Suboccipital approach for primitive trigeminal artery obliteration associated with cavernous aneurysm: Technical case report.

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Abstract

This 63-year-old woman presented with diplopia due to abducens paralysis. Examination revealed a giant cavernous aneurysm supplied by the internal carotid artery and primitive trigeminal artery (PTA) via vertebrobasilar system. After evaluation of balloon test occlusion at the distal side of the PTA origin, the aneurysm was treated with PTA obliteration through suboccipital route in the lateral position followed by cervical carotid ligation with superficial temporal artery to middle cerebral artery anastomosis in the supine position. The aneurysm was markedly shrunken after the surgery. The PTA obliteration through the retrosigmoid opening can be one of the therapeutic surgical options in a patient with cavernous aneurysm supplied by PTA.

Key words: aneurysm, primitive trigeminal artery, surgery

Introduction

Since cavernous aneurysms are inappropriate for direct clipping or coil embolization [3], the treatment is to exclude the lesion from the blood circulation. Usually, direct parent vessel occlusion at the cervical internal carotid artery directly or endovascular occlusion is a reasonable treatment with or without bypass. [3] However, if cavernous aneurysm has persistent primitive carotid-basilar anastomosis such as primitive trigeminal artery (PTA) at the ipsilateral side, simple ligation is an inadequate treatment because the aneurysm is supplied through PTA from the vertebrobasilar system. In this report, we describe the case of a giant cavernous portion aneurysm with PTA successfully treated with direct obliteration of PTA through the suboccipital route and cervical carotid ligation.

Case report

History and examination. A 63-year-old woman presented with double vision due to the right abducens paralysis. Preoperative magnetic resonance imaging (MRI) revealed a giant aneurysm at the right cavernous sinus (Figure 1). Cerebral angiography showed the cavernous aneurysm associated with a PTA (Figure 1). The PTA arose from the proximal site of the aneurysm (Figure 2). Vertebral angiograms also demonstrated the aneurysm through the PTA without carotid compression (Figure 1). The anterior communicating artery was well demonstrated. Preoperatively, 30-minute balloon test occlusion (BTO) was performed with the Masamune balloon catheter (Fuji Systems, Tokyo, Japan). The balloon catheter was inflated between the origin of the PTA and the proximal neck of the aneurysm. No neurological deficits were noted during BTO. After BTO study, the patient was taken to a radioisotope suite for single photon emission computed tomography under the internal carotid artery occlusion. Cerebral blood flow study under the occlusion demonstrated a normal perfusion with poor vasoreactivity. Therefore, low-flow bypass and proximal ligation were planned to avoid postoperative ischemic complications.

Operation. She underwent proximal ligations of the cervical internal carotid artery and the PTA with superficial temporal artery to middle cerebral artery bypass. Initially, she was placed in the lateral position and a small suboccipital craniotomy was carried out. Its craniotomy corresponded to a craniotomy for microvascular decompression of the trigeminal nerve. With gentle retraction of the right cerebellum, the trigeminal nerve and the petrosal vein were identified (Figure 3). The PTA was located below the trigeminal nerve and the superior cerebellar artery was also seen (Figure 3). The PTA ran into Meckel's cave and it was secured. The titanium clip was applied to the PTA near the Meckel's cave to avoid perforator injuries (Figure 3). The retroauricluar wound was closed. Then, she was replaced in the supine position. The cervical internal carotid artery was ligated in the neck and the superficial temporal artery was anastomosed to the middle cerebral artery.

Postoperative course. Postoperative angiogram on postoperative day 2 showed complete obliteration of the aneurysm (Figure 4). The patient was discharged without new neurological deficits 3 weeks after the surgery and follow-up MRI disclosed remarkable shrinkage of the aneurysm following complete thrombus formation (Figure 4).

