Radiology Case Reports 18 (2023) 2514–2518

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/radcr

Case Report

Endovascular management of giant post-traumatic pseudoaneurysm in cavernous sinus: A case report ☆

Nguyen Huynh Nhat Tuan, MD, Le Van Khoa, MD, Nguyen Van Tien Bao, MD, Pham Dang Tu, MD, Le Van Phuoc, PhD*

Department of Radiology, Cho Ray Hospital, 201B Nguyen Chi Thanh, Ward 12, District 5, Ho Chi Minh, Vietnam

ARTICLE INFO

Article history:
Received 16 March 2023
Accepted 12 April 2023

Keywords:
Pseudoaneurysm of cavernous carotid artery
Coils embolization
Ballon-test
Epistaxis
Parent artery occlusion

ABSTRACT

A 20-year-old male was admitted with the history of a traumatic head injury after traffic accident. The physical examination revealed blurred vision, swelling of the right face, and minor epistaxis. CT and MRI findings revealed a giant pseudoaneurysm of cavernous carotid artery. The patient was enrolled endovascular coils embolization of the internal carotid artery. After the procedure, the patient recovered well. Endovascular treatment is an effective therapy in cavernous carotid pseudoaneurysm.

Background

Cavernous carotid aneurysms are relatively rare, accounting for 9% of intracranial aneurysms [1], in which trauma is a common cause. Most post-traumatic aneurysms cases are pseudoaneurysms, therefore, the risk of rupture is not anticipated and treated promptly. We describe a case of giant post-traumatic internal carotid pseudoaneurysm, which is successfully treated with endovascular intervention.

Case description

A 20-year-old man presented with a history of 10-month of motorbike accident, maxillofacial trauma and medical treatment. A month ago, he started to suffer from blurred vision in his right eye, swelling in right face, and he experienced epistaxis which was quickly limited in severity and duration. He had no history of seizures and headaches. His CT scan shows a pseudoaneurysm in the right internal carotid artery, and the patient was advised to hospitalize for treatment.

☆ Competing Interests: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

* Corresponding author.
E-mail address: drnguyentienbao@gmail.com (N. Van Tien Bao).

