Postembolization perianeurysmal edema as a cause of uncinate seizures

José E. Cohen^{a,b,*}, Eyal Itshayek^a, Moshe Attia^a, Samuel Moscovici^a

^a Department of Neurosurgery, Hadassah–Hebrew University Medical Center, Ein-Kerem, P.O. Box 12000, Jerusalem 91120, Israel ^b Departments of Endovascular Neurosurgery and Interventional Neuroradiology, Hadassah–Hebrew University Medical Center, Jerusalem, Israel

ARTICLE INFO

Article history: Received 24 August 2011 Accepted 31 August 2011

Keywords: Aneurysm Cerebral edema Embolization Flow diverter Uncinate seizures

ABSTRACT

We report a patient with a giant unruptured supraclinoid aneurysm treated by endovascular embolization by means of bare coils and implantation of a flow diverterstent. Eight weeks after the embolization, she presented with uncinate seizures. Neuroradiological examination revealed *de novo* postembolization perianeurysmal edema, which has been described only rarely. A brief course of oral steroids successfully controlled the seizures. Perianeurysmal edema must be considered a potential complication after embolization of large aneurysms with coils and other means, and needs to be considered as a differential diagnosis in patients with unusual neurological symptoms at either the acute or delayed stages. To our knowledge, this is the first report of postembolization perianeurysmal edema occurring after successful occlusion by means of bare coils and a flow diverterstent. This report contributes to the growing evidence on adverse post-coiling inflammatory reactions, and specifically on perianeurysmal edema.

© 2011 Elsevier Ltd. All rights reserved.

1. Introduction

Postembolization perianeurysmal edema is an infrequent and poorly understood phenomenon that may develop following endovascular treatment of large and giant aneurysms.^{1–3} It is considered among the adverse inflammatory reactions that may occur after coiling, together with aseptic meningitis and hydrocephalus.^{4–6} A recent literature review³ identified 25 cases describing this phenomenon, and concluded that edema tends to occur mainly in patients older than 40 years with large unruptured aneurysms of the carotid artery. The use of second-generation bioactive coils such as polyglycolic/polylactic acid (PGLA)-coated (Matrix coils, Boston Scientific, Natick, MA, USA) and hydrogel coils (HydroCoil, Microvention, Tustin CA, USA) has been implicated, although edema has also been described in patients treated exclusively with bare platinum coils.^{1,5,6} Time frame, clinical presentation, and clinical course are highly variable and poorly defined.

Recently Vu Dang et al.³ described the first case of epilepsy in relation to this complication in a patient with an unruptured large carotid aneurysm treated with bare platinum coils 1 month earlier. We present a patient with a giant unruptured carotid–ophthalmic aneurysm successfully treated with a combination of bare coils and a flow diverterstent, who presented with uncinate seizures in relation to perianeurysmal edema 2 months after treatment.

2. Case report

A 54-year-old female presented for neurosurgical consultation due to a giant right carotid ophthalmic aneurysm discovered incidentally on a head CT scan performed for episodic dizziness. MRI revealed no perianeurysmal edema (Fig. 1A and B). The patient had an unremarkable medical history and her neurological examination was normal. Cerebral angiography was performed and the aneurysm was measured precisely; maximal diameter was 25 mm × 19 mm and the neck was 9 mm (Fig. 1C). Combined endosaccular coiling and flow diverterstent placement performed under general anesthesia facilitated total occlusion of the aneurysm (Fig. 1D and E). The postoperative period was uneventful and the patient was discharged with mild retro-orbital headaches that were controlled with regular analgesics.

Two months after endovascular treatment, the patient began to experience repeated self-limiting episodes of unpleasant olfactory hallucinations (phantosmia) without loss of consciousness, with 10 to 20 episodes occurring daily. A head CT scan and then MRI showed signs of temporal and frontal perianeurysmal edema with aneurysm wall enhancement (Fig. 1F–H). A 24-hour scalp electroencephalogram–video showed right anterior temporal spikes during sleep, confirming right temporal seizures. Treatment with cortico steroids was started (prednisone, 10 mg/day) with almost immediate control of the olfactory seizures. Follow-up MRI 5 months later showed no perianeurysmal edema. Steroids were discontinued after 2 months.

3. Discussion

The development of postembolization perianeurysmal edema has been reported infrequently and the phenomenon is likely far more prevalent than suggested by the existing literature. On serial gadolinium-enhanced MRI, Fanning et al.² detected *de novo* edema in five of 56 unruptured aneurysms (8.9%) that had been treated by endovascular coiling. All these patients were asymptomatic.

In their recent review of *de novo* perianeurysmal edema after endovascular treatment, Vu Dang et al.³ confirmed the observation of other authors^{1,2,5,6} that perianeurysmal edema tends to occur in patients over the age of 40 years, following endovascular treatment of large unruptured aneurysms of the carotid artery. The phenomenon has been observed in patients treated with bare platinum coils as well as those managed using second-generation modified coils; however, it seems to be more prone in patients treated with modified coated coils.^{1,5,6}

Aneurysm swelling and perianeurysmal edema have been welldocumented after indirect endovascular and surgical procedures, including parent vessel occlusion or Hunterian ligation for the management of large supraclinoid aneurysms.^{7,8} Perianeurysmal edema is thus not exclusive to endosaccular embolizations, and has been considered an adverse reaction to large aneurysm thrombosis.

The larger the aneurysm, the larger the thrombotic mass and the more prominent the associated inflammatory reaction.

^{*} Corresponding author. Tel.: +1 972 2 6777092.

E-mail address: jcohenns@yahoo.com (J.E. Cohen).



