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Successful Treatment of Giant Intracranial Aneurysm Using Flow-Diverter Device: First Experience in Nepal

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ABSTRACT

Giant intracranial aneurysms are defined as aneurysms that measure over 25 mm in the greatest dimension. They are rare vascular lesions that preferentially involve regions with high-velocity blood flow, such as the cavernous and supraclinoid segments of the internal carotid artery, the middle cerebral artery, the vertebrobasilar region, and the basilar apex. The treatment of giant aneurysms is challenging and associated with high rates of morbidity and mortality. Flow-diverter devices have revolutionized their treatment in recent times. We report the successful management of two patients with giant cavernous internal carotid artery aneurysms using flow-diverter devices for the first time in Nepal.

Keywords: Endovascular; flow-diverter devices; giant aneurysm

INTRODUCTION

Giant intracranial aneurysms are arbitrarily defined as aneurysms that exceed 25 mm in the greatest dimension.[1] Nearly two-thirds of all giant aneurysms are found in the anterior circulation, and they usually present with features of compression of adjacent nerves.[1,2] Neurosurgical clipping of a giant aneurysm is difficult and carries a high risk of debilitating morbidity and mortality. Recent advances in endovascular procedures and more importantly, the introduction of flow-diverter devices (FDDs), have ameliorated the management of these complex aneurysms. We present reports of two patients with giant cavernous internal carotid artery (ICA) aneurysms, who were successfully treated with FDDs with no peri-procedural complications.

CASE REPORT

Case 1

A 48-year-old woman presented to us with a history of diplopia for two weeks. On examination, there were signs of right oculomotor nerve palsy. There were no other neurologic deficits. Magnetic resonance imaging (MRI) revealed a giant aneurysm in the region of the right cavernous sinus (Figure 1a). Digital subtraction angiography (DSA) confirmed the presence of a giant right cavernous ICA aneurysm with normal-filling of the distal ICA and its branches (Figure 1b). Right femoral arterial access was obtained and a 6-F guiding catheter (Neuron Max, Penumbra, USA) was placed in the right cervical ICA. Subsequently, an intracranial support catheter (Navien, Medtronic, USA) was passed through the guiding catheter and advanced just proximal to the aneurysm. The aneurysm neck was crossed using a microcatheter and microguidewire assembly (Headway-27 and Traxcess-14, MicroVention, USA). The microcatheter and microguidewire assembly was advanced into the M-3 segment of the MCA, and the loop within the aneurysm was straightened. After confirming the tip of the microcatheter in the distal M-1 segment of the MCA, a 4.5 x 30 mm flow-diversion stent (Pipeline Embolization Device, Medtronic, USA) was deployed from the ICA bifurcation to the horizontal segment of the cavernous ICA (Figure 1c, 1d). The final check angiogram showed a significant stasis of contrast within the aneurysm (Figure 1e). The post-procedure computed tomography (CT) scan was normal.

The patient was admitted to the intensive care unit for one day after the procedure and was discharged from the

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hospital after three days. The patient was sent home on 150 mg aspirin and 150 mg clopidogrel. At three-month follow-up, there was complete resolution of diplopia, and a plain MRI revealed significant thrombosis of the aneurysmal sac (Figure 1f).

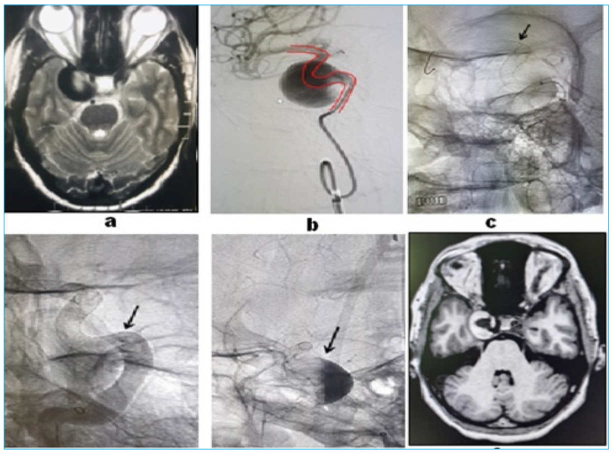

Figure 1. a) An Axial T2-weighted MRI showing right cavernous ICA aneurysm b) A 2-D right ICA angiogram showing a giant cavernous aneurysm with normal distal filling c) A lateral fluoroscopy image showing the deployment of FDD (black arrow) d) A lateral fluoroscopy image showing FDD across the aneurysm (black arrow) e) A 2-D right ICA angiogram with native images after FDD deployment showing contrast stasis (black arrow) f) An Axial T1-weighted MRI showing significant thrombosis of the aneurysmal sac.

