Case Report

Medial Trunk Aneurysm of the Distal Posterior Inferior Cerebellar Artery in the Fourth Ventricle

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We present a case of a ruptured aneurysm of the medial trunk of the right posterior inferior cerebellar artery (PICA) in the fourth ventricle. A 52-year-old man presented with sudden onset of headache, followed by an abrupt decline in consciousness. Angiographic studies revealed that the aneurysm arose from the medial trunk of the right PICA, distal to the choroidal point and associated with the stenosis of the basilar artery and the hypoplasia of the right anterior inferior cerebellar artery and superior cerebellar artery. The patient underwent a midline suboccipital craniotomy and aneurysmectomy after clipping of the parent artery. A postoperative angiogram confirmed complete obliteration of the aneurysm, but demonstrated occlusion of the vermian branch of the right PICA. The pathogenesis of this lesion could be due to hemodynamic stress.

KEY WORDS : Fourth ventricle · Intracranial aneurysm · Posterior inferior cerebellar artery.

Introduction

Aneurysms of the distal posterior inferior cerebellar artery (PICA) account for 0.5 to 0.7% of all intracranial aneurysms[6,8,13,21]. A PICA aneurysm usually arises at the proximal part of the vessel near its origin from the vertebral artery. Peripheral PICA aneurysms, on the lateral medullary, tonsillomedullary or telovelotonsillar segment are less common[10,13]. The telovelotonsillar segment often has a rostrally convex loop ('choroidal arch') near the roof of the fourth ventricle. At this location the aneurysm may project into the fourth ventricle through the tela choroidea[5,10,13,18]. Also there have been only three cases about "pure" choroidal artery aneurysm[2,17]. To our knowledge, 9 PICA aneurysms in the fourth ventricle have been described previously[1,2,5,13,16-19]. But aneurysms that arose from the medial trunk in the fourth ventricle have never been reported. We discussed the underlying etiology regarding incidence of these complicated aneurysms.

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Case Report

A 52-year-old man presented with sudden onset of headache, followed by an abrupt decline in consciousness. The patient's medical records revealed a history of cerebral infarction on the right temporo-parietal area and communicating hydrocephalus for which a ventriculoperitoneal shunt had been performed 7 years before. He was noted to be hypertensive, confused and responding to commands at admission. A neurological examination revealed cerebellar dysfunction on the left side. A computed tomographic scan demonstrated intracerebellar, intraventricular, and subarachnoid hemorrhage (Fig. 1). Cerebral angiography of the right internal carotid artery disclosed a complete occlusion of internal carotid artery at its origin level

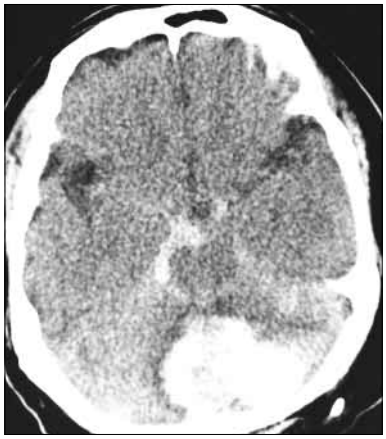

Fig. 1. Preoperative computed tomographic scan shows intracerebelar, intraventricular, and subarachnoid hemorrhage.

from the common carotid artery. Leptomeningeal collateral circulation to the right cerebral hemisphere was also seen. On angiography of the posterior circulation, an aneurysm 6mm in diameter arose from the medial trunk of the right PICA, distal to choroidal point(Fig. 2). The basilar artery was faintly opacified by stenosis due to unknown origin. The right anterior inferior cerebellar artery and superior cerebellar artery were hypoplastic and were compensated for by the right posterior cerebellar artery. The left PICA was aplastic and most of its vascular territory was compensated for by the right posterior inferior cerebellar artery. The branches of the left vertebral artery were the posterior meningeal and tentorial branches(Fig. 3).

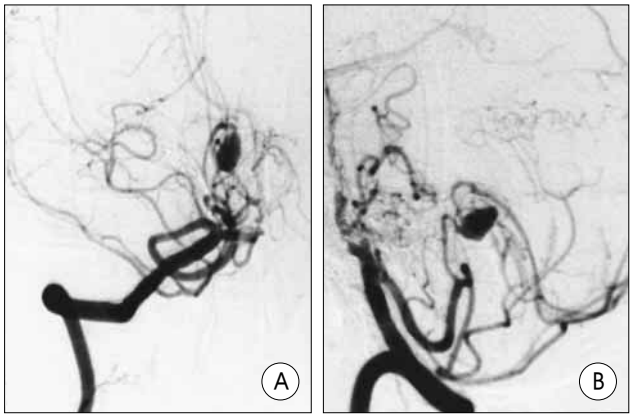

Fig. 2. Right vertebral angiogram, anteroposterior (A) and lateral (B) views demonstrate an aneurysm 6 mm in diameter arising from the medial trunk of the right posterior inferior cerebellar artery, distal to choroidal point. The basilar artery is faintly opacified by stenosis. The right anterior inferior cerebellar artery and superior cerebellar artery are hypoplastic and are compensated for by the right posterior cerebellar artery.