Fig. 1. (A) Axial fluid-attenuated inversion recovery (FLAIR) and (B) axial T2-weighted MRI before treatment showing a giant supraclinoid aneurysm without signs of perianeurysmal edema. (C) Selective angiogram of the right internal carotid artery showing the giant aneurysm obtained before, and (D) immediately after embolization. (E) Magnified radioscopic image of the implanted coils and flow diverterstent. (F) Axial FLAIR MRI obtained 2.5 months after embolization showing perianeurysmal edema extending to the temporal uncus, and (G) frontal area. (H) Coronal gadolinium-enhanced T1-weighted MRI showing significant aneurysm wall enhancement.

Postembolization perianeurysmal edema may occur from a few hours to several months after treatment but is usually self-limiting. However, the edema may last for months and may cause progressive incapacitating neurological deterioration requiring decompressive surgical procedures or shunting.^{4,7–9}

Several mechanisms have been proposed to explain this finding and its clinical course. Edema frequently occurs in association with aneurysm wall enhancement, which probably represents a normal healing response mediated by inflammatory changes.² Some authors suggested that edema may represent an epiphenomenon of either normal or exaggerated healing that extends transmurally to the adjacent brain. Others consider that perianeurysmal edema is related to the water-hammer effect transmitted to the brain parenchyma through the coil mesh and finally through the aneurysmal wall during coiling, which may lead to a slight increase of aneurysm diameter and mechanical irritation of adjacent structures due to increasing the mass effect.^{5,6,8} Horie et al.⁹ postulated that incomplete occlusion of large aneurysms located deep within the brain may lead to a disorganized intraluminal thrombosis and aneurysm pulsing, with resulting intramural hemorrhage or inflammation, all of which are associated with brain edema following aneurysm recanalization and regrowth.

Treatment options for perianeurysmal edema depend on symptoms, neuroradiological evolution and pathogenesis, and may include conservative management in asymptomatic patients, the use of steroids and other anti-edematous medications, surgical decompression, or further embolization to completely occlude growing aneurysm remnants. In our patient, steroid treatment was sufficient to control uncinate seizures, and follow-up MRI showed resolution of perianeurysmal edema.

A significant proportion of patients who develop postembolization perianeurysmal edema are most likely asymptomatic, or may present unspecific symptoms such as headaches or malaise, probably leading to underdiagnosis of this entity. Other patients may present with focal symptoms and visual deterioration in cases of supraclinoid carotid aneurysms. Seizures are an exceptional presentation of perianeurysmal edema; we found only one reported case of seizures after uncal edema in relation to a supraclinoid carotid aneurysm during our literature search.³ Patients that develop perianeurysmal edema should be followed to rule out development of hydrocephalus.

In conclusion, perianeurysmal edema must be considered a potential complication after embolization of large aneurysms with coils and other means, and needs to be considered as a differential diagnosis in the patient with unusual neurological symptoms at either the acute or delayed stages. We present a patient with an unusual postembolization perianeurysmal edema causing uncinate seizures. To our knowledge, this is the first report of *de novo* postembolization perianeurysmal edema that occurred after successful occlusion by means of combined bare coiling and flow

doi:10.1016/j.jocn.2011.08.008

diverterstent. This report contributes to the growing body of evidence on post-coiling adverse inflammatory reactions and specifically on perianeurysmal edema.

4. Conflicts of interest

The authors have no conflicts of interest to declare.

Acknowledgements

We wish to thank Shifra Fraifeld, a research association in our Departments, for her editorial assistance in the preparation of this manuscript.

References

- Deshaies EM, Adamo MA, Boulos AS. A prospective single-center analysis of the safety and efficacy of the hydrocoil embolization system for the treatment of intracranial aneurysms. J Neurosurg 2007;106:226–33.
- Fanning NF, Willinsky RA, ter Brugge KG. Wall enhancement, edema, and hydrocephalus after endovascular coil occlusion of intradural cerebral aneurysms. J Neurosurg 2008;108:1074–86.
- 3. Vu Dang L, Ággour M, Thiriaux A, et al. Post-embolization perianeurysmal edema revealed by temporal lobe epilepsy in a case of unruptured internal carotid artery aneurysm treated with bare platinum coils. *J Neuroradiol* 2009;**36**:298–300.
- Im SH, Han MH, Kwon BJ, et al. Aseptic meningitis after embolization of cerebral aneurysms using hydrogel-coated coils: report of three cases. AJNR Am J Neuroradiol 2007;28:511–2.
- Stracke CP, Krings T, Moller-Hartmann W, et al. Severe inflammatory reaction of the optic system after endovascular treatment of a supraophthalmic aneurysm with bioactive coils. *AJNR Am J Neuroradiol* 2007;28:1401–2.
- White JB, Cloft HJ, Kallmes DF. But did you use HydroCoil? Perianeurysmal edema and hydrocephalus with bare platinum coils. *AJNR Am J Neuroradiol* 2008;29:299–300.
- Attia M, Cohen JE, Shapira OM, et al. Visual failure and recovery after thrombosis of a giant carotid ophthalmic aneurysm following vascular bypass and carotid artery ligation. J Clin Neurosci 2011;18:152–4.
- Blanc R, Weill A, Piotin M, et al. Delayed stroke secondary to increasing mass effect after endovascular treatment of a giant aneurysm by parent vessel occlusion. AJNR Am J Neuroradiol 2001;22:1841–3.
- Horie N, Kitagawa N, Morikawa M, et al. Progressive perianeurysmal edema induced after endovascular coil embolization. Report of three cases and review of the literature. J Neurosurg 2007;106:916–20.