Case 2

A 52-year-old man presented to the hospital with diplopia for one month. There were signs of right third cranial nerve palsy on examination. There was no history of fever, headache, loss of consciousness, loss of vision, or trauma. We did not find any other neurologic deficit on examination. Computed tomography angiography found a giant right cavernous ICA aneurysm. DSA confirmed a giant cavernous ICA aneurysm (Figure 2a) with adequate cross-flow (Figure 2b). The aneurysm neck was crossed using a microcatheter and microguidewire assembly using the same procedural steps as in Case 1 (Figure 2c). However, straightening the loop within the aneurysm was not possible. Hence, the microcatheter was anchored distally by deploying a neurovascular remodeling device (Solitaire 4x30, Medtronic, USA) in the M-2 segment of the MCA and the loop was straightened (Figure 2d). The microcatheter was pulled to the distal M-1 segment of the MCA and a 4x35 mm flow-diversion stent (Pipeline Embolization Device, Medtronic, USA) was deployed from the ICA bifurcation to the horizontal segment of the cavernous ICA (Figure 2e). The final check angiogram revealed a significant stasis of contrast within the aneurysm (Figure 2f). The CT scan performed immediately after the intervention was unremarkable.

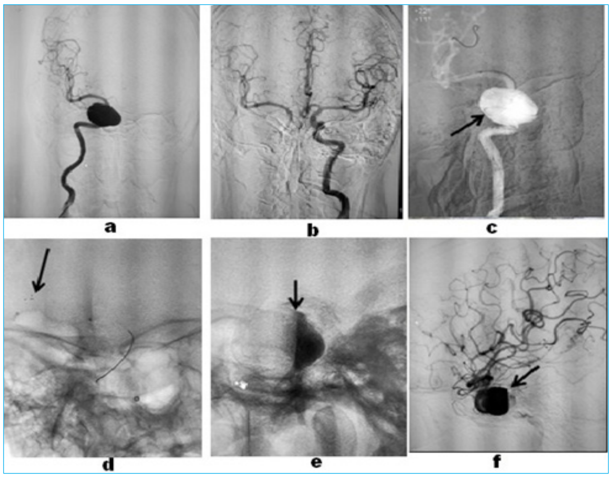

Figure 2. a) A 2-D right ICA angiogram shows a giant right cavernous ICA aneurysm b) Cross-compression study shows adequate cross-flow c) A road map image showing crossing of microcatheter/microguidewire assembly by forming a loop (black arrow) within the aneurysm d) A lateral fluoroscopy image showing stent (black arrow) placed distally for straightening the loop within the aneurysm e) A lateral fluoroscopy image after FDD deployment showing contrast stasis (black arrow) f) Final angiogram showing stasis within the aneurysm sac (black arrow) with a good filling of distal intracranial arteries.

After the procedure, the patient was admitted to the intensive care unit for two days, and was discharged from the hospital on the seventh day of admission. The patient was discharged on dual antiplatelets – aspirin (150 mg) and clopidogrel (150 mg). At 3-months follow-up, there was no diplopia, and a CT-scan revealed a significant decrease in the size of the aneurysm.

DISCUSSION

Most giant aneurysms involve the cavernous ICA, the supraclinoid ICA, the MCA, and the vertebro-basilar regions. Cavernous carotid aneurysms (CCAs) are a distinct form of extradural aneurysms, which may produce compression of the adjacent second to sixth cranial nerves resulting in features such as headache, facial pain, diminution of vision, ptosis, diplopia, and dysarthria. If the aneurysm increases in size, it can penetrate or protrude through the dura and cause hemorrhagic complications. In the International Study of Unruptured Intracranial Aneurysms study, large CCAs (>13 mm) had a 5-year rupture rate of 9.4%.[3] Optimal management of giant CCAs requires careful consideration of the aneurysm size and shape, neck morphology, relation to adjacent structures, branch artery origins, the presence of collaterals, and intraluminal thrombus. The goals of treatment are to protect against aneurysm rupture, prevent thromboembolic phenomena, decrease mass-effect, and prevent growth of the aneurysm.

