Endovascular Treatment of Post-traumatic Carotid-cavernous Fistula Using Flow Diverter Stent

Tratamento Endovascular de Fístula Carótida-cavernosa Pós-traumática com Stent Diversor de Fluxo

Guilherme de Palma Abrão¹
André Didier Lyra²
Matheus Miranda Barbosa²

ABSTRACT
We describe a case of post-traumatic high-flow carotid-cavernous fistula that was successfully treated with coils and pipeline embolization device. Following the endovascular treatment, the patient experienced clinical improvement of symptoms with complete anatomical restoration of the internal carotid artery.

Key words: Flow diverter; Direct Carotid-Cavernous Fistulas; Embolization

RESUMO
Descrevemos um caso de paciente jovem com uma fístula carótido-cavernosa traumática, tratado com stent diversor de fluxo e micromolas. Após tratamento endovascular, o paciente apresentou melhora clínica de sintomas com recuperação anatômica completa da artéria carótida interna.

Palavras-chaves: Diversor de fluxo; Fístula carótido-cavernosa direta; Embolização

Background
Carotid-cavernous fistulas (CCFs) are abnormal arteriovenous communications in the cavernous sinus, arising spontaneously or more commonly secondary to trauma. Direct CCFs result from a tear in the intracavernous carotid artery, which typically have high flow, usually present with ocular-orbital venous congestive features and oculaur bruit. They can be challenging lesions to treat and a variety of modalities and approaches have been proposed in the recent literature.

Case Presentation
A 28-year-old male, who was hit by a bus 6 months earlier present proptosis and diplopia. Ophthalmologic exam demonstrated palsy of the oculomotor nerve. Computer tomography (CT) angiography revealed an enlarged superior ophthalmic vein and early opacification of the left cavernous sinus and cortical veins. Diagnostic cerebral angiography demonstrated a high flow CCF with outflow via the superior ophthalmic veins, and into the cavernous sinus bilaterally and ipsilateral cortical veins and deep draining system (Fig. 1). Under general anesthesia and heparinization (100U/Kg/IV bolus) through the right femoral artery puncture a long sheath of Neuronmax 8Fr (Penumbra Inc.) was placed co-axially with a diagnostic catheter, curve Simmons 2, 125 cm length, at the origin of the left internal carotid artery.

¹ MD, PhD Interventional Neuroradiologist, Quinta D’Or Hospital, Rio de Janeiro, RJ, Brazil
² MD, Interventional Neuroradiologist, Quinta D’Or Hospital, Rio de Janeiro, RJ, Brazil

Received 9 Jun 18
Accepted Jun 20, 2018
Then a Neuron 6Fr, 070° (Penumbra Inc.) catheter was placed at the distal cervical segment of the left ICA for navigation of an Echelon 14 (Medtronic) microcatheter in the left cavernous sinus for placement of two coils. After securing the coils a Marksman (Medtronic) microcatheter was utilized to deliver a Pipeline Embolization Device (PED) (Medtronic) measuring 4,5 x 25 mm within the (ICA). The final contrast injections showed faint opacification of the left cavernous sinus (Fig. 2). The procedure ended without complications and the proptosis was immediately cured. Angiographic CT and DSAs were performed on the follow-up months to assess the stability of the treatment. A 6-month follow-up digital subtraction angiography (DSA) demonstrated stable obliteration of the fistula, coincident with complete resolution of the patient symptoms (Fig. 3).

**Figure 1.** A. AP. B. Lateral views. Left internal carotid artery injections showing dilatation with early opacification of the cavernous and superior ophthalmic vein bilaterally with reflux to superficial cortical vein and deep draining system.

**Figure 2.** A. AP. B. Lateral views. Control angiography after completion of the procedure showing faint residual filling of the left cavernous sinus. C. D. Non subtract images demonstrating good apposition of the stent and coil packing.

**Figure 3.** A. AP. B. Lateral views. Control angiography 6 months after treatment with complete resolution of the fistula.

