Case Report

Suction Decompression during Anterior Clinoidectomy for Direct Clipping of Paraclinoid Aneurysm Involving the Anterior Clinoid Process

Abstract

Surgical clipping of paraclinoid aneurysms involving the anterior clinoid process (ACP) can present great challenges because strong adhesion may hinder dissection of the surrounding anatomical structures from the aneurysm dome. On the other hand, retrograde suction decompression (RSD) through direct puncture of the common carotid artery is a useful adjunct technique for clipping of these aneurysms. The present case illustrates that direct clipping of paraclinoid aneurysms involving the ACP can be achieved safely and less invasively using RSD during anterior clinoidectomy. Postoperatively, her clinical course was uneventful. RSD is a useful technique during anterior clinoidectomy in direct clipping of paraclinoid aneurysms involving the ACP.

Keywords: *Anterior clinoidectomy, microneurosurgery, paraclinoid aneurysm, suction decompression*

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Introduction

Microsurgical treatment for paraclinoid aneurysms continues to pose severe challenges to vascular neurosurgeons because proximal control of the parent artery and obtaining adequate visualization of the aneurysm neck are very difficult due to its particular location.[1] Therefore, anterior clinoidectomy is an essential surgical technique for complete clipping of these aneurysms.[2,3] However, anterior clinoidectomy for paraclinoid aneurysm involving the anterior clinoid process (ACP) also presents great challenges.

On the other hand, microsurgical treatment of paraclinoid aneurysms often requires the use of the retrograde suction decompression (RSD) technique to facilitate safe and complete clipping.[1,4-6] RSD provides adequate relaxation of the aneurysm dome, enabling the surgeon to fully dissect the aneurysmal complex from the surrounding structures such as optic apparatus and dura matter, and allowing adequate visualization of the aneurysm neck and reconstruction of the parent artery. We present our experience using RSD through direct puncture of the common carotid artery (CCA) during anterior clinoidectomy for the clipping of paraclinoid aneurysms involving the ACP to achieve proximal internal carotid artery (ICA) control and safe drilling of the ACP.

Case Report

A 60-year-old woman was admitted to our hospital following an episode of retro-orbital pain. Magnetic resonance angiography showed an aneurysmal lesion at the ophthalmic segment of the ICA. Three-dimensional computed tomography (CT) angiography (3D-CTA) and digital subtraction angiography revealed a right ophthalmic artery bifurcation aneurysm, 10 mm in size, which involved the ACP [Figure 1a and b]. Bone CT revealed the half of the right ACP was eroded by the aneurysmal dome. Preoperative visual field examination revealed no deficit.

Surgical procedure

After induction of general anesthesia, spinal drainage was instituted just before positioning for surgery to avoid postoperative cerebrospinal fluid leakage and to ensure adequate brain relaxation to obtain full exposure of the epidural space in the extradural surgical procedure. Continuous intraoperative monitoring by transcranial motor-evoked potential (MEP) was performed. The patient was placed in the supine position, and the head was

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rotated away from the operative side at about 30°. The neck was slightly extended to facilitate exposure of the cervical carotid artery. A semicoronal skin incision was performed followed by interfascial dissection. A parietal branch of the superficial temporal artery was spared for reconstructive bypass surgery if needed. A standard frontotemporal craniotomy was performed up to the supraorbital notch, and the temporal squama was rongeured out until the floor of the middle cranial fossa was exposed [Figure 2d]. The lesser wing of the sphenoid was flattened until the meningo-orbital band was exposed. Peeling of the dura propria was started from the lateral wall of the superior orbital fissure and continued until the ACP was totally exposed epidurally. Simultaneously, the cervical CCA, ICA, and external carotid artery (ECA) were exposed for proximal control and RSD. The CCA was punctured using a 20-gauge needle just before RSD [Figure 2]. The dura mater was opened along the sylvian fissure and continued inferomedially to the level of the optic nerve. The sylvian fissure was widely opened for minimal retraction of the frontal lobe to expose the ICA and the optic nerve. The posterior communicating artery, anterior choroidal artery (AchoA), and their branches are also identified. The intradural part of the intracranial was fully secured for the trapping of the IC. We usually perform the extradural anterior clinoidectomy with drill and micropunch. On the other hand, we usually perform intradural anterior clinoidectomy using the ultrasonic bone curette (Sonopet) instrument (Stryker, Kalamazoo, MI, USA). The aneurysm was temporarily trapped by putting a temporal clip on the IC ICA distal to the aneurysm neck with special attention to spare the AchoA, followed by clamping of the CCA and ECA. Blood is aspirated through the catheter introduced into the cervical ICA, resulting in the collapse of the aneurysmal dome and therefore enabling the surgeon to complete dissection [Figure 2]. Thereafter, drilling of the lateral sphenoid bone was started with using the coarse burr 6 mm in diameter [Figure 2a], then the drilling of the ACP using the coarse burr 4 mm in diameter until the optic canal was partially opened and the dome of the aneurysm within the ACP was partially exposed [Figures 2a and 3a]. The optic canal was widely opened using a micropunch. The RSD was repeated through the catheter placed in the cervical IC until the dome in the ACP was fully decompressed [Figures 2b and 3b]. In addition, the optic strut was removed little by little using a high-speed diamond drill in 2 mm diameter and micropunch during RSD [Figures 2c and 3c]. The each occlusion time was limited to within 5 min and followed by 5 min of reperfusion under transcranial MEP monitoring. These procedures were repeated until the ACP was completely

