

Endovascular Treatment of Iatrogenic Internal Carotid Artery Bifurcation Dissecting Aneurysm following Craniopharyngioma Resection

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Abstract

Dissecting intracranial aneurysms are rare. Even rarer are those following resection of a craniopharyngioma. Herein, we report the case of a 42 year-old female who was admitted for surgery of a solid craniopharyngioma. One month after discharge is admitted again for loss of cerebro spinal fluid (CSF) through the nostrils: a fistula is diagnosed and was treated. In postoperative computed tomography (CT), a vascular dilation is observed, complementary digital subtraction angiography (DSA) reveals a dissecting aneurysm at the right internal carotid artery (ICA) bifurcation. Endovascular treatment is proposed and performed without complications. Endovascular treatment is a feasible option in cases of iatrogenic dissecting aneurysms after tumor removal.

Keywords: Dissecting Aneurysm, Craniopharyngioma, Stent Assisted Coil, Balloon Assisted Coil.

Abbreviations

CT: computed Tomography

CTA: computed tomography angiography

DSA: digital subtraction angiography

ICA: internal carotid artery

SAC: stent assisted coiling

BAC: balloon assisted coiling

Introduction

Dissecting aneurysms, are frequently developed after trauma or direct injury to a vessel following intracranial surgery (3, 7). These lesions should be treated promptly due to risk of rupture (1).

Craniopharyngioma is a rare, benign tumor, derived from the epithelial cells of Rathke's pouch. This tumor tends to surround neuro-vascular structures due to microscopic infiltration. Total resection is recommended, but is often associated with complications, thus, partial resections may be an option for preserving good functional outcomes (8). Most of the literature report cases of fusiform aneurysms of

the ICA in supraclinoid segments after craniopharyngioma surgery (2, 4-6, 10, 12, 13, 15, 16).

To our knowledge, this is the first reported case of a iatrogenic dissecting aneurysm at the ICA bifurcation following a craniopharyngioma total resection in an adult patient, treated with balloon assisted coiling (BAC) and stent assisted coiling (SAC) techniques.

Case Report

Previously healthy 42 year-old woman admitted to our institution because of decreased visual fields, magnetic resonance image (MRI) showed a craniopharyngioma. Right pterional craniotomy is performed with total resection of the tumor.

In postoperative follow-up, computed tomography angiography (CTA) was performed revealing an aneurysm at the right ICA bifurcation. DSA confirms the presence of a large, non-ruptured, dissecting aneurysm. After a multimodal discussion among vascular and endovascular neurosurgeons, endovascular therapy is proposed. One week prior to the procedure, 100 mg of aspirin and 75 mg of clopidogrel once a day were initiated. Under general anesthesia, DSA with 3D reconstruction was performed showing a 12mm x 8mm right ICA bifurcation aneurysm with a neck of 3.46 mm. Excelsior SL-10 microcatheter (Stryker, Fremont, CA, USA) was navigated into the right ICA at the neck of the aneurysm, afterwards a Headway 17 microcatheter (Microvention, Tustin, CA, USA) was navigated to M1 segment with an Eclipse balloon (Balt Extrusion, Montmorency, France).

Remodeling technique was employed and 5 coils were introduced into the aneurysm dome, with adequate obliteration and no neck remnant. Then, a 3.5mm x 18 mm LEO Baby stent (Balt Extrusion, Montmorency, France) was deployed across the M1 segment of the MCA and the supraclinoid ICA. Control DSA shows adequate patency of vessels without filling inside the aneurysm.

The post-operative course was uneventful with gradual recovery and was discharged home.

