Transcortical Transchoroidal Fissure Approach for Ruptured Distal Posterior Cerebral Artery (P₂-P₃ Junction) Aneurysm Associated With Packed Intraventricular Hemorrhage

—Two Case Reports—

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Abstract

A 56-year-old man with ruptured right P₂-P₃ junction aneurysm and a 66-year-old man with ruptured left P₂-P₃ junction aneurysm of the posterior cerebral artery associated with acute-stage packed intraventricular hemorrhage. The aneurysms were successfully clipped through the transcortical transchoroidal fissure approach. This approach requires less retraction of the temporal lobe, provides a wider surgical field, and the P₂ segment can be easily reached. The present approach is very useful for the treatment of ruptured aneurysms at the P₂-P₃ junction, in particular for acute stage surgery associated with packed intraventricular hemorrhage.

Key words: transcortical transchoroidal fissure approach, P₂-P₃ junction aneurysm, packed intraventricular hemorrhage

Introduction

Aneurysm rarely occurs at the P₂-P₃ junction of the posterior cerebral artery, with an incidence of only 0.3%.¹⁰⁾ Such aneurysms are located in the ambient cistern around the midbrain, so are very difficult to reach. The subtemporal approach is generally used to approach this site,^{1,6,11)} but can require excessive retraction of the temporal lobe.^{1,7)} Severe cerebral edema may occur, particularly in the acute stage or if packed intraventricular hemorrhage is present, leading to the possibility of temporal lobe contusion and intraoperative rupture. In contrast, the transcortical transchoroidal fissure approach³⁾ requires less retraction of the temporal lobe and provides a wider surgical field. In addition, preservation of the proximal artery of the aneurysm is easier.

Here, we describe two cases of large P₂-P₃ junction aneurysm associated with packed intraventricular

hemorrhage and subarachnoid hemorrhage, which were successfully treated by the transcortical transchoroidal fissure approach.

Case Reports

Case 1: A 56-year-old man was admitted to our department with complaints of headache and vomiting. On admission, his Glasgow Coma Scale (GCS) score was 14. Computed tomography (CT) revealed subarachnoid hemorrhage around the right ambient cistern and right intraventricular hemorrhage (data not shown). Cerebral angiography detected an aneurysm at the P₂-P₃ segment of the right posterior cerebral artery (Fig. 1).

Initially, we decided to perform ventricular drainage and to treat the aneurysm by the subtemporal approach. However, rebleeding occurred suddenly during ventricular drainage, and his disturbance of consciousness was aggravated (GCS score 8). Head CT showed increased intraventricular hemorrhage and severe cerebral swelling (Fig. 2).

Fig. 1 Case 1. Left vertebral angiograms, anteroposterior (left) and lateral views (right), showing a saccular aneurysm (arrow) at the P₂-P₃ junction of the right posterior cerebral artery.

Fig. 3 Case 1. Computed tomography scans 2 months after surgery showing a small low-density area in the right thalamus, but no sign of apparent infarction in the peripheral feeding area of the right posterior cerebral artery.

Fig. 2 Case 1. Computed tomography scans revealing packed intraventricular hemorrhage and subarachnoid hemorrhage.

Barbiturate coma therapy was induced for 3 days to control the intracranial pressure. When his systemic conditions had stabilized, we decided to carry out surgery. CT showed packed intraventricular hemorrhage and severe cerebral swelling. The planned surgery involved the risk of compression to the temporal lobe, so the transcortical transchoroidal fissure approach was selected to help maintain the proximal artery of the aneurysm.

The patient was placed in a supine position and general anesthesia induced. Craniotomy of the right temporal region was performed. A cortical incision of 2 cm length was made in the middle temporal gyrus,⁹⁾ avoiding injury to the cortical vein. The center of the cortical incision was approximately 5 cm from the tip of the temporal lobe. The right inferior horn was reached, and the hematoma was extracted by aspiration. Then, the choroid plexus and the choroidal fissure were identified. The site where the

anterior choroidal artery enters the inferior horn was identified in the choroidal fissure. The posterior region of the entrance site in the choroidal fissure was opened while ablating the exterior region of the hippocampus, and the hippocampus was mildly retracted, allowing identification of the P₂ segment of the right posterior cerebral artery. Following the artery in the peripheral direction exposed the aneurysm with a longer diameter of 15 mm or more. The embolized region was contained in the lumen. The entire aneurysm was difficult to ablate, so proximal clipping of the P₂ segment was performed.