**Discussion**

Late complications of head injury are well known, but many may be very difficult to resolve, leading to the continuous development of new treatment techniques. Arterial injuries are among the most common early and late complications of major head trauma. Dissections, pseudoaneurysms, thrombosis, tears and fistulas have all been reported as post-trauma findings. Therefore, the assessment of arterial lesions should be a concern both in the emergency room and in the office follow up consultations.

The objective of the treatment of CCFs is the occlusion of fistulous communication between the internal carotid artery and the cavernous sinus with preservation of the arterial patency. From 1970 the treatment began with detachable balloons with positioning through the arterial side of a latex balloon fixed on the extremity of a microcatheter and delivery inside the fistula being directed by the hyperflow of the fistula. The main problems related with detachable balloons were: early disinflation, difficulty in navigation to the cavernous sinus, early detachment in the internal carotid artery and difficulty on the adaptation of the size of the balloon inside the fistula, resulting in the growing discontinuation of this method. The embolization of the cavernous sinus through the arterial route using coils has become the method of choice. During embolization a temporary balloon catheter is positioned in the internal carotid to prevent the prolapse of coils and to serve as a three dimension anatomical parameter. Other treatment options include: embolization of the cavernous sinus through venous side, therapeutic occlusion of the internal carotid artery or the use of stent grafts. Recently the use of flow diverters for the treatment of direct CCFs has been described.
Flow diverters are self-expanding stents, composed of 48 braided strands of cobalt chromium and platinum. A single PED has 30%-35% metal surface area coverage when fully deployed within an appropriately size matched vessel. Flow diverters offer the advantage of both treating the lesion, preserving the patency of the parent artery and side branches. Five case reports have been found in the literature. Iancu et al. described a case of a direct CCF after transsphenoidal surgery for a large pituitary adenoma. The patient presented III cranial nerve paralysis and was treated with transarterial embolization of the superior ophthalmic vein and cavernous sinus with coils and a flow diverter. Nadarajah et al. described a case of traumatic direct CCF treated exclusively with 4 telescoped flow diverters. Nossek et al. described a case of a spontaneous direct CCF after rupture of a giant cavernous aneurysm that was treated by a combined technique by the arterial side with jailing of a microcatheter and delivery of coils inside the cavernous sinus and deployment of 3 telescoped FDs.

Pradeep et al. described two cases of traumatic direct CCF. In the first case they used two FD in a telescoped way and embolization of the cavernous sinus through the venous side with Onyx HD 500 and coils. In the second case they used 3 FDs and embolization of the cavernous sinus with Onyx by the venous side.

One of the major limitations to the use of PEDs in patients with traumatic CCFs is the requirement for dual antiplatelet therapy; particularly in patients with additional injuries. Others problems include high procedural costs and the lack of long term follow-up data. The literature suggests that the patient needs to be maintained on dual antiplatelet for 06 months and aspirin for life, leading to an increase risk of bleeding events. In light of these challenges, some authors suggest a staged approach that initially uses traditional techniques for CCF occlusion, later combined with the synergistic effect of flow diversion.

CONCLUSION

Flow diverters were initially approved for the treatment of giant large neck aneurysms located in the internal carotid artery between the petrous segment and superior hypophyseal segment. However techniques and applications of the new generations of flow diverters are evolving with new therapeutic possibilities. We believe that these devices appear to be an effective option and should be incorporated in the armamentarium for the treatment of direct CCFs in association with the embolization of the cavernous sinus either through the arterial or venous route.

REFERENCES

Case Report

GP Abrão, AD Lyra, MM Barbosa - Endovascular Treatment of Post-traumatic Carotid-cavernous Fistula Using Flow Diverter Stent


Corresponding Author

Guilherme de Palma Abrão, MD, PhD
Alameda das Acácia 416
ZIP CODE 24355-150
Itaipu, Niterói, RJ, Brazil
E-mail: guiabrao@yahoo.com.br.