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Case Report

Giant vertebral aneurysm: A case report detailing successful treatment with combined stenting and surgery

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Abstract

Background: Giant aneurysms (>25 mm) arising from the vertebral artery (VA) often present with slow progression of symptoms and signs because of gradual brainstem and cranial nerve compression. The underlying pathophysiology is not well understood, and treatment, wherever possible, is tailored to each singular case. Endovascular management does not usually solve the problem of mass compression, whereas surgical treatment involves several complications.

Case Description: A 58-year-old woman presented with a continuously growing giant right VA aneurysm, partially thrombosed, even after endovascular treatment (placement of two diversion flow stents). Operative partial aneurysmectomy and intraoperative placement of an endovascular balloon allowed removal from circulation without significant bleeding with a good neurological outcome.

Conclusions: The variability of VA thrombosed giant aneurysms implies a customized therapeutic strategy. Combined endovascular techniques and surgical clipping allow safe and successful trapping and aneurysmectomy. This case highlights the benefits of treating similar pathologies with a combination of both techniques.

Key Words: Endovascular treatment, fenestrated clip, flow-diverter, giant aneurysm, neurovascular surgery, temporary balloon occlusion, vertebral artery

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INTRODUCTION

Intracranial aneurysms (IAs) with a diameter of >25 mm arising from the vertebral artery (VA) are rare, representing 4–6% of all intracranial giant aneurysms.[14] They are often associated with thrombosis because of swirling blood flow and usually present as mass lesions with slow progressive growth, causing symptoms and signs due to compression of the adjacent brainstem. The underlying pathophysiology is not well understood yet, although vasa vasorum seems to play a crucial role in the growth mechanism.[6,14] The anatomical and vascularization variability implies *ad-hoc* tailored indication and treatment. Endovascular coiling and stenting, which are considered to be the treatments of choice, present a high rate of late complications mainly because they do not solve the problem of brain

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compression. Surgical procedures with the removal of the aneurysm from the circulation prove most effective; however, surgical management is still particularly difficult due to problems presented by their location, large neck, calcification, or thrombosis.

CASE DESCRIPTION

History

A 58-year-old woman presented in another institution with complaints of headache, dizziness, bilateral arm paresthesia, and visual disturbance. Her neurological examination showed abducens nerve palsy. A computerized tomography scan (angio-CT), and later cerebral angiography, displayed a giant partially thrombosed right VA (V4) dissecting aneurysm [Figure 1], distal to the posterior inferior cerebellar artery (PICA) origin, extended to the VA-basilar junction. Magnetic resonance imaging (MRI) of the posterior fossa confirmed the presence of a giant aneurysm [Figure 2], partially thrombosed, with mass effect on the brainstem.

After beginning antiplatelet therapy, the patient underwent two stent insertions: the first PED 3 × 14 (Medtronic/Covidien, Irvine, CA) in the left VA-basilar junction to exclude the dissecting segment of the right VA, and the second Silk 3 × 18 in the right VA-PICA junction (Balt Extrusion, Montmorency, France). Before discharge, VA angiograms demonstrated correct placement of diversion flow stents [Figure 3] and an initial stasis of contrast [Figure 4]. During the following days, the patient experienced moderate improvements in both convergent strabismus and initial symptoms.

Unfortunately, a subsequent magnetic resonance imaging (MRI) and angiogram [Figure 5] performed at 9 months after endovascular stenting showed persistent filling and continued growth of the aneurysm, which remained partially thrombosed and maintained a remarkable mass effect on the brainstem. The patient began to deteriorate after 6 months developing dizziness and gait ataxia.

The patient was referred to our neurosurgical center 1 year after the stenting, with a 6-month history of worsening spastic paraparesis, mild swallowing disturbance, light dysphonia, and diplopia. A right and left vertebral angiogram with an occlusion test [Figure 6] was performed using a temporary-occlusion silicone balloon catheter placed at the right VA just proximal to the stent in the VA-PICA. The angiogram showed the patency of the PICA, the proximal part of the VA, and the partial thrombosed aneurysm. There was no patency at the distal part of the VA in conjunction with the basilar artery where the second stent was positioned. The contralateral left vertebral angiography did not show any reflux into the right VA. After ascertaining that the patient had tolerated a 15-minute test occlusion, the balloon was removed. In addition, the angiography indicated that a left small artery from the left VA supplied the aneurysm.

