

SHORT REPORT

Salvage Procedure Using a Chimney Endograft for Early Cerebral Ischaemia after Hybrid Aortic Arch Repair of a Primary Aorto-bronchial Fistula

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Introduction: Hybrid aortic arch repair for the treatment of aorto-bronchial fistulas has been suggested as a safe alternative to open repair. However, surgical morbidity and mortality are still significant and re-intervention is sometimes inevitable.

Report: Successful rescue by a hybrid approach is reported in a 76 year old woman who was transferred from another centre with recurrent episodes of left hemiplegia shortly after debranching of the supra-aortic vessels and thoracic aortic stent grafting for an aorto-bronchial fistula associated with a true aneurysm at the level of origin of the left subclavian artery. Investigation revealed partial coverage of the ostium of the brachiocephalic artery and Type Ib and II endoleaks. In the first stage a chimney graft was put into the brachiocephalic trunk, and in the second stage the left subclavian artery was plugged and the thoracic stent graft was extended distally. Completion angiography showed restoration of the supra-aortic blood flow and no residual endoleaks. After 1 year follow up the patient was doing well with no recurrent neurological events and no signs of infection.

Discussion: Procedure related problems should be suspected first when early post-operative complications occur after a hybrid aortic arch repair. The chimney graft technique is a valuable option for unintentional covering of a critical supra-aortic branch. Nevertheless, the importance of precise positioning during initial thoracic stent graft placement should be emphasised.

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INTRODUCTION

Hybrid aortic arch repair (HAR) has been suggested as a safe alternative to open arch repair.¹ To date, no significant short or long-term differences have been shown although recently a higher re-intervention rate was noted after HAR.²

Owing to the rarity of aorto-bronchial fistulas (ABFs)³ and the short history of this technically demanding procedure, there is little in the literature about complications after HAR for ABF or their management.

CASE DESCRIPTION

The case of a 76 year old woman who was diagnosed with an ABF associated with a true aneurysm involving the origin of the left subclavian artery is reported (LSCA). A HAR, with debranching of the supra-aortic vessels and thoracic

endovascular aortic repair (TEVAR), was performed in a two stage procedure in a hybrid room.

On post-operative day 1 the patient presented with a mild headache and orthostatic hypotension. Therefore initially antihypertensive medication was stopped. Nonetheless, hypotension persisted and recurrent episodes of transient left hemiplegia occurred after 12 days of hospitalisation.

A selective angiogram was performed which revealed partial overstenting of the ostium of the brachiocephalic trunk (BCT) with clear flow restriction and Type Ib and II endoleaks. The latter was caused by the remaining patent LSCA. The patient was transferred for repair by the hybrid approach described below.

The patient consented to the publication of this case report.

METHODS

Under general anaesthesia, open surgical dissection of the carotid–carotid left subclavian bypass was carried out through the previous cervical incisions. A collapsed weakly pulsating bypass was observed. Following administration of

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heparin (100 IU/kg) and clamping of the crossover carotid–carotid bypass a 7F sheath was inserted retrogradely into the right common carotid artery. Digital subtraction angiography revealed severe flow restriction of the BCT due to covering (Fig. 1).

The ostium of the BCT was pre-dilated with a balloon (Armada Abbott Vascular 9 × 40 mm). A balloon expandable covered stent (Atrium Advanta 10 × 58 mm) was put in place extending into the aortic arch employing the arch chimney technique. Post-procedure angiography showed restoration of the supra-aortic blood flow with flow around the chimney stent. Over dilatation with a balloon (Armada Abbott Vascular 12 × 20 mm) resulted in better sealing. The completion angiogram revealed a patent BCT and antegrade filling of the carotid–carotid left subclavian bypass. The left common carotid artery (LCCA) was ligated and strong pulsations were detected over the carotid–carotid left subclavian bypass. An attempt to ligate the LSCA surgically to treat the type II endoleak had to be abandoned as it was not possible to proceed safely due to the recent post-operative inflammatory state of the tissues.

A second intervention was planned within 2 weeks to treat the persistent type Ib and II endoleaks. Again under general anesthesia, the thoracic stent graft was extended through a right femoral approach with another stent graft (Valiant Captiva 32 × 32 × 150 mm) to cover the Type Ib endoleak under controlled hypotension induced by adjustment of the dose of sevoflurane. Subsequently the orifice of the LSCA was plugged (16 mm Amplatzer) through a left

brachial approach and completion angiography showed no residual endoleaks (Fig. 2).

Owing to laryngeal oedema and vocal cord paralysis the post-operative course was complicated by several failed attempts to extubate. However, the hoarseness recovered finally and there were no recurrent ischaemic events. Eventually the patient received 3 months of antibiotic therapy and could be discharged 4 months post-operatively, including an intense rehabilitation.

At 1 year follow up no adverse neurological or any other events occurred and CT demonstrated a stable hybrid repair with no residual endoleaks and no signs of infection.

DISCUSSION

HAR has been suggested for treatment of aortic arch diseases as a less invasive method although morbidity and mortality remain high.¹ Re-intervention rates of up to 25% have been described, predominantly to treat type I endoleaks.^{2,4,5} There is little in the literature concerning HAR in the treatment of ABF as this is a rare clinical condition and a relative novel technique.

