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International Journal of Surgery Case Reports

journal homepage: www.casereports.com

Total endovascular repair of aberrant right subclavian artery aneurysm using the periscope technique: a case report



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ARTICLE INFO

Article history:

Received 5 October 2016

Accepted 30 October 2016

Available online 3 November 2016

Keywords:

Aberrant right subclavian artery

Periscope technique

TEVAR

ABSTRACT

INTRODUCTION: Aneurysmal degeneration of aberrant right subclavian artery (ARSA) carries a relevant risk of rupture. Timely elective treatment is mandatory. Therapeutic options include open surgery repair or hybrid surgical and endovascular repair. Few reports of total endovascular approach repair have been reported.

PRESENTATION OF THE CASE: We report the first case of total endovascular repair of an aneurysmal ARSA using a thoracic aortic endograft with a “periscope” covered stent into the ARSA itself.

DISCUSSION: The total endovascular approach was considered for patient’s age and her poor compliance to the idea of a surgical revascularization of the ARSA, which has to be preserved since the LSA was diseased. The urgent situation did not allow for the use of a custom-made graft, so the idea of a “periscope” covered graft both to preserve the flow of the ARSA and to exclude the aneurysmal lesion seemed to be the best choice.

CONCLUSION: The “periscope” technique allowed the urgent treatment of aneurysmal ARSA with good clinical results.

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1. Introduction

Aberrant right subclavian artery (ARSA), or arteria lusoria, is the most common embryologic abnormality of the aortic arch, with a reported prevalence of 0.5–1.5% on autoptic studies [1].

Aneurysmal degeneration, which may involve also the aorta, carries a relevant risk of rupture [2]. So, timely elective treatment is almost mandatory.

Therapeutic options include open surgery repair or hybrid surgical and endovascular repair [3].

Few reports of total endovascular approach repair have been reported using either custom made aortic fenestrated graft with covered stents [4] or triple-barrel stent grafts to keep patent both common carotid arteries while covering the origin of the ARSA with a thoracic endograft [5].

To our knowledge, this is the first report of total endovascular repair of an aneurysmal ARSA using a thoracic aortic endograft with a “periscope” covered stent into the ARSA itself.

2. Presentation of the case

An 86 years-old woman complained of a left subscapularis pain since few days. Her medical history included hypertension and recurrent left popliteal vein thrombosis on oral anticoagulation therapy. She underwent a thoracic computed tomography angiography (CTA) scan, which revealed an aneurysmal ARSA 32 mm in diameter with Kommerel’s diverticulum (Fig. 1). The aortic arch was not dilated (29 mm). Collaterally, there was a short severe stenosis of the left subclavian artery (LSA), in the pre-vertebral segment.

Lower limb pulses were present on both sides, while radial pulse was present only on the right forearm, but the patient was asymptomatic. A duplex scan of the supra-aortic vessels showed no carotid stenosis, a normal flow in a dominant right vertebral artery, and a reversed flow in the left vertebral artery, which was very small in caliber. The ARSA had a three-phasic flow, while a post-stenotic flow was detected in the LSA, with good compensation by collateral vessels. Echocardiography revealed an ejection fraction of 45%.

Based on the symptoms, and on the patient’s high surgical risk, endovascular repair was indicated.

Under local anesthesia, surgical right femoral and right brachial accesses and a percutaneous left femoral access were obtained. A Lunderquist® Extra-Stiff 0.035” guidewire (Cook Medical Inc.,

