Universe Scientific Publishing

Telescoping Tubridge flow diverter treatment in giant middle cerebral artery fusiform aneurysm

Hetai Lai
Zhuhai Hospital Affiliated With Jinan University (Zhuhai People's Hospital), Zhuhai 519000, China.

Abstract: Giant fusiform aneurysm of the middle cerebral artery is a rare lesion with a high risk of rupture and high mortality, which is more difficult to treat either surgically or endovascularly. We report a case of a giant middle cerebral artery (MCA) M1 segmental fusiform aneurysm treated with the Tubridge Flow Diverter (TFD) telescoping technique alone without coil embolization. The patient had a single TFD implanted initially after the accidental discovery of a giant left MCA fusiform aneurysm, and after 3 months of postoperative shortening of the proximal end of the TFD and no significant healing of the aneurysm, a second TFD was implanted in the second stage by Telescoping technique. the aneurysm healed completely at 6 and 18 months after procedure, with no significant complications during follow-up.
Keywords: Flow Diverter; Endovascular Treatment; Middle Cerebral Artery; Fusiform Aneurysm; Tubridige

Introduction

Intracranial fusiform aneurysms are characterized by low morbidity, high bleeding rate, high mortality and technical difficulty.[1, 2] Flow diverters (FD) have gradually become one of the best options for the treatment of fusiform aneurysms,[3, 4]of which, the most used are Pipeline embolization diverters (PED) and Tubridge flow diverters (TFD). The treatment is mostly coil embolization combined with a single FD implant. However, fusiform MCA aneurysms are at greater risk of penetrating infarction and generally heal less efficiently than posterior circulation aneurysms due to their origin in the penetrating ductus arteriosus.[5] In addition, fusiform aneurysms have long necks and may have incomplete coverage with a single FD length. Thus, Liu et al. reported cases of fusiform aneurysms treated by telescoping FD technique, the majority of which were combined with coil embolization and were predominantly located in the posterior circulation.[6] In this case, we report the successful treatment of MCA fusiform aneurysm with telescoping FD without coil embolization, and the patient has a good prognosis.

Case report

A 29-year-old man with no previous history of underlying medical conditions had a left middle cerebral artery fusiform aneurysm (Figure1 A) discovered unexpectedly during the completion of cranial magnetic resonance (MR) in the course of treatment for a middle ear cholesteatoma, followed by the completion of magnetic resonance artery (Figure1 B). A digital subtraction angiogram (DSA) was performed, which showed a cloacal aneurysm (Figure1 C, D) measuring 35.4 × 10.6 mm in the left M1 segment of the MCA.

Before treatment, the CYP2C19 genetic test showed a good response to aspirin (ASA) and clopidogrel. The patient was given ASA (100mg daily) and clopidogrel (75mg daily) five days before the procedure. Thromboelastograms (TEGs) was performed in the patient to evaluate the efficacy of platelet inhibition. A 8F Cordis, Fremont, California, USA) was placed at the C1 end of the left internal carotid artery. With the cooperation of a 5F MidAccess catheter(125 cm, Passageway, CHINA) and 0.014 micro-guide wire (200 cm, Stryker, USA), a T-track stent catheter (MicroPort, Shanghai) was introduced in the ipsilateral MCA M3. A Tubridge stent (4.0 × 45 mm, MicroPort, China) was released from the MCA M2 segment to the M1 segment (Figure2 A～D). No significant abnormality was seen on the 24h postoperative reexamination of the Computed Tomography. The patient was discharged without complication and the mRS score: 0. Regular medication was taken after discharge.

Three months later, DSA showed no healing of the MCA fusiform aneurysm (Figure3 A), shortening of the proximal end of the stent, and visible stenosis of the distal vessel (Figure3 B). Further treatment by TFD bridging was decided after discussion. During the procedure, a Tubridge FD (4.0 × 45 mm) was released in the M1 segment of the MCA (Figure3 C). The stent was released completely and the contrast was visible on imaging with significant retention of contrast (Figure3 D). The patient was discharged without any complication.