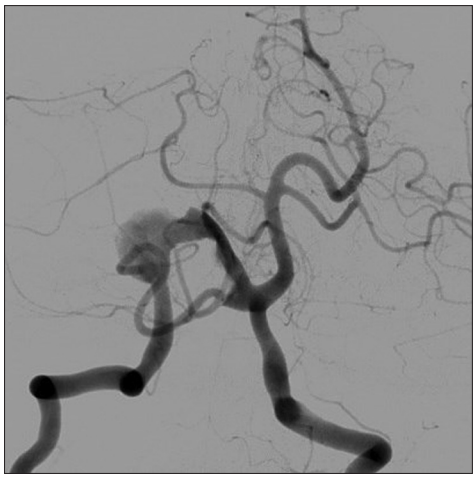

Figure 1: Cerebral angiography displaying a giant partially thrombosed right vertebral artery (VA,V4) dissecting the aneurysm from the PICA origin to the VA-basilar junction

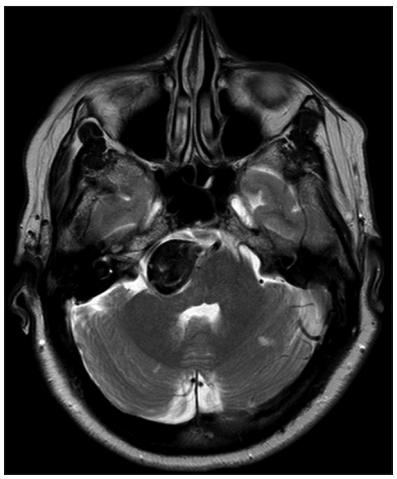

Figure 2: Magnetic resonance imaging (MRI) showing the partially thrombosed giant aneurysm with mass effect on the brainstem

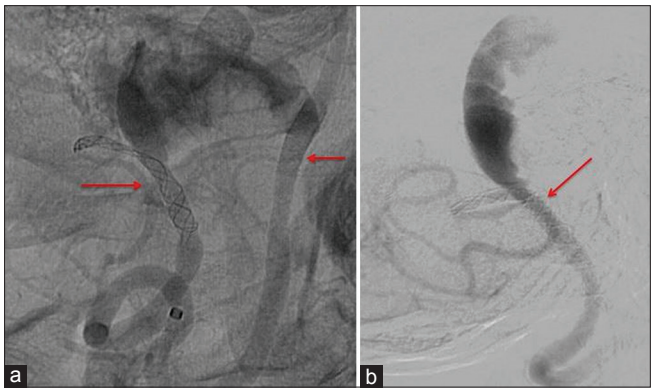

Figure 3: VA angiograms demonstrating the placement of two diversion flow stents (arrows): the first in the left VA-basilar junction to exclude the right VA and the second in the right VA-PICA junction (a). An initial intra-aneurismal stasis of contrast is visible (b)

On second admission, the patient underwent a right suboccipital craniectomy followed by partial aneurysmectomy. The surgical procedure was preceded by the placement of a nondetachable flow dependent balloon catheter (Balt B1, Balt Extrusion, France) to be inflated during reduction of the intra-aneurysmal thrombosis and clip positioning. The exact position and the inflation and deflation volume of the balloon were carefully checked several times. A 3,000 unit of heparin bolus was injected at the beginning of the procedure. The catheter had been successively washed with heparinized saline solution (5,000 units/l). When we were sure of the correct position and the adequate volume of balloon inflation, we moved the patient with the complete arterial femoral system to the neurosurgical theatre.[15]

Operation

We performed a right suboccipital craniotomy with the patient under general anesthesia along with neurophysiological monitoring. An endotracheal tube with electrodes was used for monitoring the vocal cords. Upon opening the cisterna magna, the segment of VA-PICA containing the flow diversion stent was exposed. The aneurysmal sac was identified and isolated from the surrounding tissue and cranial nerves [Figure 7]. We then inflated the balloon in the VA positioned proximally to the PICA because no temporary clipping was possible due to the stent whereas a temporary Yasargil clip (Aesculap, Center Valley, PA, USA) was positioned on the distal part of the PICA. To reduce the temporary distal occlusion of the PICA, the aneurysmal sac was opened in the most proximal part close to the PICA bifurcation. Inside thrombus was rapidly removed using an ultrasonic aspirator. The decompression and a partial aneurysmectomy proceeded until it was possible to apply a fenestrated clip to maintain the PICA patency and exclude the distal aneurysmal VA dilatations [Figures 8 and 9]. Moderate venous bleeding from the aneurysm wall occurred. At the end of the resection, we left the outer wall of the aneurysm attached to the brainstem, which appeared to be otherwise clear and pulsating. The presence of a markedly developed vasa vasorum necessitated prolonged coagulation of the aneurysm wall. Neurophysiological multimodal monitoring, used throughout the procedure, showed mild fluctuations in the electrophysiological parameters.