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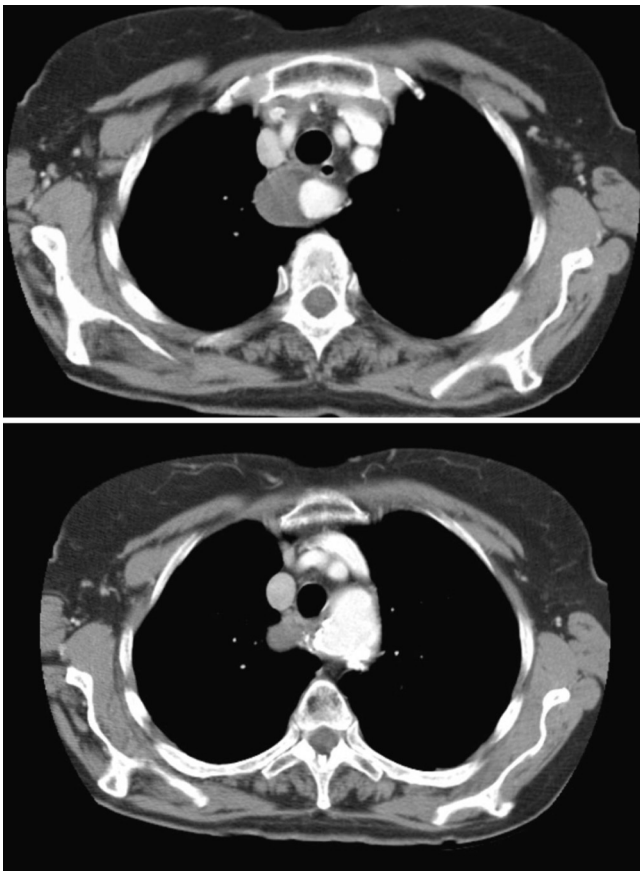


Fig. 1. Pre-operative angio-CT scan showing the aneurysmal ARSA 32 mm in diameter with Kommerel's diverticulum.

Bloomington, IN, USA) was advanced from the right femoral artery to the ascending aorta and an Amplatz Super Stiff™ 0.035" guidewire (Boston Scientific) from the brachial access to the aorta, under fluoroscopic guidance.

Under controlled hypotension, a Cook ZTA 32-32-109 mm endograft (Cook Medical Inc., Bloomington, IN, USA) was then advanced via right common femoral artery to the thoracic aorta, just distal to the origin of the left common carotid artery. The origin of the LSA was covered to achieve an optimal proximal landing zone. The ARSA was kept patent while excluding the aneurysm through the deployment of three imbricated covered stent Gore Viabahn 10-100 mm, 11-100 mm, and 10-50 mm (WL Gore and Associates, Inc., Flagstaff, AZ, USA) using the periscope technique, with a proximal landing zone just at the origin of the vertebral artery.

The postoperative course was regular. A CTA before discharge showed a little refill of the aneurysmal sac due to the "gutters" between the endoprosthesis and the periscope grafts (Fig. 2). The patient was discharged 7 days later in good clinical condition, under a low dose of acetyl-salicylic acid (ASA, 100 mg/daily) and her previous oral anticoagulant therapy. A CTA at 6 months showed the complete disappearance of the endoleak (Fig. 3).

3. Discussion

The ARSA is often found during autopsy or incidentally during diagnostic procedures, being mostly asymptomatic [6]. Aneurysmal degeneration carries a relevant risk of rupture [2], so proper diagnosis and treatment are mandatory. However, its best treatment is still a challenging point of discussion.

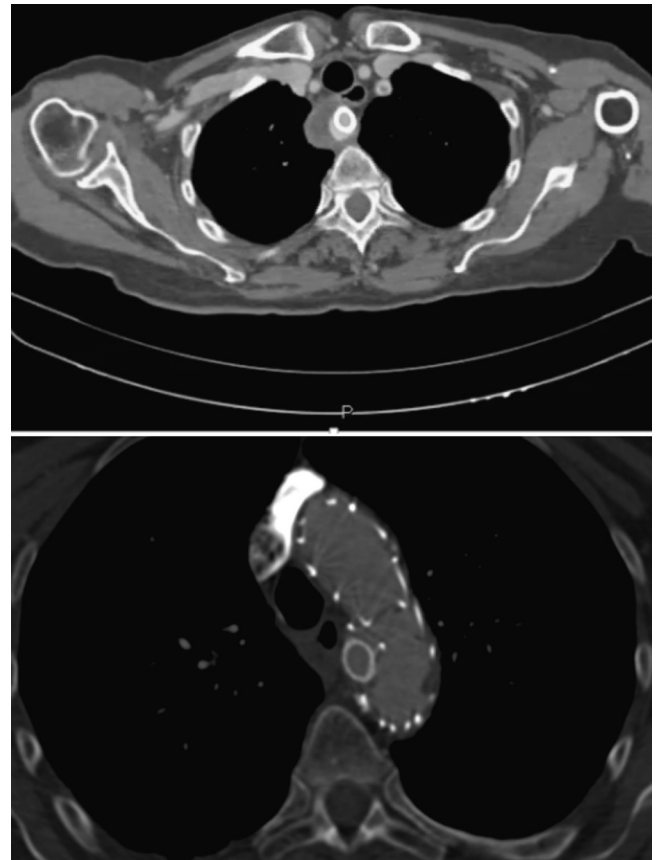


Fig. 2. Angio-CT scan before discharge with a slow endoleak due to the "gutters".