https://doi.org/10.1016/j.radcr.2023.04.023

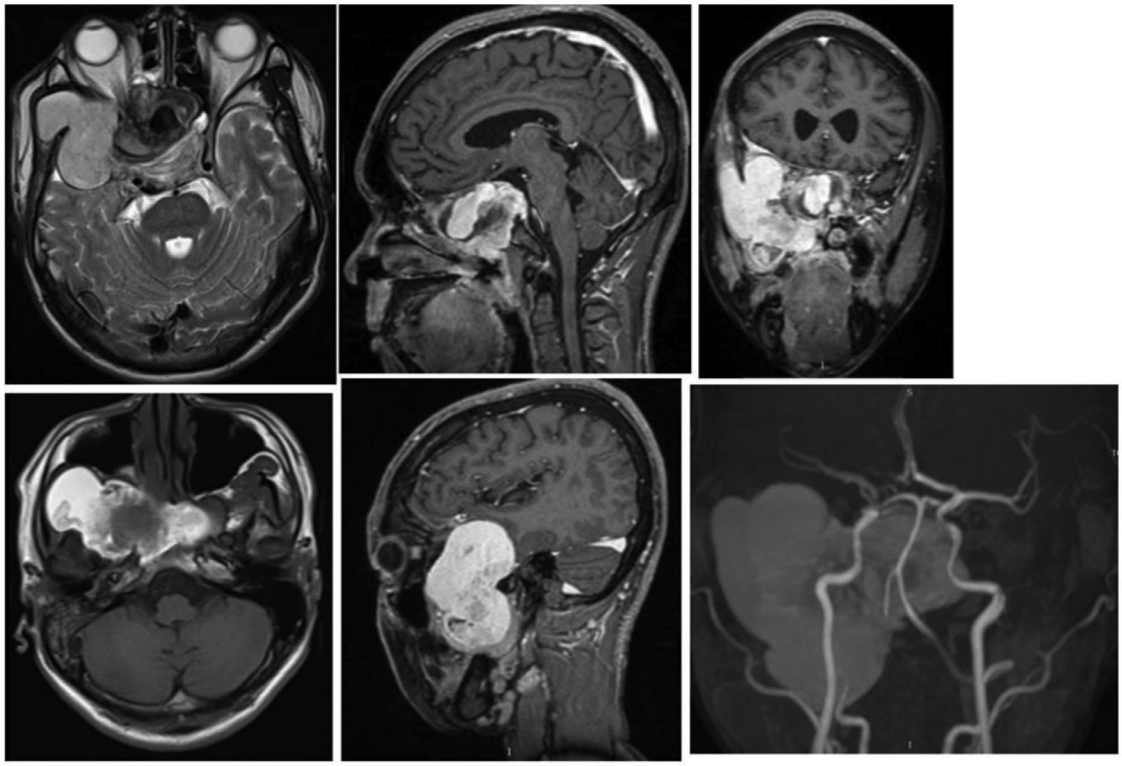

Fig. 1 – MRI revealed a giant pseudoaneurysm of the right internal carotid artery in cavernous sinus, 40 x 25 mm in size, with partial thrombus surrounded by a heterogeneous density soft tissue in the right pterygopalatine fossa, spreading to temporal fossa, 86 x 57mm in size, non-contrast enhancement, which was likely a solid fluid collection.

Physical examination reported 3/5 acuity vision in right eye and without extremities paralysis. The patient's hemoglobin level was 152 g/L. Cranial CT scan showed the signs of fractures in the roof of the orbit, the sphenoidal sinus, ethmoidal plate and maxillary sinus. MRI revealed a giant pseudoaneurysm of the right internal carotid artery in cavernous sinus (Fig. 1).

DSA showed a giant pseudoaneurysm of the right carotid artery in cavernous sinus, spreading to right sphenoidal sinus, sized 40×20 mm, with right cavernous carotid fistula to inferior petrosal sinus. It also included the sign of irregular right cavernous carotid artery stenosis, which is likely due to post-traumatic dissection (Fig. 2).

The patient was enrolled in balloon test. He was locally anesthetized and kept awake during the procedure. The Guider Softif 8F (Boston) was placed in the internal right carotid artery, put Micro-balloon Scepter C and the balloon was inflated to occlude this artery. Image examination of vertebral artery and left internal carotid artery demonstrated a good anastomosis through posterior communicating artery and anterior communicating artery. The patient presented no clinical signs and symptoms during the balloon pumping process within 30 minutes (Fig. 3).

The team proceeded to selectively insert microcatheter Pxslim and microwire Transend 0.014 into the pseudoaneurysm and 8 coils (Ruby coil, Target coil) to occlude the right external carotid artery at the level of the pseudoaneurysm, underneath the origins of ophthalmic artery. Examination showed complete occlusion of the pseudoaneurysm and the external carotid artery. The angiography of the left vertebral artery and the left external carotid artery revealed good collateral the right hemisphere through the anterior and posterior communicating branches (Fig. 4).

Discussion

In general, the injury rate of cerebral vessel after head trauma is low, about 1.2%-2.7% [2]. However, according to Biffl [3], in careful examination, 25% of patients with blunt trauma of face and head, fractures of facial bone have internal carotid injury . Moreover, in developing countries in Asian such as Viet-Nam, the high rate of traffic accident, especially motorbike accidents, leads to the increase of vessel damages in cavernous sinus area.

The main types of post-traumatic internal carotid artery injury include dissection, stenosis, thrombosis, direct fistula of cavernous carotid artery and pseudoaneurysm [4]. In general, pseudoaneurysm in cavernous carotid with arteriovenous fistula is relatively rare.

Unlike true aneurysms, which contain three layers of blood vessels, pseudoaneurysms are formed due to the partial rupture of the vessels and formation of a hematoma surrounded by perivascular tissue. Blood causes inflammatory in surrounded tissue and forms a fibrous layer which develops into

