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Operative Technique

A trapping-evacuation technique for giant carotid-ophthalmic segment aneurysm clipping in a hybrid operating theater

Peng Hu, Hong-Qi Zhang *, Gui-Lin Li, Chuan He, Li-Song Bian, Xing-Long Zhi, Feng Ling

Neurosurgery Department, Xuanwu Hospital, 45 Changchun Street, Xicheng District, Beijing 100054, China

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ABSTRACT

It is essential to collapse giant carotid-ophthalmic (OA) segment aneurysms for successful microsurgical clipping. We present a trapping-evacuation technique utilising hybrid operating theater capabilities to soften OA aneurysms. The patients were prepared for both microsurgical and endovascular procedures. After the majority of the aneurysm was exposed, a balloon was placed at the orifice of the aneurysm to fully block the blood flow. When the balloon was inflated, blood was evacuated from the aneurysm sac to eliminate the space occupying effect. Subsequently, the aneurysm neck was clearly exposed which greatly facilitated clip placement. A control angiogram was obtained prior to closing the wound to ensure complete aneurysm obliteration. After the establishment of a hybrid operating theater in our hospital, two aneurysms were successfully clipped using this technique. Although postoperative complications occurred in both patients, none of the events were related to the endovascular procedure or the trapping-evacuation technique. As a well-organized procedure designed for use in a hybrid operating theater, the current trapping-evacuation technique is an option for the surgical clipping of giant OA aneurysms.

1. Introduction

The clipping of giant carotid-opthalmic segment (OA) aneurysms is challenging and technically demanding [4,6,11,13,14]. The proximal location adjacent to the skull base and cavernous sinus, close relationship with the optic nerves and poor visualization of the aneurysm neck increase the difficulty of the operation. Originating from the development of skull base techniques, anterior clinoid process drilling and unroofing of the optic canal are well-established techniques for sufficiently exposing giant OA aneurysms [7,9]. However, the techniques for proximal carotid artery control and aneurysm collapsing continue to evolve with aim to make the trapping-evacuation method more simple and efficient [1,3,8,15,16].

The authors utilized a modified trapping-evacuation procedure utilizing the capabilities of a hybrid operating suite to clip giant OA aneurysms. The established procedures, detailed protocols and initial results are presented in the current report.

2. Methods

The surgery protocols were approved by the hospital's Ethics Committee. Patient consent forms were signed prior to the operation. The hybrid operating theater was equipped with an Artis Zeego III (Siemens, Munich, Germany) and its associated workstation and an OPMI Pentero Microscope (Carl Zeiss Surgical, Oberkochen, Germany) as well as other equipment common to typical operating rooms. Two giant OA aneurysms that were treated using this technique are described here to document the organization of the procedure and detailed techniques.

2.1. Procedure organization and operative techniques

After the administration of general anesthesia, the patient was placed supine with the head turned 30° toward the contralateral side to the aneurysm. Both the scalp and the right groin area were sterilely prepared and draped for access for the craniotomy and endovascular procedures. A 45 cm 6F Epsylar introducer sheath (OptiMed, Ettlingen, Germany) was subsequently placed into the right common femoral artery. A modified pterional craniotomy was performed as previously reported by our group [12]. After cerebrospinal fluid (CSF) release, an extradural clinoidectomy and optic canal unroofing were performed with a high speed diamond

* Corresponding author. Tel.: +86 1083198836.
E-mail address: xwzhanghq@163.com (H.-Q. Zhang).

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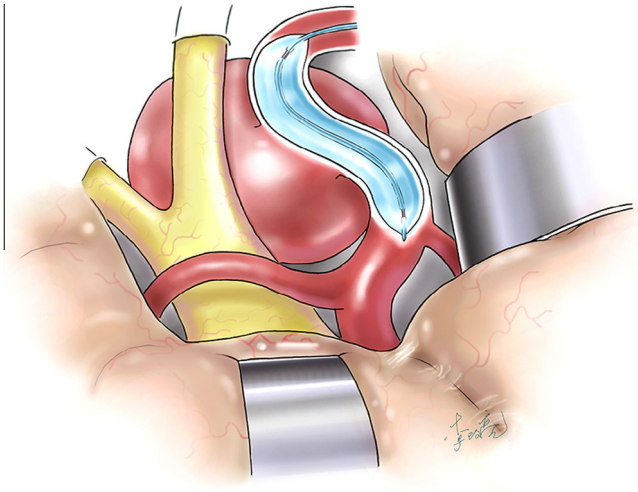

Fig. 1. This drawing illustrates the modified aneurysm blocking technique. After the aneurysm was sufficiently exposed, the balloon (blue) was inflated, and blood was evacuated from the aneurysm.

