

Emergency Endovascular Treatment of Internal Carotid Artery Injury During a Transsphenoidal Approach for a Pituitary Tumor -Case Report-

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Carotid artery injury is a very rare, but life threatening complication that can occur during a transsphenoidal approach. We experienced one case of carotid artery injury during a transsphenoidal pituitary tumor surgery. The patient was immediately treated by a balloon occlusion and complete packing of the cavernous carotid artery using Guglielmi detachable coils (GDCs) and the rest of the tumor was removed after the carotid occlusion. The patient recovered without showing any neurological deficits.

Key Words: Internal carotid artery injury, pituitary tumor, endovascular procedure, Guglielmi detachable coils

INTRODUCTION

The transsphenoidal approach has been widely accepted to be the standard treatment of pituitary tumors and CSF rhinorrheas that are caused by various etiologies.¹ Although excellent results have been reported using the transsphenoidal approach,² potentially lethal complications may result from this approach because of its anatomical proximity to vital structures such as the carotid artery, the optic chiasm, and the hypothalamus etc.²⁻⁴

Eight cases of carotid artery or cavernous sinus injury that occurred after a transsphenoidal approach have been reported in the literature.^{2,5-10} The authors present a case showing the potential

risk of complications of the transsphenoidal procedure in an unusual case of CSF rhinorrhea in which there had been a previous surgical approach.

CASE REPORT

A 35-year-old man presented with a long-standing CSF rhinorrhea and recurrent meningitis which had first developed after he had sustained a facial trauma during vigorous exercise 3 years before. He had previously been treated by the transsphenoidal route three times at another hospital to control CSF leakage under the impression of traumatic CSF rhinorrhea without improvement of his symptoms. He was referred to our neurosurgery service for further treatment.

A MRI showed a high signal intensity at the sphenoid sinus wall and the normal gland was displaced to the right side. A slightly enhanced mass that showed a low signal intensity cystic component extended from the left side of the intrasellar cavity to the suprasellar portion and there was a possible tumor invasion into the left cavernous sinus (Fig. 1). A transsphenoidal adenectomy and sellar floor reconstruction was done under the impression that there was a long-standing CSF rhinorrhea complicated by a bony erosion of the sellar floor due to the presence of a pituitary tumor. The sphenoid sinus cavity was lined with a fibrotic, thickened mucosa. The mucosa was carefully excised and a small bony defect of the sellar floor was identified near the midline. The bony defect was carefully extended

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Fig. 1. Preoperative coronal MRI showing a high signal intensity at the sphenoid sinus wall and that the normal gland was displaced to the right side. A slightly enhanced mass with low signal intensity cystic component (arrow) extended from the left side of intrasellar cavity to the suprasellar portion.

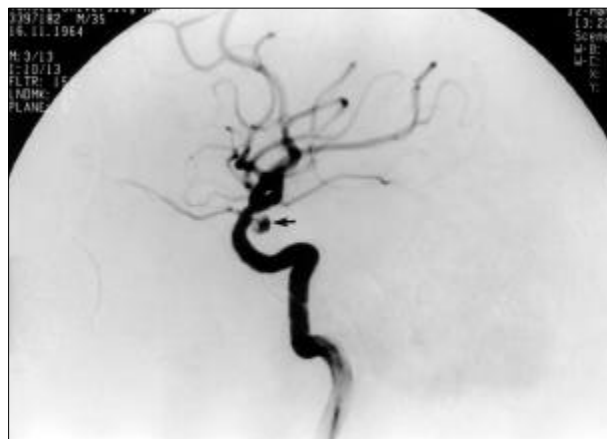


Fig. 2. Left carotid angiography with contralateral carotid compression showing a small pseudoaneurysm (arrow) at the C3 portion of left ICA.

and the dense fibrotic adhesion on the dural structures was carefully removed. Normal pituitary gland tissue was identified on the right half of the sellar cavity and an evaginated translucent cystic structure was identified on the left half of the sellar cavity below the dural opening. A dark-brownish mass was visualized through the cystic membrane and this extended into the suprasellar portion. Suddenly, a torrential arterial bleeding occurred during the dissection of the cyst wall near the midline. Several unsuccessful attempts were made to control the bleeding by using bemsheets and cottonoids. The patient's blood pressure dropped from 120/80 mmHg to a systolic pressure of 40 mmHg within 5 minutes. The bleeding was finally controlled by direct compression using suction tips over the bemsheets. The blood pressure returned to a normal level after 10 minutes by using intravenous fluid infusion and transfusion. A direct compression was maintained for 30 minutes longer and then the patient was transferred to the neuroangiographic suite for a possible intervention of the carotid artery in order to control bleeding permanently under a continuing general anesthesia.

An angiography was performed by the standard Seldinger technique on the left carotid artery first. The injection of contrast material through the left internal carotid artery (ICA) with contralateral carotid compression showed that

there was a small pseudoaneurysm (Fig. 2) at the C3 portion and that the right ICA territory was well irrigated by the anterior communicating artery. Also, the patient had good, competent collateral circulation through the posterior communicating arteries (PCoAs) as determined by vertebral angiography.

The obliteration of the pseudoaneurysm was then undertaken. A 6 F ENVOY guiding catheter (Cordis, Miami, FL, U.S.A.) was positioned in the left carotid artery. A rapid Transit 18 microcatheter (Cordis) was used for the coil deployment and a Transend 14 microguidewire (Boston scientific, Boston, MA, U.S.A.) was used with microcatheters.