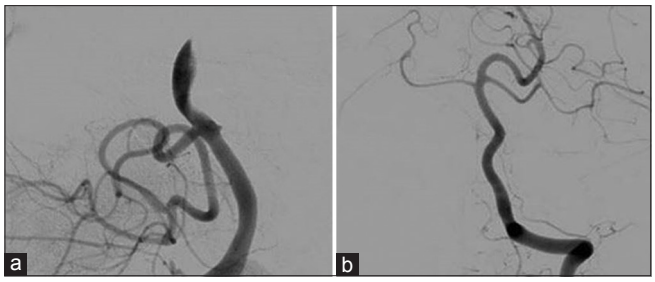

Figure 4: Three months later the angiography shows good initial results for the endovascular procedure with dimensional reduction of the aneurysmal sac (a). The closure of the aneurysm patency from the left vertebral artery flow (b)

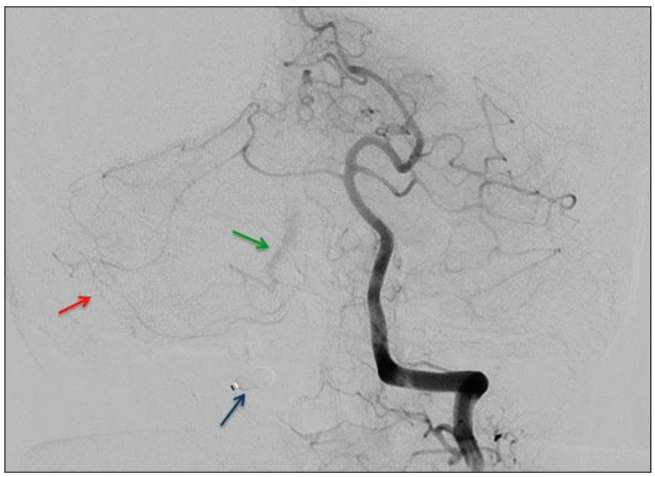

Figure 6: Angiography performed at 1 year after stenting. Balloon (blue arrow) test occlusion of the right vertebral artery and right PICA. Collateral arteries (red arrow) from the right SCA supplying the territory of the ipsilateral PICA and filling a small part of the aneurysm (green arrow)

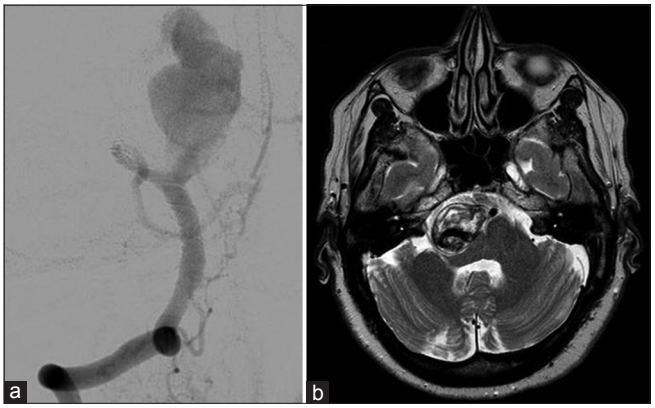

Figure 5: Angiogram (a) and MRI (b) in the following 9 months shows an enlargement of the patency of the aneurysm and of the mass effect on the brainstem

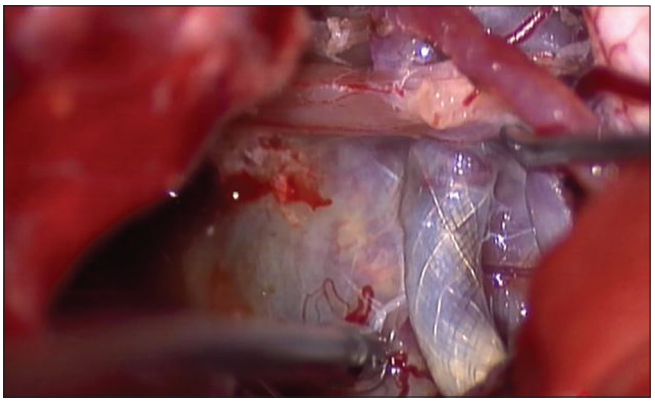

Figure 7: The aneurysmal sac identified and isolated from the surrounding tissue and cranial nerves

Postoperative course

After a transient admission to the intensive care unit, the patient was transferred to the ward. A postoperative CT scan showed no hemorrhage or ischemia in the posterior fossa. During the postoperative course, the patient experienced temporary mild worsening of her dysphonia and dysphagia, a new development of right partial palsy of the VII cranial nerve palsy (III HB) and left superior arm thermal hypoesthesia. Laryngeal endoscopy highlighted a right partial vocal cord paresis with only mild dysphagia. There was no marked effect on her gait disturbance. Speech and rehabilitation therapy was scheduled.

