Received: 24 November 2020 | Revised: 19 February 2021 | Accepted: 27 March 2021

DOI: 10.1002/ccr3.4277

CASE REPORT

Clinical Case Reports Open Access WILEY

Devastating iatrogenic internal carotid artery rupture in endoscopic endonasal surgery rescued by a covered stent

Xiaojie Fu | **Tao Quan** | **Yongjie Yuan** | **Haowen Xu** | **Sheng Guan**

Department of Neurointerventional Radiology, First Affiliated Hospital of Zhengzhou University, Zhengzhou, China

Correspondence
Haowen Xu, Prof. Sheng Guan, Department of Neurointerventional Radiology, First Affiliated Hospital of Zhengzhou University, Jianshe Road 1, Zhengzhou, China.
Emails: neuron@126.com (HX), gsradio@126.com (SG)

Abstract

Iatrogenic ICA injury is a life-threatening and underreported complication of EES. For selected patients, covered stent implantation is the best and only way to block the rupture spot immediately and maintain ICA blood flow.

KEYWORDS

covered stent, EES complication, ICA rupture

1 | INTRODUCTION

This paper reported a case of devastating iatrogenic ICA rupture in endoscopic endonasal surgery (EES) rescued by a covered stent. We also discussed the therapeutic strategies of iatrogenic ICA rupture in EES, which is of help in the management of this devastating complication.

Endoscopic endonasal surgery (EES) is a minimally invasive and efficient surgical technique that has been widely used for pituitary tumors. Iatrogenic internal carotid artery (ICA) injury accounts for 0.3% of all listed complications but is the most feared and devastating EES in pituitary tumor resections. In this paper, we report a case of disastrous ICA rupture during EES for a pituitary tumor that was rescued by a covered stent.

2 | CASE PRESENTATION

A 76-year-old man presented with frequent attacks of dizziness and blurred vision for over 1 month. CT image in local hospital indicated possible sellar tumor. Enhanced MRI revealed 30 × 13 × 16 mm macroadenoma (Figure 1A). Laboratory tests of hormone revealed a nonfunctioning adenoma. The patient had EES to remove the pituitary adenoma under general anesthesia. The surgeons encountered serious internal carotid artery rupture while opening the upper sellar floor. The immediate nasal packing stopped the extravasation of blood significantly and make it possible to transfer the patient to hybrid operating room quickly.

Emergency cerebral angiography showed no local abnormal vessels, extravasation of the contrast medium, or pseudoaneurysm in the intracranial segment of the left internal carotid artery. To save time, we assessed the intracranial collateral circulation by compressing the left common artery and found that the anterior communicating artery (AcoA) and posterior communicating artery (PcoA) of the left ICA were poorly developed, indicating that occluding the left ICA might cause serious neurological symptoms. After multidisciplinary consultation, we concluded that ICA-covered stent deployment was the best and only way to stop the disastrous bleeding and save the left ICA at the same time. Such conditions put the patient into a dilemma: the nasal packing had to be removed to reveal the rupture spot, but this could cause life-threatening bleeding. An 8F guiding catheter was positioned at the C1 segment of the ICA, and the Willis covered stent system (4.5 mm × 16 mm in size, MicroPort Scientific Corporation) was positioned over the microwire