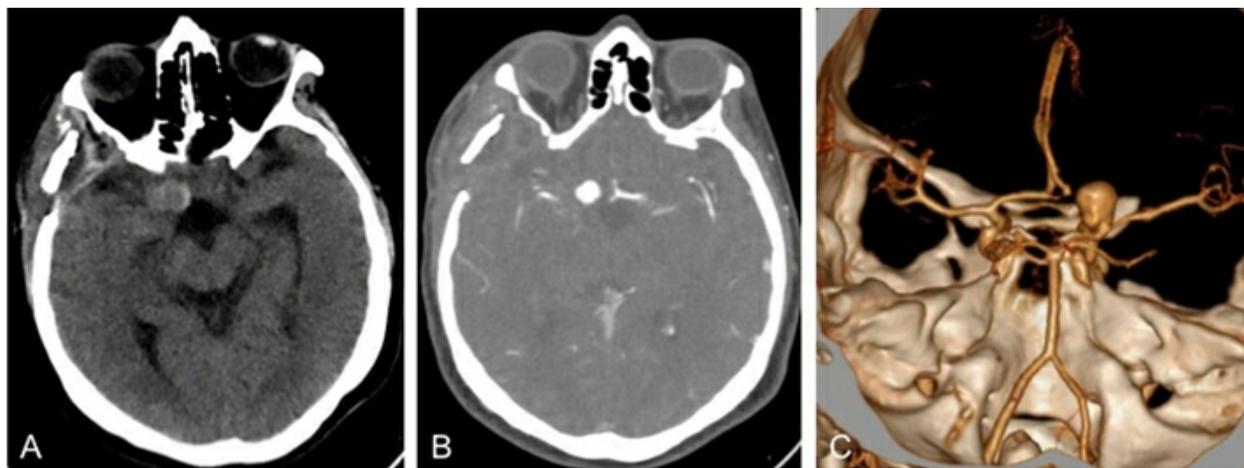


Figure 1: Pre-embolization brain computed tomography (A), computed tomography angiography (B) and 3D reconstruction (C) showing the dissecting aneurysm arising from the right internal carotid artery bifurcation

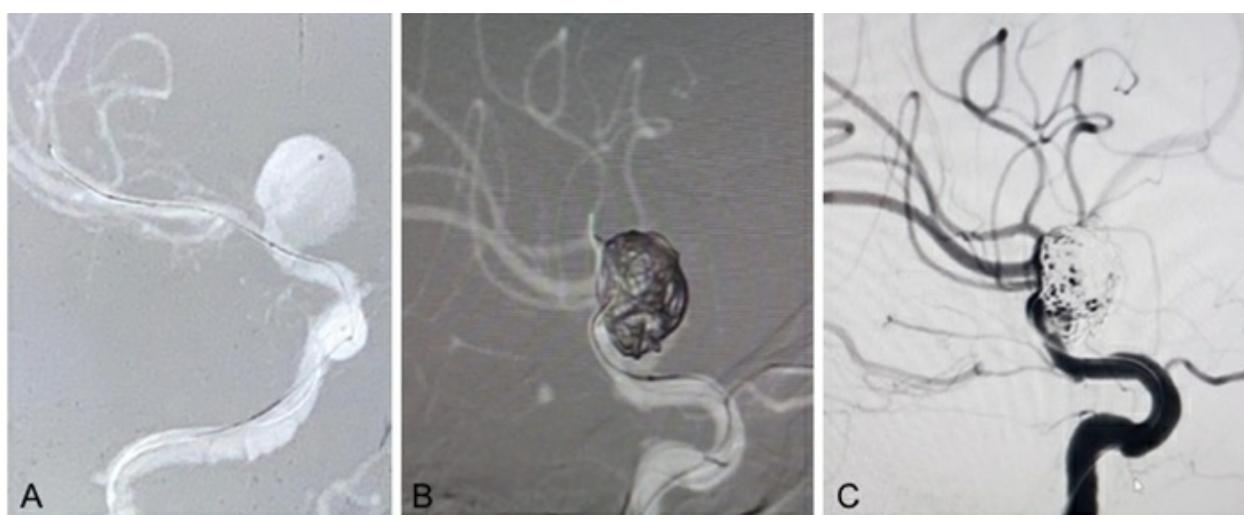


Figure 2: Embolization of aneurysm with remodeling technique. Microcatheter navigated to the right middle cerebral artery (A), then the balloon is inflated (B) and coiling of aneurysm is achieved (C)

Discussion Iatrogenic dissecting aneurysms are challenging lesions to treat and difficult to diagnose, moreover, a delayed diagnosis may lead to fatal outcomes (3).

Currently many options are available for their treatment, being the endovascular therapy the most used in recent years, nevertheless there is no consensus yet and all depends on an individual basis (1).

Diagnosis must be suspected if a damage to the arterial wall or bleeding occurred during surgery and if the patient deteriorates within 2 weeks after the procedure (3, 9).

Angiographic findings, including irregular narrowing and retention of intraluminal contrast were present in this case. Many other findings exist, including the string sign, occlusion, the presence of an intimal flap, proximal and distal dilatations and a double lumen (3).

In our case, given the rapid enlargement of the lesion, angiographic findings and a previous surgery, were sufficient elements to suspect of a iatrogenic dissecting aneurysm. Since the initial diagnosis of the lesion until treatment, the aneurysm developed gradual growth, with a

considerable high risk of rupture. The most common postoperative vascular alteration following craniopharyngioma resection is the presence of a fusiform aneurysm and surgery is recommended if symptoms develop or if there is residual tumor (12).