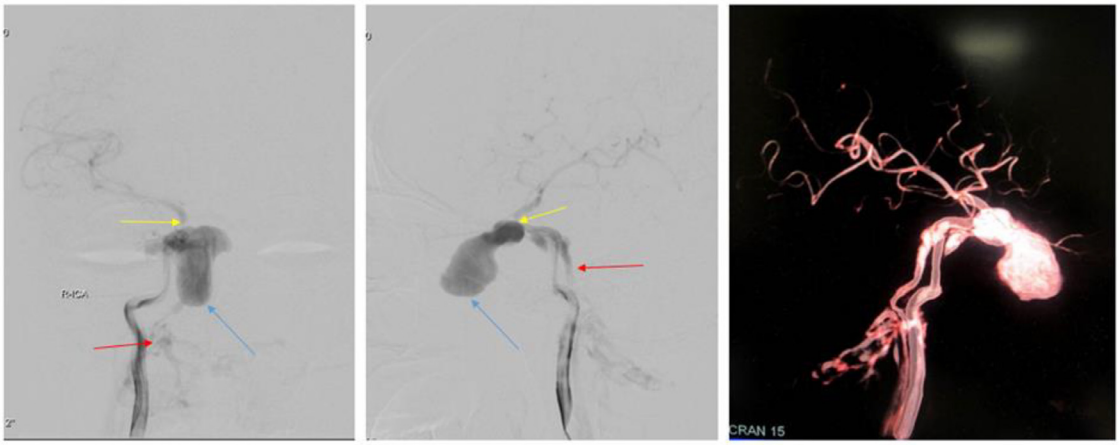

Fig. 2 – DSA angiography of the right internal carotid artery: revealed giant cavernous sinus pseudoaneurysm (blue arrow), with arteriovenous fistula in the cavernous sinus draining to the inferior petrosal venous sinus (red arrow) and severe arterial stenosis of the internal carotid artery at the level of the pseudoaneurysm (yellow arrow).

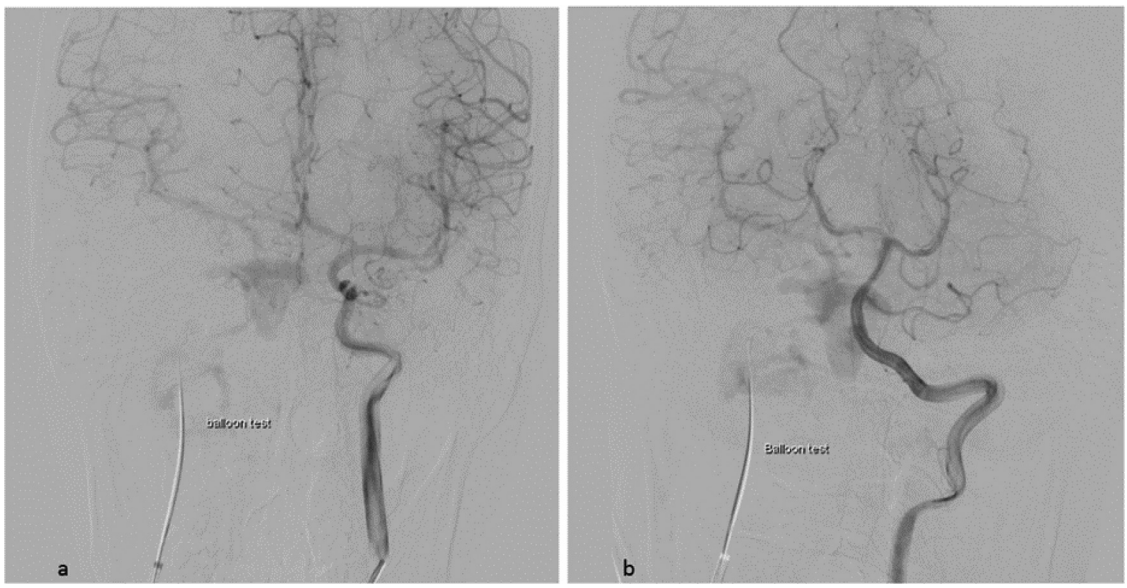

Fig. 3 – Balloon test. Angiography of the left internal carotid artery (A) and the left vertebral artery showed good circulation through anterior and posterior communicating branches.

endothelial layer. However, because of the continuous impact of the pulsating force, pseudoaneurysms tend to increase in size, the fibrous vascular layer becomes weak and fragile.

Epistaxis is a common clinical symptom, caused by the rupture of pseudoaneurysms into sphenoid sinus, which can occur a few days to months after trauma. The severities vary from minor, intermittent, self-limited in amount and duration; to large extent causing unstable hemodynamic. Most nosebleed cases due to aneurysm in cavernous sinus are often more difficult to control than the one caused by the other etiologies [5]. In some cases, a vast aneurysm can cause mass effect, compressing cranial nerves, which lead to ptosis, diplopia, or paranesthesia along the path of V nerve. Most cavernous aneurysms are often located in epidural areas, so they rarely cause subarachnoid hemorrhage. However, the rate of subarachnoid hemorrhage can occur in 0.2%-0.4% of cases [6], maybe due to large aneurysms with intradural components. In addition, these intradural components can compress the optic nerve, causing vision impairment, as in our clinical case.