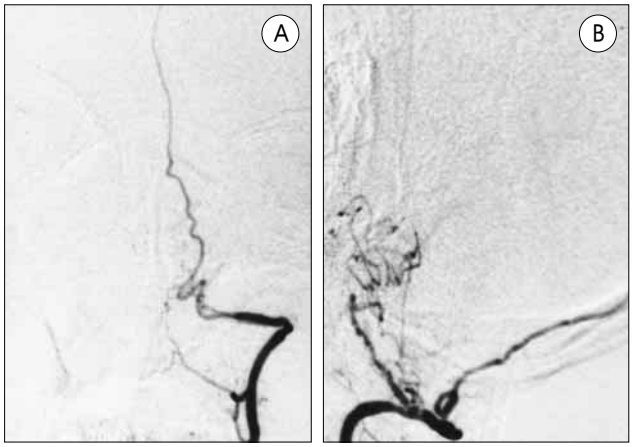

Fig. 3. Left vertebral angiogram, anteroposterior (A) and lateral (B) views reveal that the left posterior inferior cerebellar artery is aplastic and most of its vascular territory is compensated for by the right posterior inferior cerebellar artery. The branches of the left vertebral artery are the posterior meningeal and tentorial branches.

The patient underwent a midline suboccipital craniotomy under general anesthesia. The cisterna magna was opened, exposing the cerebellar tonsils and the tonsillar loop. With proximal vessel control, the tonsils were then elevated, the inferior vermis was split in the midline, hematoma on the vermis was carefully aspirated, and the PICA was exposed further distally, ultimately identifying a frank blood clot surrounding the aneurysm. After identification of the telovelotonsillar segment, or choroidal arch, of the PICA, the medial and lateral trunks were carefully dissected. The dome of the aneurysm was found protruding into the vermis. Careful dissection showed that the medial trunk of the right PICA entered directly into the fusiform dilatation. After careful inspection, the vermian artery continued from the aneurysmal wall(Fig. 4). Additionally, two small branches were connected with the aneurysm from the left side. It was thought that this represented the point at which the right PICA diverged to provide branches to the left cerebellar vermis. Owing to the absence of a definite neck and the multiple vascular channels of the aneurysm, aneurysmectomy was completely performed after the applications of a Sugita straight clip to parent artery.

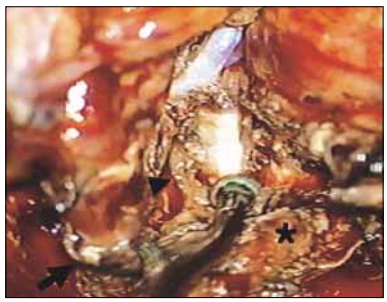

Fig. 4. Intraoperative photograph shows that the medial trunk of the right posterior inferior cerebellar artery (arrowhead) enters directly into the fusiform dilatation and the vermian artery (arrow) continues from the aneurysmal wall (asterisk).

Postoperative CT scan showed complete removal of intracerebellar hemorrhage and no evidence of hydrocephalus. Postoperative angiography did not disclose an aneurysm, but vermian branch of the right posterior inferior cerebellar artery was inevitably occluded. His mental status was slightly improved, but cerebellar dysfunction remained. Two month after surgery, the patient was well tolerated and discharged home.

Discussion

Anatomy of the PICA and its bifurcation

The anatomy of the PICA is quite variable. The PICA has the most complex, tortuous, and variable course and area of supply of the cerebellar arteries[10,14]. The PICA is divided into five segments: 1) anterior medullary, 2) lateral medullary, 3)

tonsillomedullary, 4) telovelotonsillar, and 5) cortical. These segments are often longer than the distance around the medulla or the tonsil because the PICA frequently has a tortuous course and forms complex loops on the side of the brainstem among the lower cranial nerves, near the tonsil, and caudal to the roof of the fourth ventricle[10,14]. In most, but not all, hemispheres, telovelotonsillar segment often forms a loop with a convex rostral curve, called the cranial loop. Most PICAs bifurcate into a smaller medial and a larger lateral trunk. The medial trunk supplies the vermis and adjacent part of the hemisphere and the lateral trunk supplies most of the hemispheric and tonsillar parts of the suboccipital surface[14]. The most common site of the bifurcation is in the telovelotonsillar fissure as the artery courses around the rostral pole of the tonsil. The medial trunk ascends in vermohemispheric fissure to reach the vermis, and the lateral trunk passes laterally out of the telovelotonsillar fissure to reach the hemispheric surface[14]. In the case presented here, the course of the right PICA was unusual. The apex of cranial loop was inferior to the level of the midportion of the tonsil and the medial trunk of the right PICA was elongated into the fourth ventricle.