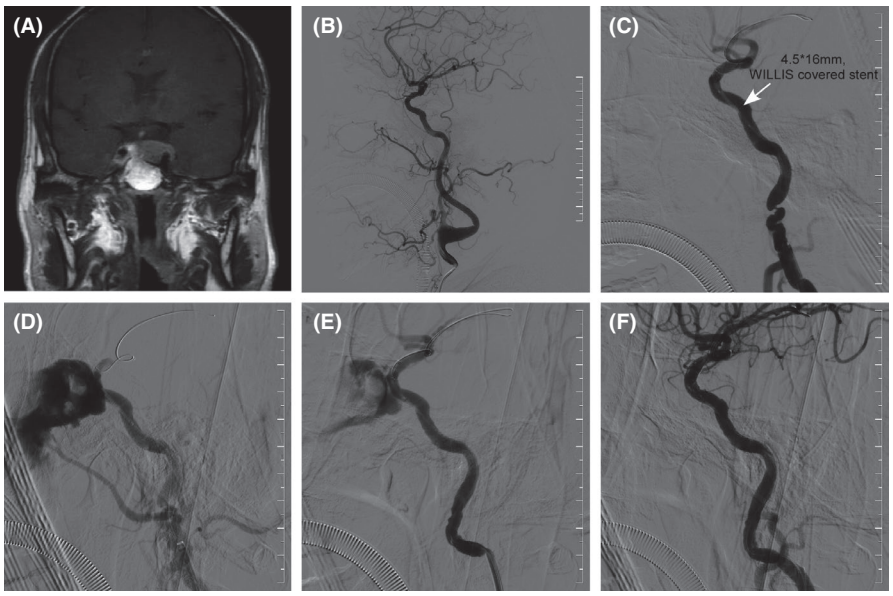

FIGURE 1 Endovascular procedure in the treatment of iatrogenic ICA rupture in EES A, Coronal T1-weighted sequence of MRI revealed 30 × 13 × 16 mm macroadenoma that had eroded into bilateral sphenoid sinus. B, Cerebral angiography of the left ICA. C, The Willis covered stent (4.5 mm × 16 mm) was positioned. D, The ICA rupture spot was revealed. E, The stent position was rapidly released. F, Iatrogenic ICA injury was occluded

at the cavernous sinus segment of the left ICA (Figure 1C). Subsequently, the hemostatic brain cotton was gently pulled out under endoscopy. As the cottons were removed, the bleeding became more serious, and the stent position was rapidly adjusted to cover the ruptured spot. We released the stent with balloon inflation within 20 seconds (Figure 1E). ICA angiography demonstrated that the iatrogenic carotid cavernous fistula was successfully occluded (Figure 1F). A loading dose of dual antiplatelet therapy (300 mg aspirin and 300 mg Plavix) was administered after the procedure. The patient lost over 4000 ml blood and received 8500 mL fluid during the whole surgery. The patient showed no obvious symptoms after recovery from anesthesia revival and was discharged without neurological deficits 9 days after the surgery. The patient was instructed to take 100 mg aspirin daily for at least 1 year and 75 mg clopidogrel daily for 6 months.

3 | DISCUSSION

Iatrogenic injury of the ICA is the most dangerous and underreported complication of EES. The reported ICA injury incidence in EES for pituitary surgery remains low, but a study from 1998 found that 50% of neurosurgeons experienced ICA injury during EES for pituitary pathologies, whereas the percentage dropped to 20% in 2017,[1,2] which indicates that ICA injury in EES is underreported.

Once ICA injury occurs, hemostasis should be immediately applied. Nasal packing is the most used method. Surgical ligation of the ICA or direct vessel closure is time-consuming, can block access to potential interventional procedures, and is not available if the bleeding is uncontrolled. The endovascular method has become the most common treatment for ICA injuries in EES[1] : ICA occlusion, [2] ICA rupture embolization (with or without stent assistance), and [3] ICA reconstruction.[3] If the ICA is about to be occluded by a balloon or coil, the collateral circulation should be fully assessed to avoid permanent serious stroke. However, since patients undergo EES under general anesthesia, the angiographic conclusions drawn from the balloon occlusion test (BOT) may not reflect possible neurologic deficit.[3] ICA occlusion should be carefully applied in patients who [1] have good collateral circulation (such as AcoA or PcoA collateral flow), [2] have devastating uncontrolled bleeding, [3] have intrinsically curved ICA anatomy or important artery branches near the ICA lesion (not suitable for covered stent deployment), and [4] are not indicated to receive subsequent antiplatelet therapy.

