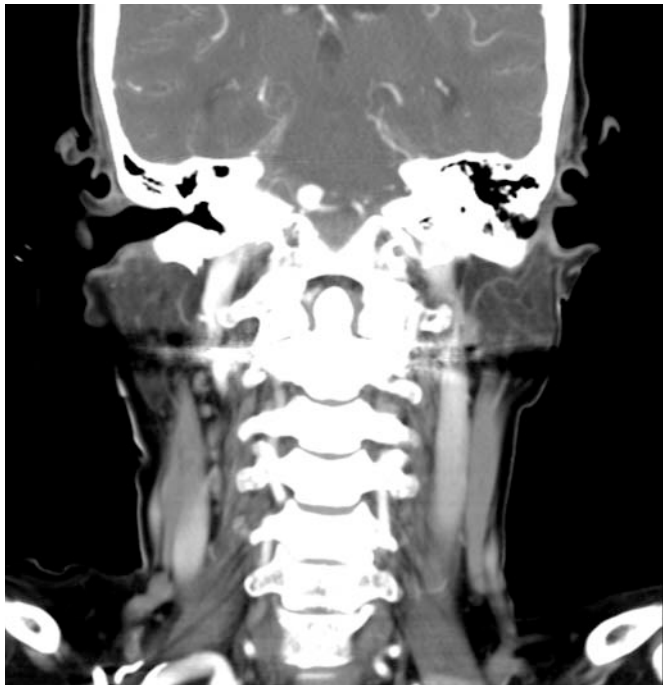

FIGURE 5: Coronal view.
Axial, sagittal and coronal views further depict this aneurysm. Of note, there were no further aneurysms or arteriovenous malformations.

Treatment of posterior circulation aneurysms poses a great technical challenge for the practicing neurosurgeon. PICA aneurysms can be routinely treated with either surgical clipping or endovascular (interventional) coiling. The surgical approach is commonly via suboccipital craniotomy and surgical clipping of the aneurysm. If a suboccipital craniotomy is not a feasible surgical approach, a transcondylar approach may also be utilised, which minimises retraction of the cerebellum. The decision on which approach to use will often depend on the exact location of the aneurysm. It is common for patients to experience lower cranial nerve palsies after the procedure. Endovascular coil embolisation of posterior circulation aneurysms is an effective treatment in the short term, but is associated with recurrence, possible retreatment, and rehaemorrhage. Hydrocephalus, if present, is generally associated with an unfavourable outcome. These patients may require a ventricular shunt to prevent the devastating effects of hydrocephalus.[9,11]

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