The Occipital Artery as an Alternative Donor for Low-Flow Bypass to Anterior Circulation After Internal Carotid Artery Occlusion Failure prior to Exenteration for an Atypical Cavernous Sinus Meningioma

Shunya Hanakita[1], Stéphanie Lenck[2], Moujahed Labidi[1], Kentaro Watanabe[1], Damien Bresson[1], Sébastien Froelich[1]

■ BACKGROUND: **In skull base tumors involving the cavernous sinus, indications for aggressive resection are sparse and must be carefully examined because of their invasiveness. With careful evaluation, techniques including internal carotid artery sacrifice with or without extracranial-intracranial bypass may still be an option in some cases. Moreover, previous surgery with the sacrifice of potential donor vessels requires adjusting the revascularization strategy. We describe an occipital artery–middle cerebral artery bypass before skull base tumor resection.**

■ CASE DESCRIPTION: **A 47-year-old woman with a recurrent cavernous sinus meningioma was referred to our department. Because of tumor recurrence after radiotherapy and its rapid progression, radical resection, including part of the cavernous sinus, was planned. A balloon test occlusion was performed and showed good tolerance. An endovascular internal carotid artery occlusion was performed. The patient eventually experienced motor deficits and aphasia after surgery. Therefore, bypass surgery using an occipital artery–middle cerebral artery anastomosis was performed. The patient showed no exacerbation of symptoms after bypass surgery and subsequently underwent tumor resection.**

■ CONCLUSIONS: **The reliability of balloon test occlusion in the management of giant aneurysms may not be similarly applicable to skull base tumors. If hypoperfusion symptoms occur after occlusion of the internal carotid artery, a surgical revascularization procedure should be considered because of the risk of ischemic stroke following tumor resection. For patients whose superficial temporal artery is not available, the occipital artery can be a valuable alternative donor for low-flow bypass.**

INTRODUCTION

Meningiomas in the cavernous sinus (CS) often involve the internal carotid artery (ICA). In some cerebrovascular pathologies and in complex skull base tumors, a balloon test occlusion (BTO) may be indicated, and it is considered a reliable method to evaluate the neurologic risks of ICA sacrifice.[1,2] Recently, we encountered a case of recurrent atypical skull base meningioma wherein the negative predictive value of the BTO was insufficient. With the BTO revealing good tolerance, an endovascular ICA occlusion was performed (first procedure); however, the patient presented with hemodynamic ischemic events within 2 weeks of the occlusion. To reduce the risk of major perioperative ischemic complications during or after tumor resection, we performed surgical revascularization (second procedure). As the superficial temporal artery (STA) had been occluded during the previous craniotomy, an extracranial-intracranial (EC-IC) bypass was required. To prevent the need of an interposition graft that would have required 2 anastomoses and would have increased the risk of morbidity at the level of the donor vessel site, we performed a bypass from the occipital artery (OA) to the middle cerebral artery (MCA) (second procedure). Following this operation and a period of hemodynamic adjustment, the patient subsequently underwent tumor resection (third

Key words
- BTO
- EC-IC bypass
- OA-MCA bypass

Abbreviations and Acronyms
BTO: Balloon test occlusion
CS: Cavernous sinus
EC-IC: Extracranial-intracranial
ICA: Internal carotid artery
MCA: Middle cerebral artery
MRI: Magnetic resonance imaging
OA: Occipital artery
OphA: Ophthalmic artery

From the Departments of [1]Neurosurgery and [2]Neuroradiology, Lariboisière Hospital, University of Paris Diderot, Paris, France

To whom correspondence should be addressed: Sébastien Froelich, M.D. [E-mail: sebastien.froelich@aphp.fr]

Citation: World Neurosurg. (2018) 109:10-17.
https://doi.org/10.1016/j.wneu.2017.08.181

*Journal homepage: **www.WORLDNEUROSURGERY.org***

*Available online: **www.sciencedirect.com***

1878-8750/$ - see front matter

procedure) and had an uneventful postoperative course. We report this case of a CS atypical meningioma invading the CS with emphasis on the technical aspects of the OA-MCA bypass. We also discuss the reliability of BTO in the treatment of skull base tumors.