The golden standard for diagnosis of post-traumatic cavernous carotid aneurysms is still DSA with 99% specificity and 100% sensitivity [2]. However, with sensitivity approximately 99.7%, CT scan (16 or more probes) can be used in replacement for diagnosis, treatment planning, as well as following-up after intervention. DSA is used for evaluation of connectivity of Willis polygon through balloon-test.

Our patient matched the radiology features of a post-traumatic pseudoaneurysm such as (1) irregular wall, (2) difficulty in identifying aneurysm neck (3) not origins at bifurca-

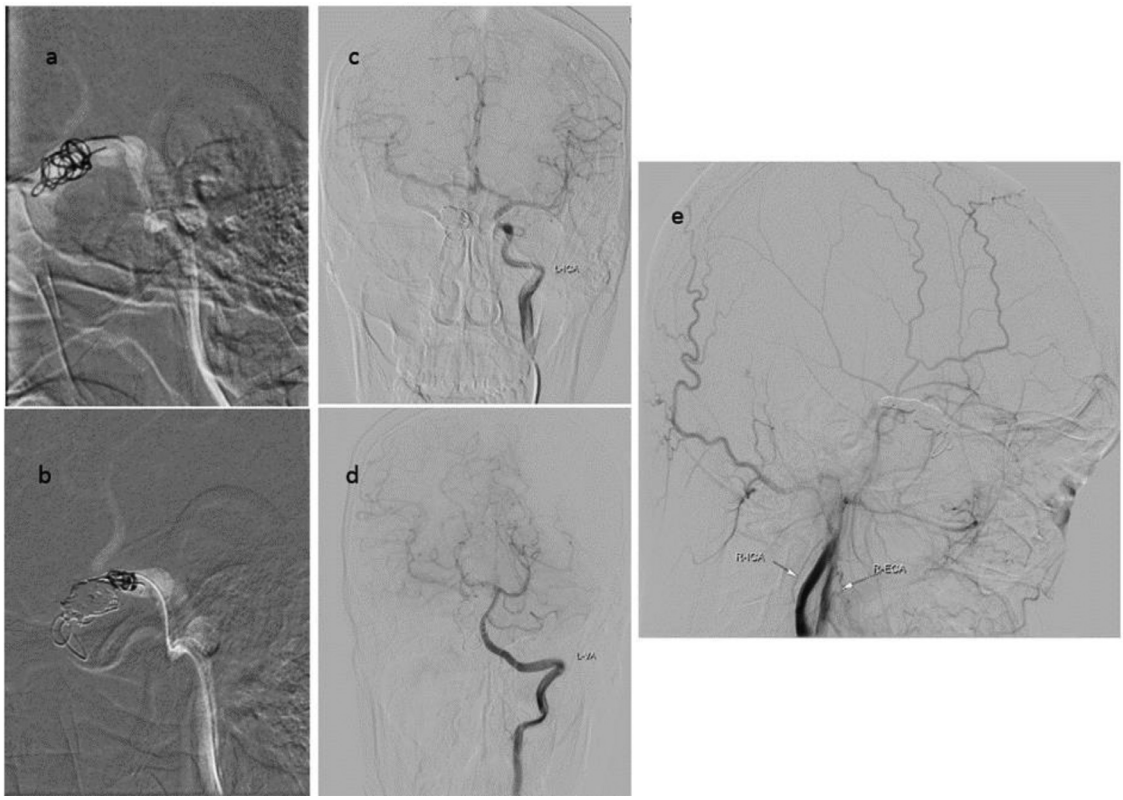

Fig. 4 – (A) Partly coil occlusion in pseudoaneurysm. (B) Internal carotid coil occlusion at the level of pseudoaneurysm. Angiography of left internal carotid artery (C), left vertebral artery (D) after intervention noted good circulation to the right hemisphere. Right common carotid artery angiogram. (E) Showed complete occlusion of the artery containing pseudoaneurysm.

tion site (4) contrast deposition in late phase in the aneurysm [5].

The special feature of this patient is that the surrounding part of the pseudoaneurysm is a massive mass of mixed tissue and solid fluid, which spreads to the nasal cavity, temporal fossa, causing swelling in the patient's face. This can be the result of prolonged obstruction of the sinus catheter [7].