drill following the techniques described by Sebastien et al. [9]. The Sylvian fissure and the distal carotid dural ring were fully dissected to sufficiently expose the aneurysm. Next, the operation concentrated on the endovascular procedure which was initiated via the evacuation of the thrombus within the introducer sheath. Two lines of continuous saline irrigation were each connected to the common femoral artery introducer sheath and an 6F guiding catheter (Cordis, Bridgewater, NJ, USA). The guiding catheter irrigation solution was composed of a mixture of 3000 units of heparin and 1000 ml of saline to eliminate the formation of thrombosis within the carotid artery system. The guiding catheter was placed in the common carotid artery. A 4×20 mm Scepter C balloon catheter (MicroVention, Aliso Viejo, CA, USA) was inserted into the internal carotid artery (ICA) under the guidance of a Traxcess 14 microwire (Microvention). The balloon was placed at the orifice of the aneurysm and temporarily inflated to determine the injection volume that could entirely block the ICA blood flow (Fig. 1). A butterfly-type venous needle was prepared, by removal of the bilateral wings, to evacuate the blood within the aneurysm. After all preparations were performed, the microscope was moved into place to initiate aneurysm clipping. The balloon was completely inflated with the contrast agent which was mixed with dye. Using this method, the balloon inflation process could be adequately visualized under the microscope. Aneurysm blood evacuation was subsequently performed with the prepared needle. Finally, the aneurysm neck could be adequately viewed and clipped followed by balloon deflation.

3. Case report

3.1. Patient 1

A 47-year-old woman experienced deterioration in right side vision for 6 months prior to admission. The preoperative visual testing indicated blindness on the right side, whereas the left side remained normal. A 26.5 mm OA aneurysm was identified on the right side with a neck that measured 7 mm (Fig. 2A). The aneurysm was clipped in the hybrid operating theater using the techniques previously described. The patient was sent to the intensive care unit for postoperative recovery. During the surgery, the aneurysm was found to occupy the subarachnoid space around the right ICA and optic nerve. The right optic nerve was significantly shifted superomedially (Fig. 2B). The proximal margin of the aneurysm neck could be identified after the dissection of the distal dural ring (Fig. 2B). The blood flow into the aneurysm was completely arrested following balloon inflation (Fig. 2C). Finally, the aneurysm was successfully obliterated without compromising the parent artery (Fig. 2D). The occlusion time was 4 min. This patient experienced CSF rhinorrhea which was surgically repaired after 2 weeks of failed conservative treatment. The postoperative visual testing indicated no change on the left side.

3.2. Patient 2

A 48-year-old woman experienced headaches and vomiting for 15 days prior to admission. No evidence of a subarachnoid hemorrhage was identified. The physical examination indicated that her left visual acuity was decreased to 0.2 and her right visual acuity was decreased to 0.4. There was a field deficit in her left superior temporal visual field. A 26.2 mm giant OA aneurysm with a neck that measured 7 mm was identified on the left side (Fig. 3A). A decision was made to clip the giant left OA aneurysm using the previously described techniques. The aneurysm exhibited a significant space occupying effect of the subarachnoid space (Fig. 3B). The proximal aneurysm neck could be identified after the dissection of the distal dural ring (Fig. 3B). After inflation of the balloon

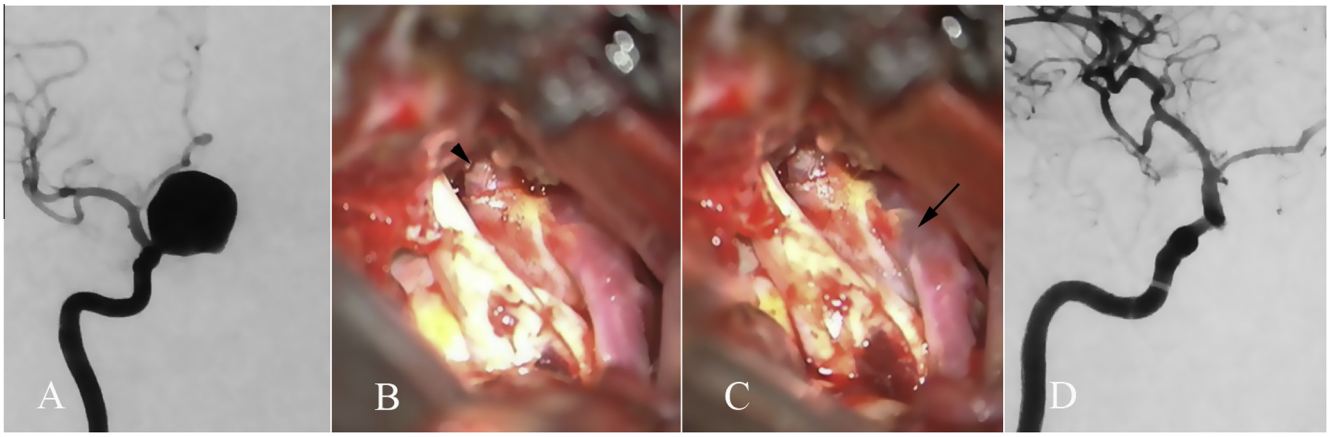

Fig. 2. Images and intraoperative views from Patient 1. (A) Preoperative internal carotid angiogram indicates a giant right carotid-ophthalmic segment aneurysm. (B) Intraoperative view indicates that the aneurysm has been sufficiently exposed. The arrowhead indicates that the distal dural ring has been dissected to expose the proximal neck of the aneurysm. (C) Intraoperative view indicates that the balloon has been fully inflated. The arrow points to the transparent view of the inflated balloon. (D) Intraoperative internal carotid angiogram indicates that the aneurysm has been successfully obliterated without compromising the parent artery.