Discussion

PTA is the most common persistent carotid-basilar artery anastomosis and is involved in vascular diseases. Cerebral aneurysms associated with PTA have been reported to occur at bifurcations formed by the PTA and internal carotid or basilar artery as well as at other locations.[1, 4] The present aneurysm had no direct relation to PTA. However, the PTA occlusion was necessary to treat the aneurysm because the aneurysm was also fed by the PTA through the vertebrobasilar system. Simple ligation of cervical carotid artery was not sufficient in the present case. In addition, the special balloon catheter was essential to perform BTO at the distal side of the origin of the PTA.[6]

PTA is divided into two groups (medial and lateral types).[4, 7] Medial type of PTA perforates the sella turcica and joins the basilar artery.[4, 7] Lateral type of PTA originates from C4/5 portion and courses along the cavernous sinus, Meckel's cave, and the trigeminal artery.[4] The lateral one gives perforating arteries to the pons.[4, 7, 8] Therefore, a brainstem infarction will occur following an inadequate occlusion of PTA. In the present case, the PTA belonged to the lateral type. Therefore, it was essential that the PTA including surrounding structures was directly observed and the appropriate clip was placed not to damage perforators. In the present case, the proximal occlusions followed by low-flow bypass were performed in the lateral and supine positions. Staged surgery combined with low-flow bypass and endovascular proximal occlusion of ICA including the orifice of the PTA is another treatment option.

Some cases similar to the preset case were reported in the literature.[1, 2, 6] Endovascular parent artery occlusions using detachable balloons[2, 5] or coils[6] are useful for cavernous aneurysm with PTA. However, there may be a risk of clot emboli and perforator occlusion related to PTA occlusion. We selected the lateral suboccipital route to obliterate the PTA under direct observation. This approach is well known and same for microvascular decompression of the trigeminal nerve. It was sufficient to secure the lateral type of PTA with minimum retraction of cerebellum. Successful direct obliteration of PTA was also reported through pterional [9] and subtemporal [1] routes previously. The operative field for PTA through the pterional and subtemporal approaches under cerebrum retraction would be deeper rather than the present lateral suboccipital approach under cerebellum retraction. In addition, the PTA was located in the posterior fossa and it was easily accessed through a suboccipital approach. Although a long segment of PTA can be seen through a suboccipital craniotomy comparing with other two routes, the present procedures were needed to change the patient position and surgical field. After the exact location of PTA and surrounding structures are evaluated with preoperative MRI and three-dimensional computed tomography angiography, an appropriate surgical route including endovascular one should be selected.

In this report, we described the successful treatment case of cavernous aneurysm with PTA obliterated through retromastoid opening. There have been no reports on the suboccipital approach for PTA exposure in the literature. Since the course of PTA depends on individuals, appropriate approach route for PTA should be selected based on preoperative neuroimagings.

Figure legends

Figure 1: Preoperative magnetic resonance imaging (A) and right internal carotid artery (ICA) angiogram (B; anteroposterior view) showing right cavernous aneurysm. Preoperative right vertebral angiograms (C; anteroposterior view) showing the aneurysm fed by primitive trigeminal artery (PTA; arrow) through posterior circulation.

Figure 2: A: Three-dimensional computed tomography angiography demonstrating the location of PTA (arrow), aneurysm (asterisk), and proximal ICA (arrowhead). B: Schema representing the relationship between the aneurysm (asterisk) and surrounding vessels. ACA: anterior cerebral artery, BA: basilar artery, MCA: middle cerebral artery, PCA: posterior cerebral artery, SCA: superior cerebellar artery

Figure 3: Intraoperative photographs (A: before clipping, B: after clipping). Asterisk: PTA, V: trigeminal nerve.

Figure 4: Postoperative anteroposterior angiograms (A: the right carotid injection, B: the right vertebral injection, C: the left carotid injection) on postoperative day 2 demonstrating complete obliteration of the aneurysm. Arrow indicates the patency of anastomoosis. Magnetic resonance imaging 15 months after surgery (D) showing the marked shrinkage of the aneurysm.