Nevertheless, we think that the decision should be made in an individual basis. Stent-assisted coiling is one of the preferred and more studied techniques for treating this lesions (1).

However, in this case because of the size and location, we decided to perform in first instance the remodeling technique and afterwards, the placement of the stent across the defect and the neck. Other options remaining are coiling alone and stent alone including flow diverter devices. Sutton et al were the first to describe fusiform aneurysm formation in the ICA after resection of craniopharyngiomas (13).

They reported 9 of 31 cases of children in whom dilatation of the ipsilateral supraclinoid ICA developed after surgery. The clinical course of those patients was uneventful except for one patient, recommending treatment if symptoms developed and observation if there were no symptoms (12).

Treated cases of vascular injuries by endovascular procedures following craniopharyngioma resection are scarce: Ogilvy et al in 2011, reported the first case of a iatrogenic pseudoaneurysm in a 4 year-old child following craniopharyngioma resection treated with stent-assisted coiling, with a 6-month follow-up DSA revealing complete obliteration of the aneurysm (7).

In 2015, Li et al reported the case of a child who underwent stent-assisted coiling with subtotal occlusion of the lesion and with good clinical outcome (4).

Reynolds et al in 2018, placed a Pipeline Embolization Device (PED; Medtronic, Dublin, Ireland) in a 39 year-old woman, with minor residual filling of the aneurysm (10).

In the case of our patient, two endovascular techniques were employed: first, balloon remodeling and afterwards we deployed a stent across the neck of the aneurysm to seal the defect in the arterial wall.

The current concept in treating dissecting aneurysms is to seal the defect in the arterial wall with a stent and try to occlude the dome with coils (1). Coiling alone is a hazardous decision due to inconsistency of the wall vessel and could not support the packing of the coils inside the dome, hence, is not recommended in a routine fashion.

We hypothesize that the tumor itself had some degree of relationship in the aneurysm formation, while dissecting the capsule's tumor it may occur that a disruption on an already established and damaged adventitia could predispose the rupture at that level and consequently the hemorrhage that was observed during surgery. Craniopharyngioma has an invading behavior and produces anaplastic changes associated with glial reaction in surrounding neuro-vascular structures (11, 14).

Thus, a combination of the surgery itself, the presence of the tumor involving structures and the debilitated artery predisposed to the formation and growth of the aneurysm.

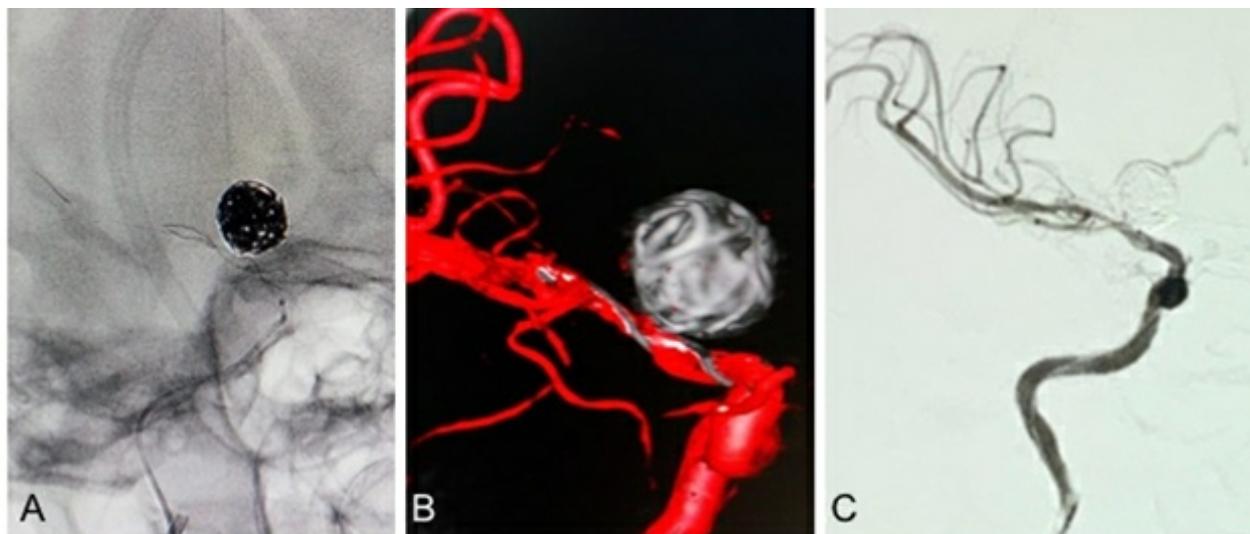


Figure 3: Embolization of aneurysm with stent assisted coiling and final control. After coil detachment, a stent was deployed across the neck of the aneurysm from M1 segment to ICA (A), 3D reconstruction shows adequate apposition and filling of aneurysm's dome (B). Oblique projection shows complete obliteration of aneurysm and absence of neck (C).

