Surgical bailout of giant supraclinoid ICA aneurysm following treatment with Pipeline Embolization Device

TO THE EDITOR: We read with great interest the recent article by Abla et al.1 wherein the authors describe the case of a giant fusiform internal carotid artery (ICA) aneurysm that was treated with a Pipeline Embolization Device (PED) (Abla AA, Zaidi HA, Crowley RW, et al: Optic chiasm compression from mass effect and thrombus formation following unsuccessful treatment of a giant supraclinoid ICA aneurysm with the Pipeline device: open surgical bailout with STA-MCA bypass and parent vessel occlusion. J Neurosurg Pediatr 14:31–37, July 2014). The patient developed progressive symptoms of mass effect and bilateral visual decline, necessitating surgical bailout to decompress the optic apparatus and an extracranial-intracranial bypass with parent artery occlusion. The authors articulately discussed yet another cautionary phenomenon following flow diversion, namely rapid intramural thrombus formation and worsening of mass effect involving the optic structures.

We have previously encountered this uncommon and probably underreported complication. Our patient was a 47-year-old woman who presented with visual decline and headaches. Examination revealed a homonymous hemianopia, and an MRI study demonstrated a giant left supraclinoid ICA aneurysm with compression of the optic apparatus. The lesion was treated with a PED, and the patient continued to have progressive visual decline. Approximately 3 weeks later she could not recognize faces, and examination confirmed dramatic visual decline. At that time, optic decompression was deemed necessary. The patient tolerated balloon test occlusion with hypotensive challenge, and we planned to attempt decompression and aneurysm clipping or trapping. Aspirin and clopidogrel were discontinued 1 day before surgery, and she received super pack of platelets prior to and during the procedure. The falciform ligament was released with unroofing of the optic canal before aneurysm exposure. The aneurysm was dissected far from the neck for debulking, and we encountered bleeding from the thrombus. The PED rendered the ICA stiff and difficult to mobilize. The clinoid process was removed, and the proximal aneurysm neck could not be visualized. Aneurysm trapping was performed with temporary clips over the PED proximal to the posterior communicating artery and the cervical ICA. Ongoing filling of the aneurysm was controlled with clipping of the ophthalmic artery. We were concerned about application of temporary clipping over the pipeline due to the risk of deformity or occlusion of the vessel at the PED-treated ICA segment. However, we noticed flow inside the ICA after removal of the temporary clip and proceeded with placement of a permanent clip. The bleeding from the thrombus was reduced significantly, and thrombectomy with decompression was completed. Postoperatively, the patient remained blind in the left eye and improved to acuity of 20/25 in her right eye, and she adjusted to monocular vision and was able to drive again.

Despite an encouraging experience with flow diversion, the biological mechanism of aneurysm occlusion and development of mass effect is unclear. Theoretically, gradual aneurysm thrombosis occurs following alterations in the intraaneurysmal flow by the PED, and this process is followed by resorption of the thrombus and collapse of the aneurysm.3 However, this model assumes an optimal balance between thrombus formation and degradation so that the aneurysm would not increase in size, a concept that has been able to predict potential aneurysm enlargement and development of mass effect. As noted in the authors’ case and in our patient, aneurysm thrombosis can exacerbate the mass effect and cause permanent visual loss. In addition, conservative management with steroids, soft packing with coils, and deployment of additional devices have an unpredictable outcome and may not obviate the need for definitive treatment with surgical decompression and aneurysm obliteration. The presence of PEDs in the parent vessel also added complexity to the procedure because the vessel became rigid and difficult to manipulate. While discontinuing antiplatelet therapy puts the patient at risk of device thrombosis and ischemic complications, intraoperative bleeding may be challenging despite administration of platelets.

We share the authors’ concerns, because the optic nerve has a relatively lower tolerance to extrinsic compression and, in comparison, might be less tolerant to mass effect than other cranial nerves. Another important principle refers to the application of temporary clips over PED in vivo. We noted that placement of aneurysm clips effectively arrested flow through the PED-treated ICA segment. Although in vitro flow models have shown that the PED may be irreversibly deformed after the first clip application,
causing a decrease in the luminal diameter of the vessel,\(^2\) the degree of device deformity, reduction in luminal flow, and pressure gradient across the vessel wall harboring the PED have not been studied in vivo. Finally, the degree of tolerance of the optic nerve and chiasm to prolonged compression remains obscure. The duration of mass effect and preoperative visual acuity are commonly used to estimate the postoperative outcome. Garcia et al.\(^3\) showed that the thickness of the nasal retinal nerve fiber layer appears to be a predictor of peripheral visual field recovery, but the threshold at which surgical decompression is warranted has yet to be defined. In the era of flow diverters, these cases illustrate the newer challenges faced by vascular neurosurgeons and the need to address the mass effect on the optic apparatus expeditiously and effectively.

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DISCLOSURE
The authors report no conflict of interest.

References

Response
We would like to thank Brasiliense et al. for their insightful comments on our paper and for reporting a similar case in which mass effect on the optic apparatus developed following flow diversion. Our understanding of the intricacies and relationships between aneurysm thrombosis with thrombus deposition and concurrent thrombus degradation remain the topic of continued study. This phenomenon will benefit from ongoing computational modeling and animal models of flow diversion. Although the flow diverters that are currently available are not new and are suitable for a host of indications, as with any new use of technology, caution is appropriate while more data on the inherent strengths and weaknesses accumulate.

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