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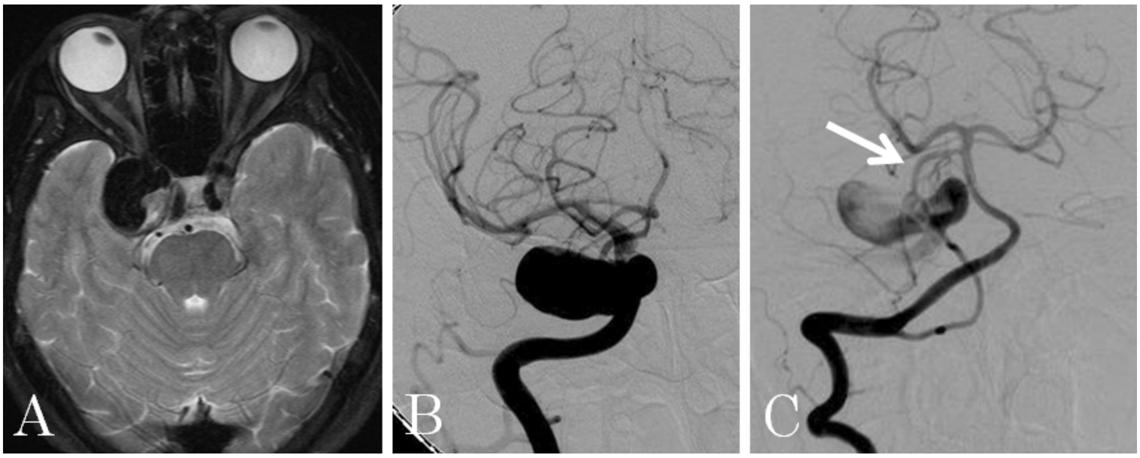