Six months after telescoping, DSA showed that the fusiform aneurysm was significantly reduced and the distal stenosis was improved (Figure4 A, B). And the DSA was reexamined at 18 months, showing complete healing of the aneurysm (Figure4 C, D).

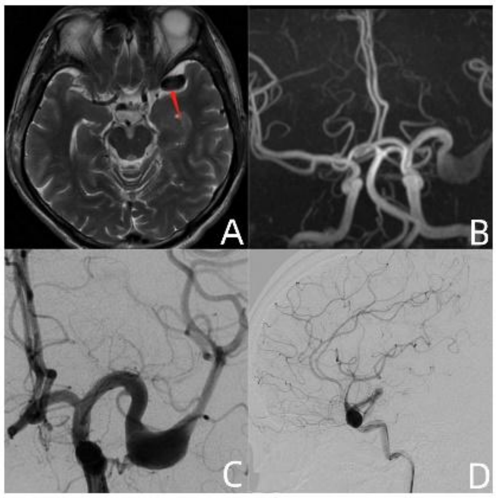

Figure1: (A) and (B) magnetic resonance of the giant middle cerebral artery fusiform aneurysm. (C) and (D) before the procedure, anteroposterior and lateral angiography of the left internal carotid artery.

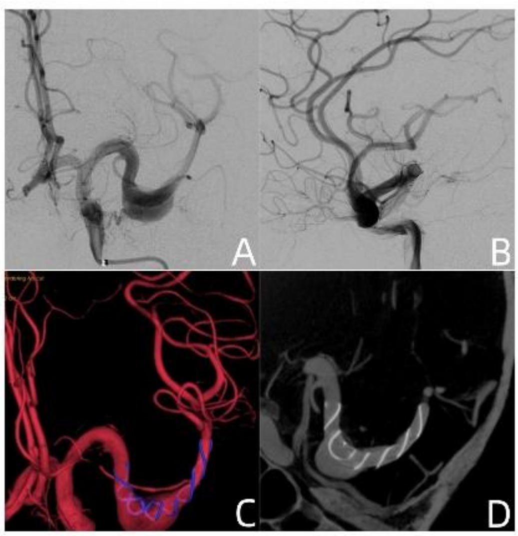

Figure2:（A）and (B) after the procedure, anteroposterior and lateral angiographies of the left internal carotid artery. (C) and

(D) the FD was completely opened and released well.

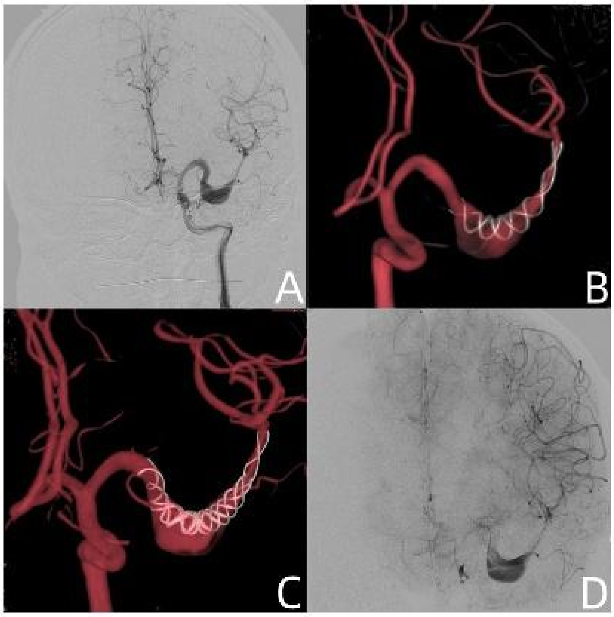

Figure3: （A）no significant healing of the aneurysm. (B) shortening of the proximal end of the stent, and visible stenosis of the distal vessel. (C) after the treatment of telescoping FD. (D) significant contrast stagnation within the aneurysm can be seen.