Post-traumatic brain aneurysm is a potentially life-threatening lesion, with the mortality rate up to 50% in the case of ruptured aneurysms [8], so surgery or endovascular intervention are always required. Depending on the specific case, the treatment options may be conservative or embolized of the artery containing aneurysm. Evaluating the function of Wilis circulation by balloon-test determines the choice of treatment. If the patient fails to pass the test (poor anastomosis or clinical symptoms presence), his artery with aneurysm needs to be preserved by selective embolization coils; flow-modified stent or revascularization by artery bypass graft surgery. If the patient can pass the balloon-test, surgical ligation or artery embolization with coils or balloon can be performed.

The rate of cerebral ischemic complications in internal carotid ligation surgery is reported to be rather high, approximately 41% [9]. Combination with bypass surgery can reduce the risk rate to 14.6%. It is ability to conduct superficial temporal artery – middle cerebral artery bypass surgery (low flow bridge) or external carotid – middle cerebral artery bypass surgery with the radial artery or saphenous vein graft (high flow bridge)

Despite lack of case control research comparing surgery and intervention in treatment of post-traumatic cavernous carotid aneurysms, the rate of morbidity and mortality of intravascular intervention is lower in numerous studies [2]. Endovascular techniques include coils, detachable balloon, cover stent, and flow-modifying stent. Currently there is no research with sufficient sample size to determine which method is optimal, the choice depends on the patient's state, characteristics of the aneurysm and experience of individual center.

Selective pseudoaneurysm embolization with coil or stent-supportive coil is effective, however, placing coil in acute pseudoaneurysm poses high risk of rupture [10–12]. Struffert described 2 cases in which placed coils drifted from pseudoaneurysm to nasal peduncle after intervention [13]. This is explained by the author that post-traumatic pseudoaneurysms lack full layers like aneurysm, so placing coils into pseudoaneurysm can exert force to surrounding tissue, leading to wide extension of the pseudoaneurysm into the sinuses. Moreover, in our patient's circumstance with a giant pseudoaneurysm, the usage of coils to selectively occlude the pseudoaneurysm is costly, and the possibility of mass effect after embolization is high.

There are many reports of the effectiveness of stent graft in treatment of post-traumatic cavernous carotid pseudoaneurysms [14]. In general, the use of stent graft in intracranial segment often presents obstacles because stent is large, rigid, and often difficult to inflate in the tortuous vascular segment. Ruiz – Juretscheke describes the usage of 2-3 stents overlapping to effectively flow-modified occlude pseudoaneurysm [15]. Currently, some authors use flow-modified stent in post-traumatic carotid pseudoaneurysm treatment [16]. However, pseudoaneurysms are often not immediately blocked and may take several weeks, leading to the possibility of rupture. Another limitation of stent usage is the necessity of prolonged antiplatelet therapy and cost is also an issue in developing countries.

Parent artery occlusion can be used with detached balloons or coils. This method is acceptable in the case of giant pseudoaneurysm and the patient pass the balloon – test [17]. However, there are still 22% of patients passing the test and progressing to the complications after parent artery embolization [18].

In our patient circumstance, we occluded internal carotid at the level of aneurysm because (1) the artery at the level of aneurysm showed the sign of serious stenosis, which can be due to post-traumatic dissection, and may lead to extent dissection or thrombosis and artery occlusion, therefore, carrying artery conservation cannot be applied; (2) balloon – test revealed the good circulation through anterior and posterior communicating artery, no need for bypass surgery.

Conclusion

For patient with history of head trauma, regardless of time, once there are any abnormal sign and symptoms such as vision impairment, nasal bleeding, ptosis,... it is necessary to determine if there is any cerebral vascular injury or not. Endovascular treatment is an effective and safe in the cases of post-traumatic cranial artery pseudoaneurysm.

Patient consent

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

REFERENCES

[1] Barr HW, Blackwood W, Meadows SP. Intracavernous carotid aneurysms. A clinical-pathological report. Brain 1971;94(4):607–22. doi:10.1093/brain/94.4.607.

[2] Spanos K, Karathanos C, Stamoulis K, Giannoukas AD. Endovascular treatment of traumatic internal carotid artery pseudoaneurysm. Injury 2016;47(2):307–12. doi:10.1016/j.injury.2015.09.015.

[3] Biffl WL, Moore EE, Ryu RK, Offner PJ, Novak Z, Coldwell DM, et al. The unrecognized epidemic of blunt carotid arterial injuries: early diagnosis improves neurologic outcome. Ann Surg 1998;228(4):462–70. doi:10.1097/00000658-199810000-00003.