Figure 1

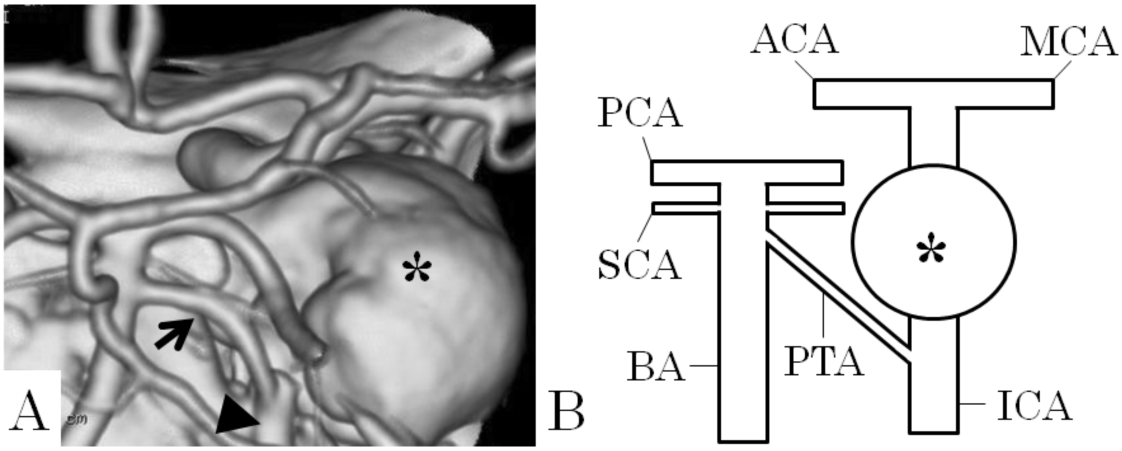

Figure 2

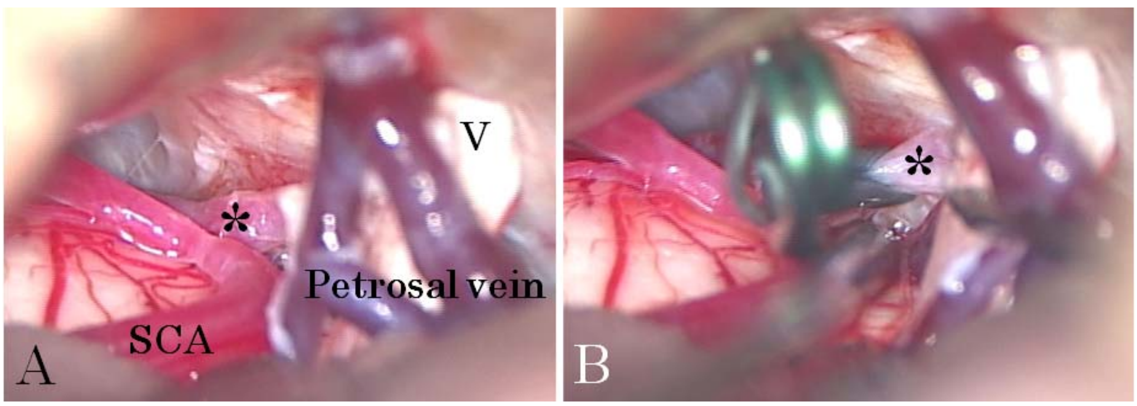

Figure 3

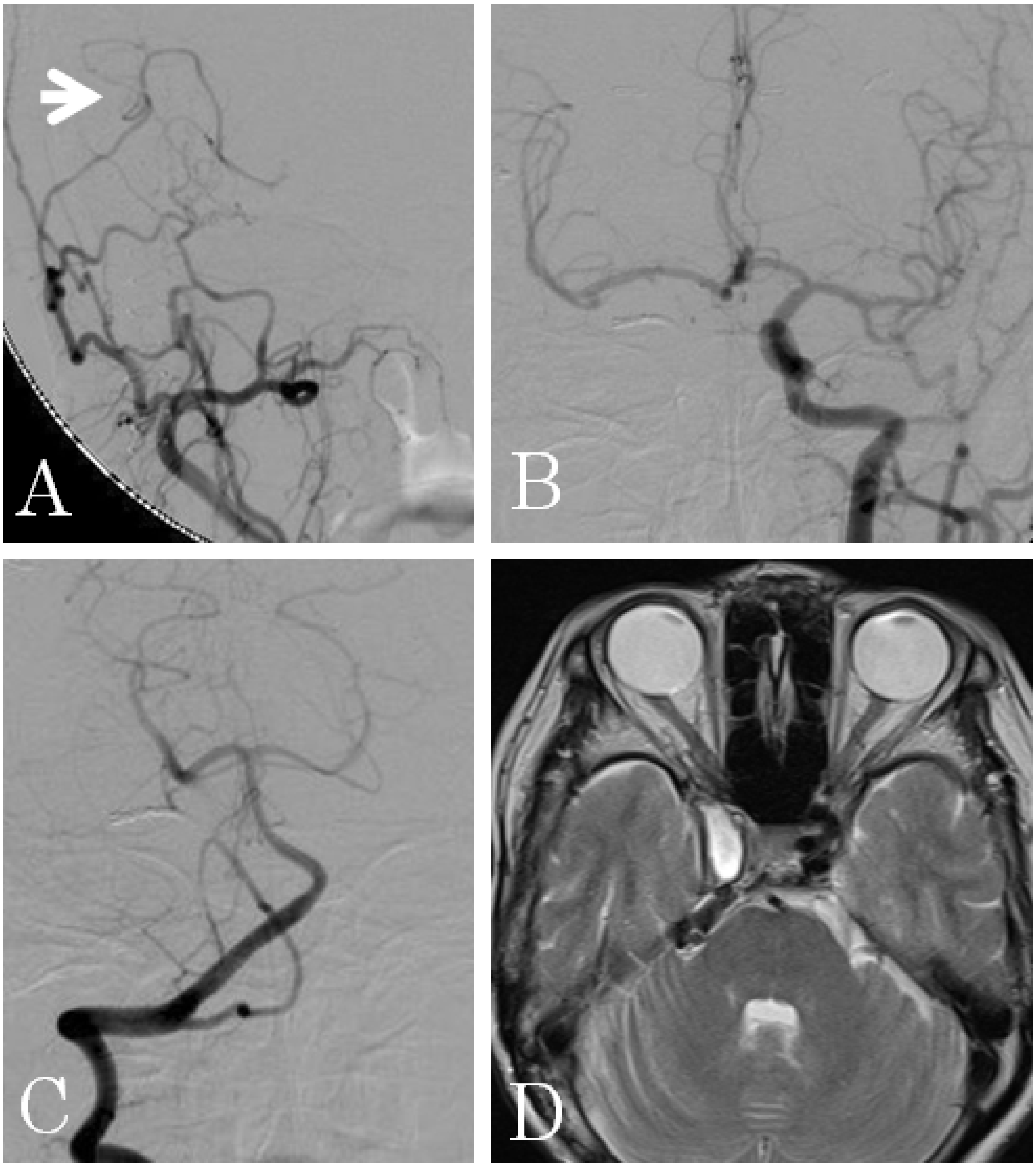

Figure 4