ICA rupture embolization has been reported in patients [1] with controlled bleeding, [2] with poor collateral circulation, and [3] whose ICA lesions are extravasation, carotid cavernous fistula (CCF), or pseudoaneurysm. Such patients can receive selective ICA rupture embolization surgery days or weeks after EES. The embolic materials include coils, onyxes, and balloons, with or without stents.[3] Single coiling can avoid subsequent antiplatelet therapy and seems to be an appropriate therapy in selected patients. However, this method has a potential risk of rebleeding, has a high recurrence rate, and may need a second surgery with stent assistance.

ICA reconstruction can block ICA rupture and maintain ICA blood flow. The most commonly used reconstruction systems are pipeline embolization device (PED) [4] and covered stents.[5] PED is the most reported flow diverter used in ICA rupture during EES, especially for patients with controlled bleeding, poor collateral circulation, or ICA pseudoaneurysm. PED has many advantages over covered stents[1] : it is more suitable for intracranial navigation, [2] it is more flexible in intrinsically curved anatomy, and [3] it is available in patients whose ICA lesions are located at important artery branches. Covered stents can be used in uncontrolled

bleeding, can block ICA rupture immediately, have a lower rebleeding risk than PED, but can only be used in selected patients due to the stiffness of the system. Both PED and covered stent deployment necessitate months of dual antiplatelet therapy and may preclude further tumor resection.

In conclusion, this case suggests that covered stent deployment is an effective method to treat life-threatening ICA rupture during EES in selected patients. Multiple factors should be considered to choose the best endovascular treatment.

ACKNOWLEDGMENTS

We would like to thank Yoyo Wang for assistance in collecting literature with this manuscript.

CONFLICT OF INTEREST

None declared.

AUTHOR CONTRIBUTIONS

XF and HX: performed the surgery and wrote the manuscript. TQ and SG: reviewed the literature and collected the data. HX and SG: reviewed and approved the submission.

ETHICAL APPROVAL

This study was carried out in accordance with the recommendations of the ethics committee of the First Affiliated Hospital of Zhengzhou University. Written informed consent was obtained from the patient for the publication of this case report.

ORCID

Xiaojie Fu https://orcid.org/0000-0002-7367-2735

REFERENCES

1. Rowan NR, Turner MT, Valappil B, et al. Injury of the carotid artery during endoscopic endonasal surgery: surveys of skull base surgeons. *J Neurol Surg B Skull Base*. 2018;79(3):302-308. https://doi.org/10.1055/s-0037-1607314
2. Ciric I, Ragin A, Baumgartner C, Pierce D. Complications of transsphenoidal surgery: results of a national survey, review of the literature, and personal experience. *Neurosurgery*. 1997;40(2):225-237. https://doi.org/10.1097/00006123-199702000-00001
3. Chimowitz MI, Kokkinos J, Strong J, et al. The warfarin-aspirin symptomatic intracranial disease study. *Neurology*. 1995;45(8):1488-1493. https://doi.org/10.1212/wnl.45.8.1488
4. Arenillas JF. Intracranial atherosclerosis: current concepts. *Stroke*. 2011;42(1 Suppl):S20-S23. https://doi.org/10.1161/STROKEAHA.110.597278
5. Zaidat OO, Fitzsimmons BF, Woodward BK, et al. Effect of a balloon-expandable intracranial stent vs medical therapy on risk of stroke in patients with symptomatic intracranial stenosis: the VISSIT randomized clinical trial. *JAMA*. 2015;313(12):1240-1248. https://doi.org/10.1001/jama.2015.1693

How to cite this article: Fu X, Quan T, Yuan Y, Xu H, Guan S. Devastating iatrogenic internal carotid artery rupture in endoscopic endonasal surgery rescued by a covered stent. *Clin Case Rep*. 2021;9:e04277. https://doi.org/10.1002/ccr3.4277