Postoperative cerebral angiography could not identify the aneurysm. CT 2 months later detected a small low-density area in the right thalamus, but no sign of apparent infarction in the peripheral feeding area of the right posterior cerebral artery (Fig. 3). After the operation, his disturbance of consciousness was gradually alleviated, and transient mild disturbance of memorization was recognized. However, the patient was able to lead an independent daily life and was ambulatory at discharge from the hospital 2 months later. The patient refused detailed examination of the visual field disturbance.

Case 2: A 66-year-old man suffered sudden severe disturbance of consciousness and was admitted to our department. On admission, his GCS score was 5. CT revealed packed intraventricular hemorrhage in the entire ventricular system and subarachnoid hemorrhage around the left ambient cistern (Fig. 4). Three-dimensional (3D) CT angiography showed an aneurysm at the left P₂-P₃ junction (Fig. 5). Disturbance of consciousness was severe and complicated by acute hydrocephalus.

Emergency surgery was performed by the

Fig. 4 Case 2. Computed tomography (CT) scans revealing packed intraventricular hemorrhage and subarachnoid hemorrhage. CT scans with contrast medium revealing an aneurysm (arrow) and a choroid plexus (curved arrow).

Fig. 5 Case 2. Three-dimensional computed tomography angiograms, anteroposterior (left) and posteroanterior views (right), showing a saccular aneurysm (arrow) at the P₂-P₃ junction of the left posterior cerebral artery and a choroid plexus (double arrow).

transcortical transchoroidal fissure approach. The patient was placed in a supine position, general anesthesia was induced, and craniotomy of the right temporal region was performed. A cortical incision of 2 cm length was made in the middle temporal gyrus⁹⁾ to reach the left inferior horn. The hematoma was aspirated, and the choroidal fissure was confirmed. The exterior region of hippocampus was ablated and the choroidal fissure was opened. The hippocampus was mildly retracted to identify the P₂ segment. The intraventricular hematoma was removed up to the trigone, and the aneurysm dome was exposed in the temporal lobe. A temporary clip was applied on the proximal and distal regions, and

Fig. 6 Case 2. Intraoperative photographs showing the clipped aneurysm (AN) (left) and the surrounding vascular structure, P₂ segment (arrow) and P₃ segment (double arrow) (right).

Fig. 7 Case 2. Postoperative left vertebral angiograms, anteroposterior (left) and lateral views (right), showing disappearance of the aneurysm.

neck clipping was performed (Fig. 6). The longer diameter of the aneurysm was 15 mm.

Postoperative cerebral angiography could not identify the aneurysm (Fig. 7). Disturbance of consciousness improved mildly. After 2 months, the patient was still almost completely bedridden, so was transferred to another hospital for rehabilitation at the request of his family. Magnetic resonance (MR) imaging study and detailed examination of the disturbance of visual field could not be carried out because of his consciousness disturbance.

Discussion

Aneurysms in the peripheral posterior cerebral artery frequently become giant aneurysms. The incidence of giant aneurysms in the total peripheral posterior cerebral artery is 20%.⁴⁾ Our two cases were both large aneurysms with long diameters of 15 mm or more. The domes were in contact with the

inferior horn of the lateral ventricle, and may have caused intraventricular hemorrhage after rupture. Surgery is relatively difficult to perform on such large aneurysms. The intravascular approach may be another choice.⁸⁾

The posterior cerebral artery in the ambient cistern can be divided into three segments, and approaches defined for each segment.⁵⁾ Specifically, S1 is from the top of the basilar artery to the lateral region of cerebral peduncle, and an aneurysm in this segment can be reached by pterional, pretemporal, or subtemporal approach; S2 is from the lateral region of the cerebral peduncle to the quadrigeminal cistern, and the subtemporal or subtemporal transventricular approach is suitable; and S3 is from the quadrigeminal cistern to the peripheral region, and the occipital interhemispheric approach is suitable.