[4] Feiz-Erfan I, Horn EM, Theodore N, Zabramski JM, Klopfenstein JD, Lekovic GP, et al. Incidence and pattern of direct blunt neurovascular injury associated with trauma to the skull base. J Neurosurg 2007;107(2):364–9. doi:10.3171/JNS-07/08/0364.

[5] Zanini MA, Tahara A, Santos GS dos, Freitas CCM de, Jory M, Caldas JGMP, et al. Pseudoaneurysm of the internal carotid artery presenting with massive (recurrent) epistaxes: a life-threatening complication of craniofacial trauma. Arq Neuro-Psiquiatr [Internet] 2008;66(Arq. Neuro-Psiquiatr., 2008 66(2a)):268–71. doi:10.1590/S0004-282x2008000200029.

[6] Kasliwal MK, Suri A, Sai Kiran NA, Sharma BS. Spontaneous thrombosis of giant cavernous internal carotid artery aneurysm in a neonate. Case report and review of the literature. Pediatr Neurosurg 2008;44(4):329–32. doi:10.1159/000134926.

[7] Wang TJ, Liao SL, Jou JR, Lin LL. Clinical manifestations and management of orbital mucoceles: the role of ophthalmologists. Jpn J Ophthalmol 2005;49(3):239–45. doi:10.1007/s10384-004-0174-8.

[8] Fontela PS, Tampieri D, Atkinson JD, Daniel SJ, Teitelbaum J, Shemie SD. Posttraumatic pseudoaneurysm of the intracavernous internal carotid artery presenting with massive epistaxis. Pediatr Crit Care Med 2006;7(3):260–2. doi:10.1097/01.PCC.0000216418.01278.5E.

[9] Regli L, Piepgras DG, Hansen KK. Late patency of long saphenous vein bypass grafts to the anterior and posterior cerebral circulation. J Neurosurg 1995;83(5):806–11. doi:10.3171/jns.1995.83.5.0806 .

[10] Tantana S, Pilla TJ, Awwad EE, Smith KR. Balloon embolization of a traumatic carotid-ophthalmic pseudoaneurysm with control of the epistaxis and preservation of the internal carotid artery. AJNR Am J Neuroradiol 1987;8(5):923–4.

[11] Sridharan R, Low SF, Mohd MR, Kew TY. Intracavernous internal carotid artery pseudoaneurysm. Singapore Med J 2014;55(10):e165–8. doi:10.11622/smedj.2014148.

[12] Pandey P. Parent vessel occlusion and revascularization: A dying art? Neurol India 2018;66(3):657–60. doi:10.4103/0028-3886.232315.

[13] Abdalkader M, Piotin M, Chen M, Ortega-Gutierrez S, Samaniego E, Weill A, et al. Coil migration during or after endovascular coiling of cerebral aneurysms. J Neurointerv Surg 2020;12(5):505–11. doi:10.1136/neurintsurg-2019-015278.

[14] Maras D, Lioupis C, Magoufis G, Tsamopoulos N, Moulakakis K, Andrikopoulos V. Covered stent-graft treatment of traumatic internal carotid artery pseudoaneurysms: a review. Cardiovasc Intervent Radiol 2006;29(6):958–68. doi:10.1007/s00270-005-0367-7.

[15] Ruiz-Juretschke F, Castro E, Mateo Sierra O, Iza B, Manuel Garbizu J, Fortea F, et al. Massive epistaxis resulting from an intracavernous internal carotid artery traumatic pseudoaneurysm: complete resolution with overlapping uncovered stents. Acta Neurochir (Wien) 2009;151(12):1681–4. doi:10.1007/s00701-009-0294-5.

[16] Amenta PS, Starke RM, Jabbour PM, Tjoumakaris SI, Gonzalez LF, Rosenwasser RH, et al. Successful treatment of a traumatic carotid pseudoaneurysm with the Pipeline stent: case report and review of the literature. Surg Neurol Int 2012;3:160. doi:10.4103/2152-7806.105099.

[17] Kupersmith MJ, Hurst R, Berenstein A, Choi IS, Jafar J, Ransohoff J. The benign course of cavernous carotid artery aneurysms. J Neurosurg 1992;77(5):690–3. doi:10.3171/jns.1992.77.5.0690.

[18] Elias AE, Chaudhary N, Pandey AS, Gemmete JJ. Intracranial endovascular balloon test occlusion: indications, methods, and predictive value. Neuroimaging Clin N Am 2013;23(4):695–702. doi:10.1016/j.nic.2013.03.015.