Even in experienced hands, total open surgical repair is burdened by high mortality and complication rates, due to the need of either thoracotomy or sternotomy with extracorporeal circulation, according to the underlying pathology of the aortic arch. Kieffer and Coll. reported about 33 patients surgically treated by either a cervical approach, median sternotomy, or left/right-sided thoracotomy, for a symptomatic or aneurysmal ARSA [7], with a perioperative mortality rate of 23.5%.

The development of endovascular techniques has offered a valid alternative to total surgical repair, first with hybrid procedures and then towards a total endovascular approach.

The combined endovascular occlusion of the aortic origin of the lusorian artery with surgical subclavian artery transposition or reconstruction through a right carotid-subclavian artery bypass has been reported in few case series with good early and mid-term results [3].

The evolution of endovascular techniques and materials however has progressively pushed the limit towards the total endovascular approach for the treatment of diseases of the aortic arch involving the supra-aortic vessels. Gaafor and Coll. [4] were the first to describe a total percutaneous repair of an ARSA and thoracic aneurysm using a custom made aortic fenestrated graft with covered stents for the left subclavian and lusoria arteries. However, the use of fenestrated endoprostheses is limited by the wait time for the customization of the graft, which precludes its employment in an emergent setting.

In our case report, the total endovascular approach was considered for patient's age and her poor compliance to the idea of a surgical revascularization of the ARSA, which has to be preserved since the LSA was diseased. The urgent situation did not allow for the use of a custom-made graft, so the idea of a "periscope" cov-



Fig. 3. Angio-CT scan at six months, with no signs of endoleaks and patency of the periscope grafts in the ARSA.

ered graft both to preserve the flow of the ARSA and to exclude the aneurysmal lesion seemed to be the best choice.

The use of the “triple-barrel technique”, first developed as a bailout technique in the juxtarenal aortic district, has progressively become an increasingly common treatment approach also for complex aortic arch pathologies, often combined with surgical revascularization of the supra-aortic trunks, as proposed by Schwein and Coll. [5]. The chimney technique in fact allows the use of devices which are usually available in an endovascular suite and do not need a custom-made process, with high technical success and low perioperative mortality rates [5]. Taakahashi and Coll. [8] proposed the use of a chimney graft to preserve the flow of the left common carotid artery, in adjunct of bilateral carotid artery-to-subclavian artery bypasses and a thoracic stent to treat an arch aneurysm with ARSA.

To our knowledge, this is the first report of total endovascular repair of an aneurysmal ARSA using a thoracic aortic endograft with a “periscope” covered stent into the ARSA itself.

Some concerns however remains about the occurrence of “gutter” endoleaks due to an inadequate seal between the grafts and the aortic wall. In our case, however, the initial “gutter” endoleak had disappeared after 6 months, maybe due to the correct oversizing of the stent-grafts.

Graft thrombosis may also occur, as reported by the larger experience of elective chimney in the juxtarenal/thoraco-abdominal aortic repair. However we still have a little knowledge about the consequences of these implications, for both the renal district and even more for the aortic arch region, where the experiences reported about chimney/periscope TEVAR are limited to a few cases.

4. Conclusion

The “periscope” technique should be considered as a valid solution for the urgent endovascular treatment of aneurysmal ARSA in high surgical risk patients.

Conflict of interest statement

All Authors disclose any conflicts of interest.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Funding

No funding was obtained for the study.

Ethical approval

The case is reported in accordance with the internal ethical guidelines. No ethical judgement was needed as in our Research Hospital (IRCCS Policlinico San Donato), each patient on admission signs a consent to use his anonymous health data for research purposes.

Authors' contribution

Daniela Mazzaccaro: study concept, data collection, writing the paper, critical revision of the paper.

Teresa Maria Derosa: data collection, writing the paper.

Erika De Febis: data collection, writing the paper.

Paolo Righini: data collection.

Giovanni Nano: study concept, critical revision of the paper.

Guarantor

Daniela Mazzaccaro, M.D., is the Guarantor of the study. The work has been reported in line with the SCARE criteria [9].

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