Distal PICA aneurysm in the fourth ventricle

Aneurysms of the PICA are relatively uncommon, accounting for only 0.5 to 3% of all intracranial aneurysms in a previously reported series[6,8,13,18]. They usually arise at the point where the PICA branches out of the vertebral artery[6,13]. Distal PICA aneurysms are particularly rare, constituting 15-30% of all PICA anrusysms[5,7,19,21]. Unlike the mudullary segment and the peripheral branches of the PICA, the telovelotonsillar segment, or choroid arch, rarely seems to be involved. The telovelotonsillar segment often has a rostally convex loop near the roof of the fourth ventricle. At this location the aneurysm may project into the fourth ventricle through the tela choroidea[5,10,13,18]. A PICA aneurysm in the fourth ventricle is extremely rare and, to the best of our knowledge, has been described only eight times[1,2,5,13,16-19]. Among them, there have been only two article about "pure" choroidal artery aneurysm[2,17]. As usual, PICA aneurysms arise at branching sites, on a curve of the parent vessel and point in the direction the vessel would have continued, if the curve had not been present[6]. In our case, the basilar artery was severely stenotic and the right anterior inferior cerebellar artery and superior cerebellar artery were hypoplastic. The right PICA may have a lot of hemodynamic stress and this stress is speculated to a causative factor of the aneurysm. The force of impact of the axial blood stream against the point in the direction that the PICA would have pointed if the curve had not been present, should lead to the initial disruption of the internal elastic layer and subsequent aneurysm formation[6].

The role of imaging

Even with adequate initial angiography, aneurysms of the distal PICA may not be seen initially perhaps because of localized vasospasm or a clot in the neck[16]. Cerebral angiography may demonstrate a peripheral PICA aneurysm but the unique location of the aneurysm in the fourth ventricle is difficult to ascertain and may easily to be overlooked. PICA aneurysms can cause combined or isolated subarachnoid or intraventricular hemorrhage. The former often extends to the supra and infratentorial cisterns, but is usually thicker at the periphery of the brain stem and at the site of the aneurysm[9].The rate of intraventricular hemorrhage is high and in most cases it is due to reflux of blood. Intraventricular hemorrhage can also be caused by a direct penetration of a peripheral PICA aneurysm or of the hematoma into the fourth ventricle, or very rarely by a rupture of an aneurysm within in the ventricle[20]. As a peripheral PICA aneurysm is most suspicious in isolated fourth ventricular hemorrhage, MRI may be helpful[18]. The possibility of a distal PICA aneurysm should be considered if isolated intraventricular blood is found without obvious parenchymal hematoma or subarachnoid blood in the basal cisterns, and complete vertebral arteriography is required. The bilateral vertebral angiogram will also provide valuable information, such as the presence of the contralateral PICA or collateral circulatory patterns. This may be vital to operative planning.

Treatment of the distal PICA aneurysm

A bilateral medial suboccipital approach is advocated for aneurysms of the far distal peripheral PICA(tonsillomedullary, telovelotonsillar, and cortical segments); this provides exposure of the vermis and the ventricles[12,15]. Present optimal surgical treatment is clipping of saccular aneurysm with preservation of PICA[13,18,19]. Although clipping of the aneurysmal neck is desirable, the aneurysm may be trapped or the vessel may be sacrificed in those locations beyond the choroidal point, vital brainstem and deep cerebellar nuclei perforators have already been given off, assuming that no major abnormalities exist that contraindicate vessel occlusion. Intracranial arterial reconstructive techniques were used when conventional neck clipping was not feasible due to the size, location or symptoms of their aneurysms. Two techniques of

revascularizing the PICA during aneurysm surgery are presented4). One involves transposition of the PICA to the vertebral artery proximal to the aneurysm using a superficial temporal artery as a graft. This is used in cases in which the PICA has branched off from the wall of the giant vertebral artery aneurysm. The other technique involves end-to-end anastomosis of the PICA after excision of a giant distal PICA aneurysm located at the cranial loop near the roof of the fourth ventricle. Complete resection of distal PICA fusiform aneurysm with end-to-end anastomosis of the vessel has been reported by Dolenc[3]. Giant peripheral aneurysm of the PICA treated with excision and end-to-end anastomosis of the PICA[11]. End-to-end anastomosis with resection of the aneurysm was preoperatively advocated for our case, but it was not available due to small diameter of the vessel and technical difficulty.

Conclusions

The PICA has the most complex and variable course of the all the cerebellar arteries. We present an unusual case of an aneurysm of the medial trunk of the distal PICA in the fourth ventricle. Such an aneurysm has not been reported previously. In suspicion of the distal PICA aneurysm, the bilateral vertebral angiogram will provide valuable information, such as the presence of the contralateral PICA or collateral circulatory patterns. This may be vital to operative planning. End-to-end anastomosis with resection of the aneurysm is advocated for fusiform aneurysm of the distal PICA.

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