Conclusions

Currently, endovascular techniques are the treatment of choice for dissecting aneurysms. A combination of remodeling and SAC are a safe and feasible options for treatment of this complex lesions.

References

1. Daou B, Hammer C, Chalouhi N, Starke RM, Jabbour P, Rosenwasser RH, Tjoumakaris S: Dissecting pseudoaneurysms: predictors of symptom occurrence, enlargement, clinical outcome, and treatment. *J Neurosurg* 125:936-942, 2016
2. Hoffmann A, Warmuth-Metz M, Lohle K, Reichel J, Daubenbuchel AM, Sterkenburg AS, Muller HL: Fusiform dilatation of the internal carotid artery in childhood-onset craniopharyngioma: multicenter study on incidence and long-term outcome. *Pituitary* 19:422-428, 2016
3. Kinugasa K, Yamada T, Ohmoto T, Taguchi K: Iatrogenic dissecting aneurysm of the internal carotid artery. *Acta Neurochir (Wien)* 137:226-231, 1995
4. Li Q, Wang C, Xu J, You C: Endovascular Treatment for Fusiform Dilatation of Internal Carotid Artery Following Craniopharyngioma Resection: A Case Illustration. *J Child Neurol* 30:1354-1356, 2015
5. Linfante I, Tucci C, Andreone V: Fusiform dilatation of the internal carotid artery after craniopharyngioma resection. *Pediatr Neurol* 39:139-140, 2008
6. Nagata T, Goto T, Ichinose T, Mitsuhashi Y, Tsuyuguchi N, Ohata K: Pathological findings of fusiform dilatation of the internal carotid artery following radical dissection of a craniopharyngioma. *J Neurosurg Pediatr* 6:567-571, 2010
7. Ogilvy CS, Tawk RG, Mokin M, Yang X, Levy EI, Hopkins LN, Siddiqui AH: Stent-assisted coiling treatment of pediatric traumatic pseudoaneurysm resulting from tumor surgery. *Pediatr Neurosurg* 47:442-448, 2011

8. Okada T, Fujitsu K, Ichikawa T, Miyahara K, Tanino S, Uriu Y, Tanaka Y, Niino H, Yagishita S: Radical Resection of Craniopharyngioma: Discussions Based on Long-term Clinical Course and Histopathology of the Dissection Plane. *Asian J Neurosurg* 13:640-646, 2018
9. Parkinson D, West M: Traumatic intracranial aneurysms. *J Neurosurg* 52:11-20, 1980
10. Reynolds MR, Heiferman DM, Boucher AB, Serrone JC, Barrow DL, Dion JE: Fusiform dilatation of the internal carotid artery following childhood craniopharyngioma resection treated by endovascular flow diversion-A case report and literature review. *J Clin Neurosci* 54:143-145, 2018
11. Shida N, Nakasato N, Mizoi K, Kanaki M, Yoshimoto T: Symptomatic vessel narrowing caused by spontaneous rupture of craniopharyngioma cyst--case report. *Neurol Med Chir (Tokyo)* 38:666-668, 1998
12. Sutton LN: Vascular complications of surgery for craniopharyngioma and hypothalamic glioma. *Pediatr Neurosurg* 21 Suppl 1:124-128, 1994
13. Sutton LN, Gusnard D, Bruce DA, Fried A, Packer RJ, Zimmerman RA: Fusiform dilatations of the carotid artery following radical surgery of childhood craniopharyngiomas. *J Neurosurg* 74:695-700, 1991
14. Takeuchi S, Wada K, Sakakibara F, Nawashiro H, Mori K: Anterior cerebral artery dissecting aneurysm associated with untreated craniopharyngioma. *Br J Neurosurg* 27:102-104, 2013
15. Tirakotai W, Sure U, Benes L, Aboul-Enein H, Schulte DM, Riegel T, Bertalanffy H: Successful management of a symptomatic fusiform dilatation of the internal carotid artery following surgery of childhood craniopharyngioma. *Childs Nerv Syst* 18:717-721, 2002
16. Wang L, Shi X, Liu F, Qian H: Bypass surgery to treat symptomatic fusiform dilation of the internal carotid artery following craniopharyngioma resection: report of 2 cases. *Neurosurg Focus* 41:E17, 2016