The patient presented with hypotension immediately after a two stage HAR to treat a primary ABF. As withdrawal of the antihypertensive medications did not result in an increase in blood pressure, extensive diagnostic work up was performed. Finally non-invasive blood pressure measurement in both the upper and lower extremities revealed



Figure 1. Intra-operative retrograde digital subtraction angiogram revealing the partial coverage of the brachiocephalic trunk (BCT) resulting in compromised supra-aortic blood flow. Fine arrows, start and end of covered atrium stent; triangle, start of covering part of the thoracic stent graft; triangle, BCT.

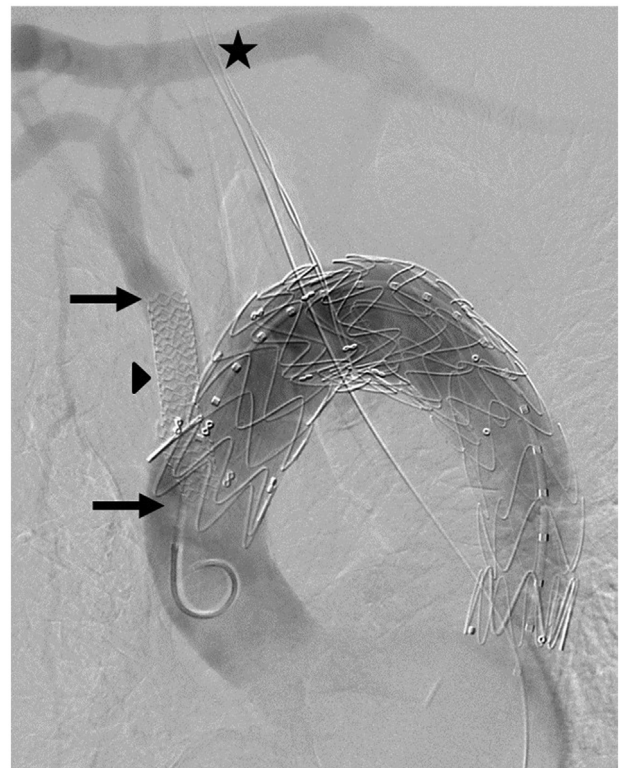


Figure 2. Intra-operative antegrade digital subtraction angiogram showing the covered Atrium stent functioning as a chimney to allow sufficient flow into the supra-aortic native vessels and bypasses. Thick arrows, start and end of covered atrium stent; triangle, BCT; star, crossover carotid–carotid bypass.

low pressure at the level of the right brachial artery and much higher pressures in the level of the lower extremities gave the clue.

In retrospect, this triad of recent TEVAR in Zone II, hypotension and transient hemiplegia could have raised the suspicion of partial covering of the BCT earlier. Initial presentation of cerebral hypoperfusion can be ambiguous. Lowering the threshold for imaging evaluation in the presence of persisting hypotension early after TEVAR should be considered.

Many techniques have been described to avoid covering the BCT by optimizing precise thoracic stent graft placement during TEVAR.⁶ During deployment, a combination of actions needs to be carefully executed and is considered safe and effective in experienced hands. Although the initial TEVAR procedure was performed in a hybrid room applying controlled hypotension, the thoracic stent graft was still deployed too proximally leading to compromised supra-aortic blood flow. The proximal landing zone was 15 mm and the completion angiogram revealed good patency of the brachiocephalic trunk. However, in retrospect this was a superimposed image and partial overstenting might have been suspected by paying more attention to the velocity of arterial filling on the completion angiogram. A better angulation of the C-arm could have avoided this problem. This case illustrates the need for a multidisciplinary approach to this kind of complex problem. The use of the complementary expertise of both the vascular surgeon and the interventional radiologist can reduce this type of failure.

A chimney graft is often used to preserve blood flow in aortic side branches.⁷ In this case, the chimney graft was used to restore flow to the BCT as described by others. Owing to the recent surgery and the presence of the carotid–carotid left subclavian bypass an open surgical approach was chosen to properly catheterise and stent the BCT. The need for technical expertise for both safe surgical exposure and precise deployment in the target location, resulted in collaboration between the vascular surgeon and radiologist, something that is done for all complex endovascular and hybrid cases.

The type II endoleak caused by the non-ligated LSCA, was eventually solved with an endovascular plug although surgical ligation was initially selected but could not be safely performed due to the surrounding inflammation. Ligation or

plugging of the LSCA at the primary intervention could have prevented this issue.

CONCLUSION

This report describes the clinical picture and hybrid rescue in the case of inadvertent covering of a critical supra-aortic branch resulting in a stable repair at 1 year follow up. Further close follow up is required to assess long-term results.

Procedure related complications after HAR are significant and technique related issues should be suspected first when early post-operative abnormalities are present.

These cases should be reported to make physicians aware of the complexity of these procedures and the potential complications with the associated clinical picture, to prevent these complications happening in the future and to avoid delay in diagnosis and management.

CONFLICTS OF INTEREST

None.

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