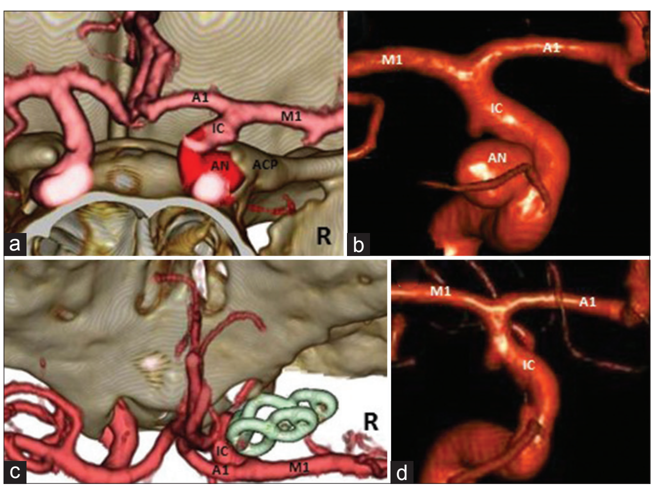

Figure 1: A 60-year-old woman was admitted to our hospital following an episode of retro-orbital pain. Three-dimensional digital subtraction angiography showed a right ophthalmic artery bifurcation aneurysm, 10 mm in size (b). Three-dimensional computed tomography angiography revealed that this aneurysm involved the anterior clinoid process (a). Postoperative three-dimensional computed tomography angiography showed that complete clipping was achieved (c and d). Postoperative course was uneventful. AN – Aneurysm; ACP – Anterior clinoid process

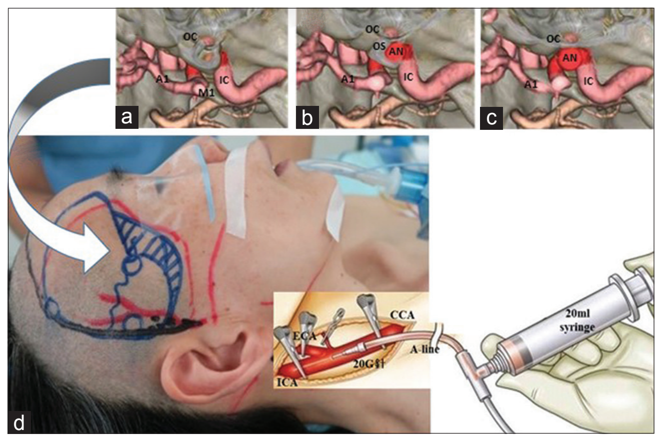

Figure 2: Illustration showing the surgical procedure. The patient was placed in the supine position, and the head was rotated away from the operative side at about 30°. A standard frontotemporal craniotomy was performed up to the supraorbital notch (d). Simultaneously, the cervical common carotid artery, internal carotid artery, and external carotid artery were exposed for proximal control and retrograde suction decompression. The common carotid artery was punctured using a 20-gauge needle just before retrograde suction decompression. The dura mater was opened along the sylvian fissure, and the sylvian fissure was widely opened. The intradural part of the intracranial was fully secured for the trapping of the intracranial. The aneurysm was temporary trapped by putting a temporal clip on the intracranial internal carotid artery distal to the aneurysm neck, followed by clamping of the common carotid artery and external carotid artery. Blood is aspirated through the catheter introduced into the cervical internal carotid artery, resulting in the collapse of the aneurysmal dome and therefore enabling the surgeon to complete dissection. Thereafter, drilling of the lateral sphenoid bone was started with using the coarse burr 6 mm in diameter (a), then the drilling of the anterior clinoid process using the coarse burr 4 mm in diameter until the optic canal was partially opened and the dome of the aneurysm within the anterior clinoid process was partially exposed (b). The retrograde suction decompression was repeated through the catheter placed in the cervical intracranial until the dome in the anterior clinoid process was fully decompressed. In addition, the optic strut was removed little by little using a high-speed diamond drill in 2 mm diameter and micropunch during retrograde suction decompression (c). These procedures were repeated until the anterior clinoid process was completely removed from the aneurysmal dome (c). ICA – Internal carotid artery; ECA – External carotid artery; CCA – Common carotid artery; A-line – Artery line; OC – Optic canal; OS – Optic strut; AN – Aneurysm