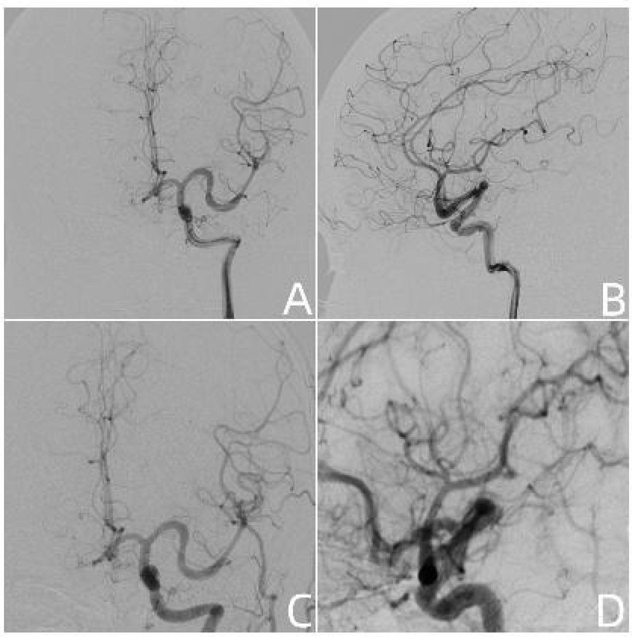

Figure4: (A) and (B) 6 month later, anteroposterior and lateral angiographies of the left internal carotid artery. (C) and (D) the angiographies still showed a complete healing.

Discussion

MCA giant fusiform aneurysms are relatively rare in clinical practice, and there is no standard treatment option. The healing efficiency of conventional stent-assisted embolization for fusiform aneurysms is low because of the long aneurysm neck that is difficult to embolize densely, as well as the low metal coverage of conventional stents and slow intra-aneurysm thrombus formation. FD is generally safe and effective when applied to fusiform aneurysms, with neurological morbidity/mortality ranging from 4 to 8% and aneurysm occlusion rates of 59-75%.[3, 4, 7] Chalouhi et al. reported that the application of multiple FD to the same unruptured aneurysm would not only increase the technical difficulty of the procedure but also further increase the rate of complications.[8] However, limited by the size of the FD and the potential for shortening, not all fusiform aneurysms can be well occluded by a single FD. In addition, the telescoping FD technique increases metal coverage, which can reduce intra-aneurysmal flow velocity by up to 30%, accelerating aneurysm healing and reducing the risk of rupture bleeding. [9, 10]

The application of telescoping FD techniques to MCA fusiform aneurysms is currently reported to be limited and is mostly based on coil embolization. Ikeda et al. reported the successful treatment of M2 segment fusiform aneurysms with 3 telescopic PEDs. [2] Although Liu et al. reported 2 cases related to MCA aneurysms, one of them used coil embolization and the other case was unknown. To our knowledge, this is the first report of a giant fusiform aneurysm of MCA treated with telescoping TFD alone. In this report, we chose TFD mainly because of the large size of this aneurysm and the fact that the stent is more likely to shorten or even fall off intraoperatively or during the follow-up period when FD is applied to shuttle aneurysms, resulting in incomplete coverage of the aneurysm and preventing intra-aneurysmal thrombosis. [6, 11] The TFD has longer dimensions, stronger radial force and higher metal coverage than the PED, and its safety and effectiveness have been proven. [12] In telescoping technology, it is important to understand the characteristics of FD.

It has been shown that FD apposition is associated not only with aneurysm healing efficiency, but also with in-stent restenosis during the follow-up period. [13, 14] Our experience is that after the telescope technique, there may be poor apposition between the two FD's. Therefore, a "J" wire technique is used to promote apposition, and balloon dilation is used when necessary. In addition, the extent of FD telescope should be increased as much as possible to ensure coverage of the aneurysm neck, which is beneficial for improving metal coverage and the healing process. It has been suggested that the overlapping FD technique will greatly increase the incidence of occlusion of the penetrating artery or in-stent thrombosis , [3] which may be due to a wide aneurysm neck (>20 mm) or insufficient dual anti-platelet aggregation effect. In this case, we followed the approach and extended the patient's time on dual antiplatelet agents until complete healing of the aneurysm, which may be the reason why we were able to keep the patient free of ischemic complications during the follow-up period.