A total of 46 cm of GDCs 18 system (Target Therapeutics, Boston, MA, U.S.A.) was deployed, including a 6 mm × 20-cm coil, a 4 mm × 10-cm coil, and two 3 mm × 8 cm coils. All coils were deployed using a live simultaneous biplane roadmapping technique. The cavernous carotid artery, including the pseudoaneurysm portion, was completely packed with 4 GDCs; however, one coil loop was protruding into the pseudoaneurysm sac (Fig. 3). A 3000-unit bolus of heparin was administered during the procedure. The flush lines were heparinized with 2000 units/L. Two detachable silver balloons (No. 16, diameter 8 mm, length 21 mm, volume 0.8 ml, NYCOMED, France), which were attached to a coaxial catheter (NYCOMED), were introduced and positioned at the petrous ICA and cervical ICA, respectively.



Fig. 3. An obliteration of the pseudoaneurysm was done. A total of 46 cm of GDCs 18 system were deployed using live simultaneous biplane roadmapping. The cavernous carotid artery including the pseudoaneurysm portion was completely packed with 4 GDCs (large arrow); however, one coil loop was protruding into the pseudoaneurysm sac. Two detachable balloons (small arrows) were positioned at the petrous ICA and cervical ICA, respectively.

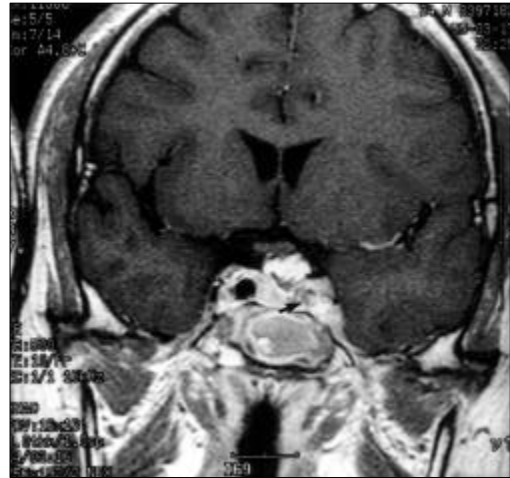


Fig. 4. Postoperative coronal MRI showing that high signal intensity fat tissue had replaced the suprasellar tumor mass and that the left ICA (arrow) was completely occluded.

The balloon was filled with 40% contrast medium for visualization under digital subtraction (DS) fluoroscopy. The balloons were easily detached by using a slow, gentle traction, again under DS fluoroscopy. Following the occlusion, a repeated angiography was done to ensure that there was adequate collateral circulation through the anterior communicating artery. This showed a complete left proximal carotid artery occlusion without a filling of the pseudoaneurysm from any other vessels and a good collateral flow to the left hemisphere. The effect of the heparin was reversed at the end of the procedure by using 20 mg of protamine sulfate.

The patient was transferred to the operating room to remove the remaining tumor. During the removal of the rest of the pituitary adenoma, one loop of the coil was identified on the medial portion of the left cavernous sinus. The tumor was totally excised. The sellar cavity was packed with fat tissue and fibrin glue. The sellar floor was then reconstructed using a piece of fascia lata, fibrin glue and a piece of vomer (Fig. 4).

The patient recovered completely without showing any neurological deficits and no further evidence of CSF rhinorrhea and meningitis after an 8 month follow up period. The tissue diagnosis

was a non-functioning pituitary adenoma.

DISCUSSION

The anatomical relationship between the cavernous carotid artery and pituitary fossa accounts for the mechanism of the injury to the cavernous carotid artery during transsphenoidal surgery. The average distance between the cavernous portions of the ICAs is 12 mm. In a small percentage of patients, this distance can be as little as 4 mm.⁴ Injury to the carotid artery during transsphenoidal surgery can cause a hemorrhage or a carotid artery fistula, and often causes devastating results. Five cases in which there was the formation of a false aneurysm and three cases in which there was the formation of carotid cavernous fistula after a transsphenoidal surgery have been reported.^{2,5-10} In all these patients, an intraoperative hemorrhage was immediately controlled by using nasal packing. However, all patients developed a severe epistaxis and a carotid cavernous fistula 3 days to 5 weeks after the surgery. Therefore, all of the patients required permanent treatment for control of their symptoms. The treatment modalities included carotid ligation, surgical ICA trapping and embolization using a muscle plug, gradual closure of the ICA using a Silverstone clamp, surgical ICA

trapping and ICA occlusion by placing a balloon, etc. Debrun et al.¹¹ treated 54 patients who had a traumatic carotid-cavernous fistula by using a detachable balloon that was directly positioned into the cavernous sinus. Chen et al.¹² reported 6 cases of cavernous ICA pseudoaneurysms, and all of their patients were successfully treated by endovascular embolization techniques that included detachable balloons and coils.

In our patient, even though we fully understood the anatomical relationship between the tumor mass and adjacent structures and maintained a midline operative approach to the sellar cavity and a careful dissection, the possible weakness of the carotid artery wall from the three previous surgical procedures and repeated inflammatory events resulted in carotid artery injuries. Therefore, we decided to treat the iatrogenic carotid injury immediately. One reason for this was that the bleeding was so profuse, and we had no confidence that the bleeding could be controlled by direct compression alone. The other reason was that, as in other previously reported cases, all patients required a surgical or endovascular approach to control the recurrent epistaxis or carotid cavernous fistula. Moreover there was no spontaneous healing reported in patients with an iatrogenic carotid artery injury during the transsphenoidal approach for the treatment of a pituitary tumor. In addition, our patient definitely required treatment for the CSF rhinorrhea and recurrent meningitis.

We emphasize the possible danger of carotid artery injury during transsphenoidal surgery especially in those patients in which there are complications from a repeated, recurrent CSF rhinorrhea or meningitis. Surgeons should also consider preoperative angiography to rule out vascular lesions and must be prepared for the

possibility of emergency endovascular treatment for ICA rupture before performing the surgery.

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