Our two cases were on the S2 according to this classification, so the subtemporal or subtemporal transventricular approach is recommended. However, the subtemporal approach may lead to significant morbidity because of the extensive retraction of the temporal lobe. Our patients were in the acute stage with packed intraventricular hemorrhage and severe cerebral swelling, so the possibility of brain contusion or intraoperative rupture of aneurysm was even higher. Excessive retraction of the temporal lobe may cause damage to the vein of the Labbé complex.⁵⁾ On the other hand, the subtemporal approach can open an extended surgical field to the caudal side (superior cerebellar artery, basilar artery, etc.). However, we did not need to have access to the caudal side. It was more important to reach the proximal portion of the posterior cerebral artery in the ambient cistern.

We selected the transcortical transchoroidal fissure approach and performed our cortical incision in the middle temporal gyrus, despite the possibility of disturbance of the visual field. This approach involves less retraction of the temporal lobe,³⁾ allows removal of the intraventricular hematoma from inferior horn to trigone, and obtains a wider surgical field for severe cerebral edema in the acute stage. The P₂ segment of the posterior cerebral artery could be easily reached by opening the choroidal fissure, and the proximal artery of the aneurysm preserved. However, to reach the proximal portion of the aneurysm in the ambient cistern, we needed to identify the entrance portion (plexal point) of the anterior choroidal artery as it joins the inferior horn of the lateral ventricle, and open the choroidal fissure at the posterior site of the plexal point. A shorter distance from the plexal point to the peripheral anterior choroidal artery and the posterior cerebral artery requires less retraction from the hippocampus to the

inferior region,²⁾ and may present the clearest indication for the present approach.

Clinically, the plexal point may not be easy to identify by cerebral angiography. The intraoperative findings of our present two cases showed the distance between the anterior choroidal artery and the posterior cerebral artery was short. Opening the choroidal fissure reached the aneurysm with minimum retraction. However, surgery in the acute stage associated with packed intraventricular hemorrhage may indicate the present approach, even if there is a greater distance between the anterior choroidal artery and the posterior cerebral artery. Preoperative imaging diagnosis using cerebral angiography, 3D CT angiography, and MR imaging remains important. In particular, 3D CT angiography was useful for confirming the choroidal fissure and the height of the aneurysm in Case 2.

There were no technical difficulties in reaching, dissecting, and clipping the aneurysms in our patients. These results suggest that the present approach is very useful for the treatment of ruptured aneurysms at the P₂-P₃ junction, in particular for surgery in the acute stage associated with packed intraventricular hemorrhage.

References

- 1) Drake CG, Amacher AL: Aneurysms of the posterior cerebral artery. *J Neurosurg* 52: 165-188, 1980
- 2) Ikeda K, Yamashita J, Futami K, Hassan M, Tanaka S: [Surgical indication of the transchoroidal fissure approach for vascular lesions in and around the interpeduncular and ambient cisterns: from a surgical microanatomical study using cadaver]. *Surgery for Cerebral Stroke* 23: 139-144, 1995 [Jpn, with Eng abstract]
- 3) Orita T, Tsurutani T, Kitahara T: P2 aneurysm approached via the temporal horn: technical case report. *Neurosurgery* 41: 972-974, 1997
- 4) Pia HW, Fontana H: Aneurysm of posterior cerebral artery. *Acta Neurochir (Wien)* 47: 3-30, 1979
- 5) Seoane H, Tedeschi E, Rhoton AL Jr: Management strategies for posterior cerebral artery aneurysms: a proposed new surgical classification. *Acta Neurochir (Wien)* 139: 325-331, 1997
- 6) Stein BM: Arteriovenous malformation of the medial cerebral hemisphere and the limbic system. *J Neurosurg* 60: 23-31, 1984
- 7) Sugita K: Proximal posterior cerebral artery aneurysm, in: *Microneurosurgical Atlas*. Berlin, Springer-Verlag, 1985, pp 94-100
- 8) Vishteh AG, Smith KA, McDougall CG, Spetzler RF: Distal posterior cerebral artery revascularization in multimodality management of complex peripheral posterior cerebral artery aneurysms: technical case report. *Neurosurgery* 43: 166-170, 1998

- 9) Waga S, Shimosaka S, Kojima T: Arteriovenous malformation of the lateral ventricle. *J Neurosurg* 63: 185-192, 1985
- 10) Yasargil MG: Pathological contributions, in: *Micro-neurosurgery, vol 1*. Stuttgart, Georg Thieme Verlag, 1984, pp 299-300
- 11) Yasargil MG: Vertebrobasilar aneurysms, in: *Micro-neurosurgery, vol 2*. Stuttgart, Georg Thieme Verlag, 1984, pp 266-267

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