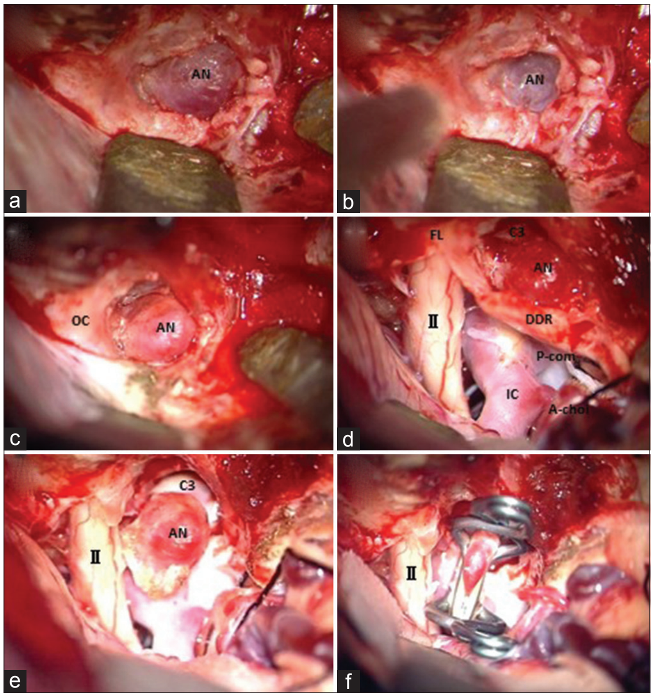

Figure 3: Intraoperative photographs during anterior clinoidectomy under retrograde suction decompression. The retrograde suction decompression was started through the catheter placed in the cervical intracranial and the dome within the anterior clinoid process was fully decompressed (a and b). These procedures were repeated until the anterior clinoid process was completely removed from the aneurysmal dome (c). An incision from the falciform ligament to the optic sheath was useful to mobilize the optic nerve (d). An additional incision was made in the distal dural ring to expose and identify the origin of the ophthalmic artery and to mobilize the internal carotid artery, exposing the proximal clinoid segment (C3) of the internal carotid artery (d). Thereafter, the aneurysm was detached from the distal dural ring using retrograde suction decompression again (e), and clipped after shrinkage of the aneurysm dome under repeated retrograde suction decompression (f). OC – Optic canal; AN – Aneurysm; DDR – Distal dural ring; FL – Falciform ligament; II – Optic nerve

removed from the aneurysmal dome [Figure 2c]. An incision from the falciform ligament to the optic sheath was useful to mobilize the optic nerve [Figure 3d]. An additional incision was made in the distal dural ring (DDR) to expose and identify the origin of the ophthalmic artery and to mobilize the ICA, exposing the proximal clinoid segment (C3) of the ICA. Thereafter, the aneurysm was detached from the DDR using RSD again [Figure 3e] and clipped after shrinkage of the aneurysm dome under repeated RSD [Figure 3f]. Indocyanine green angiography confirmed complete clipping of the aneurysm and preservation of the parent artery and ophthalmic artery. Postoperative 3D-CTA showed no remarkable abnormality and achieved complete clipping [Figure 1c and 1d]. Postoperative course was uneventful.

Discussion

Paraclinoid aneurysms are surrounded by many important osseous and neurovascular structures, which continue to present great difficulties in achieving proximal control of the parent artery and obtaining adequate visualization of the aneurysm neck because of adhesion to surrounding anatomical components.[1,7,8] Therefore, anterior clinoidectomy and dissection of the neurovascular components from the aneurysm dome are the key steps to safe and successful clipping surgery for these aneurysms. In addition, there are great difficulties and high risk for direct clipping with anterior clinoidectomy of paraclinoid aneurysms involving the ACP. The RSD technique provides adequate relaxation of the aneurysm dome enabling complete dissection of the aneurysm from the surrounding important neurovascular structures.[1,4-6] Furthermore, we demonstrated RSD which facilitated the safe ACP removal in the case of IC paraclinoid aneurysm involving the ACP. We herein recommend that the RSD could be used during anterior clinoidectomy in direct clipping of the paraclinoid aneurysm involving the ACP.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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