An angiography performed 10 days later showed complete resolution of the aneurysm patency, however, unfortunately also the PICA occlusion even if without sequelae. MRI confirmed an initial reduction of mass effect on the brainstem and cerebellum and no evidence of PICA distribution ischemia. However, the patient's condition improved gradually; she was discharged 18 days after the surgery to a rehabilitation unit.

After 4 months, the patient experienced a progressive and almost complete recovery. Now she ambulates independently without assistance, has a normal diet, and has right HB 1 facial paresis. Follow-up angiography and MRI were performed at 4 months after the surgery. The angiogram confirmed the right PICA occlusion and the exclusion of the aneurysm from the circulation [Figure 10]. It also showed some anastomosis between the right superior cerebellar artery (SCA) and terminal branches of right PICA. MRI highlighted significant reduction of mass effect [Figure 11].

DISCUSSION

In the case of giant VA aneurysms, symptoms commonly result from the compression of neuronal structures, ischemic stroke, or aneurysm rupture. Most cases reported in the literature describe a progressive enlargement with the deterioration of symptoms, even after repeated endovascular treatments. Although this enlargement phenomenon has been extensively studied, there is no consensus regarding the mechanisms underlying the increase of almost completely thrombosed giant aneurysms presenting as mass lesions.[13,14]

The treatment of similar cases is scarcely reported in the literature with every case presenting its own unique features. Surgery may represent too high a risk, but on the other hand, embolization alone does not guarantee the reduction of the mass effect. Quite often, the opposite result is obtained, with the enlarging of the sac and it is necessary to adopt different customized approaches to solve the problem.[3,6,7,10,14] Moreover, ruptures following the placement of flow diverters for large and giant aneurysms have previously been reported.[2,4,5,9]

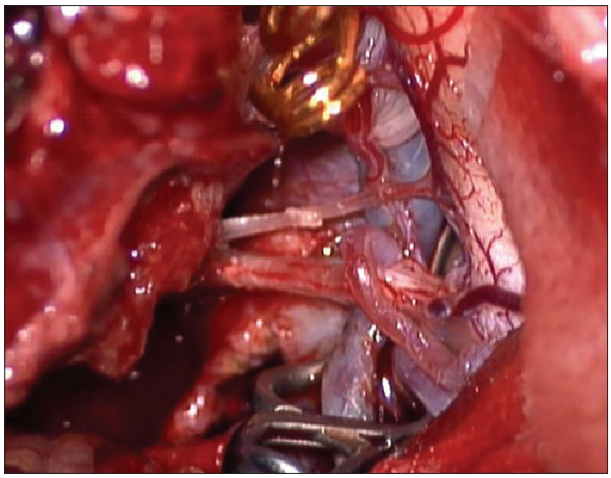

Figure 8: A temporary Yasargil clip positioned on the distal part of the PICA, partial aneurysmectomy and application of a fenestrated clip to maintain the PICA patency

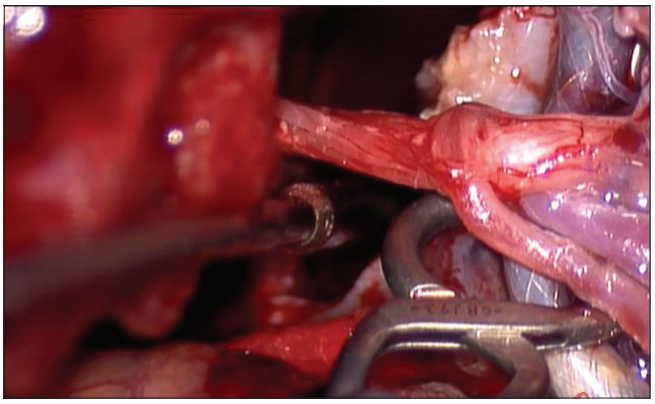

Figure 9: The photograph shows the placement of the fenestrated clip and the progression of aneurysmectomy after the removal of the temporary clip