CASE PRESENTATION

History and Examination

A 47-year-old woman initially underwent resection of a left sphenoid meningioma with large extension to the CS at another institution. The histopathologic diagnosis was a World Health Organization grade I meningioma, and the residual tumor inside the cavernous portion was treated with fractionated radiotherapy at 50 Gy/25 fractions. The residual tumor had enlarged 3 years later, and the patient experienced a rapidly progressive decrease in visual acuity, ophthalmoplegia, and V1 anesthesia. She was referred to our department for further treatment. Because the tumor recurred only a few years after radiation therapy, the tumor was deemed more aggressive. Thus, a radical resection including the CS was considered. As the tumor involved the ICA and as functional use of the left eye was lost with complete third nerve palsy, we attempted an endovascular occlusion of the ICA to allow for radical resection of the cavernous portion of the tumor and CS exenteration (Figure 1). Written informed consent of treatment was obtained from the patient before further treatment.

Endovascular Procedure

Angiography was performed under local anesthesia. BTO was performed with inflation of the balloon into the petrous portion of the ICA. Mean blood pressure was 70 mm Hg and was pharmacologically decreased to 65 mm Hg with administration of nicardipine 1 mg. The patient was clinically monitored for 10 minutes before balloon deflation. Conventional angiography was then performed with injection of the right ICA when the

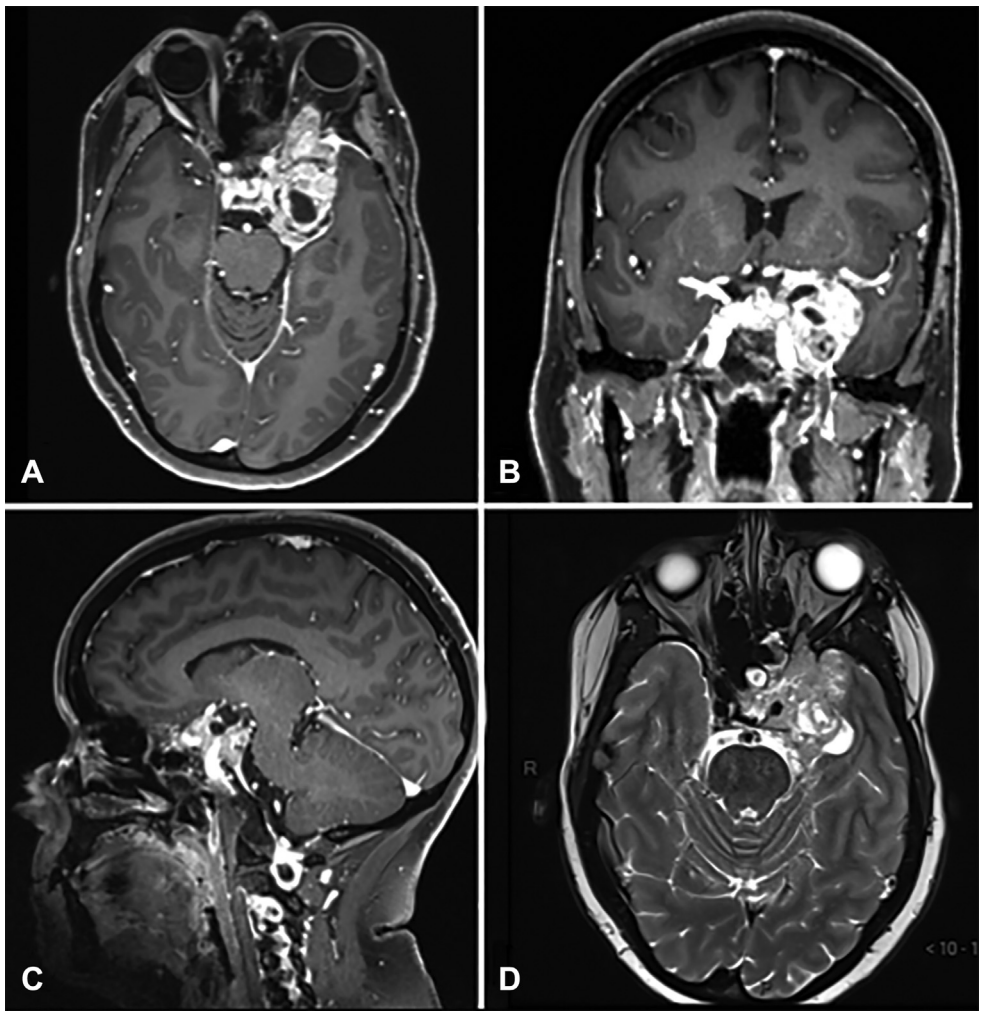

Figure 1. Preoperative T1-weighted gadolinium-enhanced axial (**A**), coronal (**B**), and sagittal (**C**) and T2-weighted axial (**D**) magnetic resonance imaging showing recurrence of a cavernous sinus meningioma extending into the orbit.