Broadly, giant CCAs can be treated by deconstructive or reconstructive approaches. Deconstructive approaches include parent artery occlusion (PAO) with or without a vascular bypass. Reconstructive techniques include neurosurgical clipping, endovascular coiling, and flow-diversion. The reconstructive approach aims to preserve the parent artery. However, there are limitations to all these techniques. PAO has long-term complications related to vessel sacrifice. Direct microsurgical clipping of giant CCAs is extremely challenging as it is difficult to create a surgical corridor without injuring adjacent cranial nerves. Coil embolization of giant aneurysms has several limitations, such as procedural difficulties, incomplete aneurysm occlusion, high recurrence rate, and delayed thromboembolism.[4] Flow-diversion is a relatively new technique that promotes aneurysm occlusion by mechanically redirecting blood away from the aneurysm, leading to stasis of blood in the sac, clot formation, remodeling, and neo-intimal growth.[5]

The Pipeline for Uncoilable or Failed Aneurysms (PUFS) trial established FDDs as a safe and effective treatment modality for giant ICA aneurysms with low rates of neurologic complications.[6] Several subsequent studies have established the safety and feasibility of FDDs in the treatment of anterior circulation aneurysms.[7,8] With the use of FDDs, complete aneurysm occlusion was noted in 82.6% cases by Pistocchi et al,[9] 95% of cases by Lylyk et al,[10] and 86.8% cases in the PUFS trial.[6] Emerging evidence suggests that FDDs are superior to conventional coiling in the obliteration of giant aneurysms with no significant difference in complication rates. Although thromboembolic manifestations are theoretically more likely with FDDs than endovascular coils because of their large size and high metal surface area coverage, there is no convincing evidence to support this theory in clinical practice. However, like in any endovascular procedure, clinicians must be vigilant of the potential complications of FDDs, such as technical failure, improper device positioning, intraparenchymal hemorrhage, and ischemic events.

CONCLUSIONS

FDDs have lately emerged as the preferred treatment option for giant ICA aneurysms. Both our patients were successfully treated with FDDs with good outcomes. To the best of our knowledge, this is the first report of the successful use of FDDs to treat giant intracranial aneurysms in Nepal.

REFERENCES

1. Choi IS, David C. Giant intracranial aneurysms: Development, clinical presentation and treatment. Eur J Radiol. 2003;46(3):178-194.[ScienceDirect] https://doi.org/10.1016/S0720-048X(03)00090-1
2. Sundt TM, Jr., Piepgras DG. Surgical approach to giant intracranial aneurysms. Operative experience with 80 cases. J Neurosurg. 1979;51(6):731-742. https://doi.org/10.3171/jns.1979.51.6.0731
3. Wiebers DO, Whisnant JP, Huston J. Unruptured intracranial aneurysms: Natural history, clinical outcome, and risks of surgical and endovascular treatment. Lancet. 2003;362(9378):103-110.
4. Biondi A, Jean B, Vivas E, Le Jean L, Boch AL, Chiras J, et al. Giant and large peripheral cerebral aneurysms: etiopathologic considerations, endovascular treatment, and long-term follow-up. Am J Neuroradiol. 2006;27(8):1685-92.[FullText]
5. Rajah G, Narayanan S, Rangel-Castilla L. Update on flow diverters for the endovascular management of cerebral aneurysms. Neurosurg Focus. 2017;42(6):E2.https://doi.org/10.3171/2017.3.FOCUS16427
6. Becske T, Kallmes DF, Saatci I, McDougall CG, Szikora I, Lanzino G, et al. Pipeline for uncoilable or failed aneurysms: results from a multicenter clinical trial. Radiology. 2013;267(3):858-68.https://doi.org/10.1148/radiol.13120099
7. Park KY, Yeon JY, Kim BM, Jeon P, Kim JH, Jang CK, et al. Efficacy and Safety of Flow-Diverter Therapy for Recurrent Aneurysms after Stent-Assisted Coiling. Am J Neuroradiol. 2020;41(4):663-8.https://doi.org/10.3174/ajnr.A6476
8. Zhang Y, Zhou Y, Yang P, Liu J, Xu Y, Hong B, et al. Comparison of the flow diverter and stent-assisted coiling in large and giant aneurysms: safety and efficacy based on a propensity score-matched analysis. Eur Radiol. 2016;26(7):2369-77.[Springer]
9. Pistocchi S, Blanc R, Bartolini B, Piotin M. Flow diverters at and beyond the level of the circle of willis for the treatment of intracranial aneurysms. Stroke. 2012;43(4):1032-1038. [FullText]
10. Lylyk P, Miranda C, Ceratto R, Ferrario A, Scrivano E, Luna Hr, Berez AL, et al. Curative Endovascular Reconstruction Of Cerebral Aneurysms With The Pipeline Embolization Devicethe Buenos Aires Experience. Neurosurgery. 2009;64(4):632-43.https://doi.org/10.1227/01.NEU.0000339109.98070.65