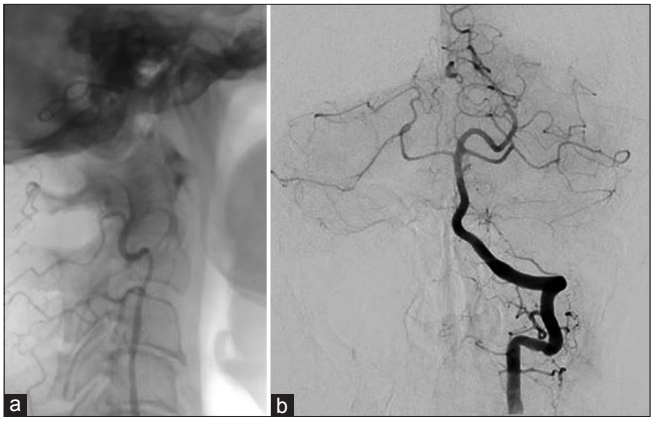

Figure 10: Postoperative angiogram (performed 4 months after surgery) showing a complete occlusion of the aneurysm and also the PICA (a, lateral view; b, anteroposterior view)

Attempts to treat patients with giant vertebrobasilar junction aneurysm with a combination of flow diversion and bypass surgery have been chronicled previously.[8] Despite initial successful

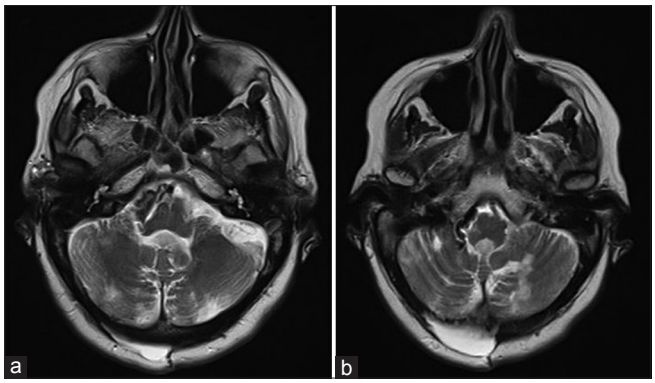

Figure 11: The MRI shows a significant reduction of the mass effect (a and b)

treatment, the long-term outcomes of these patients remain guarded.

Balloon assistance surgery is not frequently used though it has been described since 1993.[12] Few reports with anecdotal experience about the use of temporary balloon occlusion during the surgery of vertebrobasilar aneurysms have previously been published in the literature.[1,11,17–19]

Our patient presented with a giant VA aneurysm that continued to grow even after proximal and distal endovascular treatment. The proximal stent maintained flow patency to PICA, but did not avoid sac-filling; conversely, the distal stent successfully excluded the back flow from the basilar artery. It was not sufficient to stop the aneurysm growing and leave the compression on the brainstem. In our case, combined use of the neuroradiological and surgical treatments overcame the problem. The availability of the two stents has proven to be very useful to the surgeon. The proximal stent on the PICA allowed safe manipulation[16] of the vessel and positioning of the fenestrated clip. The distal stent, completely occluding the patency, allowed the surgeon to open and manipulate the aneurysm without the necessity of controlling the most distal and difficult part of the VA; finally, the combination of the intraoperative temporary occlusion with a balloon of the VA proximal part enabled the surgeon to safely manipulate and exclude the aneurysm with decompression of the stem.

An alternative treatment could be a bypass surgery. Some authors would have preferred a proximal occlusion and anastomosis. During the planning of the operation, we did not consider a bypass to the distal part of the PICA considering that the reinforced vessel would facilitate the clipping without delayed complications and because of the uneventful temporary balloon occlusion of the VA which shows collateral vessels supplying the territory of the PICA. Hence, we decided to avoid additional difficulties to this procedure and to use fenestrated clip.

Nevertheless, we did not avoid PICA occlusion. We did not check the flow with micro-Doppler Ultrasound or ICG angiography during the surgery because we were very confident of the vessel patency as it appeared along a quite long segment. However, we did not think that we would be able to significantly modify the clip position in case of flow reduction. In that situation, the only other option we would have considered was an anastomosis if feasible under the circumstances. Furthermore, we did not use antiplatelet therapy and antivasospastic agent, which could avoid this complication, considering the good postoperative course.

Indeed, the patient did not experience neurological deficits and had good collateral flow compensation as postoperative angiography showed. After 4 months, she reached an almost complete satisfactory recovery

CONCLUSION

In the case of a giant partially thrombosed aneurysm with thick wall and brain compression, aneurysmectomy should be considered as the goal. The challenging case presented here clearly illustrates the usefulness of an endovascular-neurosurgical combined strategy to treat such cases. Using only one of these approaches could increase the risks of treatment, and might not solve the problem.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient has given her consent for her images and other clinical information to be reported in the journal. The patient understands that name and initial will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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