Overall, we report a case of a giant fusiform aneurysm in MCA treated with TFD telescoping technique alone. Future multicenter, large sample, prospective cohort studies are needed to confirm this finding.

References

[1] Xu F, Xu B, Huang L, et al. Surgical Treatment of Large or Giant Fusiform Middle Cerebral Artery Aneurysms: A Case Series [J]. World Neurosurg, 2018, 115(e252-e62.

[2] Ikeda DS, Marlin ES, Shaw A, et al. Successful endovascular reconstruction of a recurrent giant middle cerebral artery aneurysm with multiple telescoping flow diverters in a pediatric patient [J]. Pediatr Neurosurg, 2015, 50(2): 88-93.

[3] Griffin A, Lerner E, Zuchowski A, et al. Flow diversion of fusiform intracranial aneurysms [J]. Neurosurg Rev, 2021, 44(3): 1471-8.

[4] Monteith SJ, Tsimpas A, Dumont AS, et al. Endovascular treatment of fusiform cerebral aneurysms with the Pipeline Embolization Device [J]. J Neurosurg, 2014, 120(4): 945-54.

[5] Xu C, Wu P, Zou L, et al. Anterior Circulation Fusiform Aneurysms Have a Lower Occlusion Rate After Pipeline Embolization Device Treatment Than Posterior Circulation Fusiform Aneurysms: A Multicenter Cohort Study [J]. Front Neurol, 2022, 13(925115.

[6] Tang H, Shang C, Hua W, et al. The 8-year single-center experience of telescoping flow diverter for complex

intracranial aneurysms treatment [J]. J Clin Neurosci, 2022, 100(131-7.

[7] Fischer S, Perez M A, Kurre W, et al. Pipeline embolization device for the treatment of intra- and extracranial fusiform and dissecting aneurysms: initial experience and long-term follow-up [J]. Neurosurgery, 2014, 75(4): 364-74; discussion 74.

[8] Chalouhi N, Tjoumakaris S, Phillips JL, et al. A single pipeline embolization device is sufficient for treatment of intracranial aneurysms [J]. AJNR Am J Neuroradiol, 2014, 35(8): 1562-6.

[9] Damiano RJ, Ma D, Xiang J, et al. Finite element modeling of endovascular coiling and flow diversion enables hemodynamic prediction of complex treatment strategies for intracranial aneurysm [J]. J Biomech, 2015, 48(12): 3332-40.

[10] Uchiyama Y, Fujimura S, Takao H, et al. Hemodynamic Investigation of the Effectiveness of a Two Overlapping Flow Diverter Configuration for Cerebral Aneurysm Treatment [J]. Bioengineering (Basel), 2021, 8(10).

[11] Miyachi S, Hiramatsu R, Ohnishi H, et al. Usefulness of the Pipeline Embolic Device for Large and Giant Carotid Cavernous Aneurysms [J]. Neurointervention, 2017, 12(2): 83-90.

[12] Xie D, Zhao L, Liu H, et al. Tubridge Flow Diverter for the Treatment of Unruptured Dissecting Cerebral Aneurysms [J]. World Neurosurg, 2023.

[13] Liu JM, Zhou Y, Li Y, et al. Parent Artery Reconstruction for Large or Giant Cerebral Aneurysms Using the Tubridge Flow Diverter: A Multicenter, Randomized, Controlled Clinical Trial (PARAT) [J]. AJNR Am J Neuroradiol, 2018, 39(5): 807-16.

[14] Aquarius R, De Korte A, Smits D, et al. The Importance of Wall Apposition in Flow Diverters [J]. Neurosurgery, 2019, 84(3): 804-10.