Total endovascular repair of aortic arch dissection using parallel graft technique

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Abstract:

Purpose: To present the successful repair of aortic arch dissection using parallel graft technique.

Technique: A 62 years old man with history of arterial hypertension experienced retrosternal pain radiating to the back and nausea. An emergent CT depicted a non A- non B dissection of aortic arch. Endovascular repair was suggested to the patient. A total endovascular reconstruction with exclusion of primary entry tear using thoracic stent graft followed by chimney technique to the innominate and left common carotid artery and periscope graft of left subclavian artery were successfully performed.

Conclusion: Total endovascular repair of aortic arch dissection using parallel graft technique is an effective minimal invasive treatment especially in emergent situations. More studies are required to assess its future efficacy.

Keywords: *Aortic arch Dissection, Chimney technique, total endovascular repair*

INTRODUCTION

Conventional open repair of aortic arch dissection with cardiopulmonary bypass and deep hypothermic arrest is a highly demanding procedure with significant morbidity and mortality despite improvements in cardiothoracic surgery[1]. Thoracic endovascular aortic repair (TEVAR) was principally designed for pathologies of the descending thoracic aorta[2]. However aortic lesions proximal to the left subclavian artery (aneurysm, dissection, penetrating ulcer, intramural hematoma) which are highly challenging due to their anatomical configuration and hemodynamics of the aortic arch can also be treated endovascularly using off-the-self devices minimizing unfavorable outcome in high risk patients, providing less perioperative morbidity and mortality[3]. Total endovascular aortic arch repair using parallel graft technique is a minimal invasive technique which allows exclusion of the aortic arch lesions preserving concurrently inflow to the supra aortic branches avoiding median sternotomy and aortic clamping even in emergent situations. We describe a case of a patient with acute aortic arch dissection successfully treated by parallel graft technique.

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CASE REPORT

A 63 years old man was presented to the emergency department due to retrosternal pain radiating to the back and nausea the last 2 hours. His medical history was remarkable for arterial hypertension without taking appropriate antihypertensive regimen and smoking. His blood pressure was 250/120 mmHg during examination, ECG showed sinus tachycardia and chest X-ray was normal. D-dimers were 2600 μu/dl, troponin levels were negative for myocardial ischemia. Biochemical tests were within normal range apart from kidney function tests where creatinine and urea were 2.6mg/dl and 130 mg/dl accordingly. A provisional diagnosis of acute dissection was made and an emergent computed tomography aortography (CTA) was performed. CTA depicted a non A- non B aortic dissection initiating between left common carotid and left subclavian artery at Ishimaru zone 2 extending up to common iliac arteries (Figure 1). The patient was hospitalized to the coronary unit for hemodynamic monitoring and control of blood pressure and rhythm with antihypertensive and anti-impulse therapy. The patient experienced recurrent episodes of retrosternal pain during his hospitalization so emergent intervention was scheduled. We decided to use the technique of total endovascular repair using TEVAR plus parallel graft technique for perfusion of supra aortic branches as the patient refused hybrid or open repair due to the necessity for sternotomy. Informed consent was obtained from the patient to proceed with TEVAR.

Figure 1. CTA depicted an aortic arch dissection at Ishimaru zone 2.

TECHNIQUE

Under general anesthesia exposure of the right common femoral, right axillary, left common carotid artery (LCCA) and left branchial artery was gained under surgical cutdown. A guidewire (Terumo Corporation, Tokyo, Japan) was advanced from right axillary artery to the right common femoral artery to avoid inadvertent entry to the false lumen through retrograde approach. It was then exchanged with an extra-stiff double curved exchange guidewire (Lunderquist, Cook Medical, Bloomington, USA) through a Vertebral catheter (Boston Scientific, MN, USA) 100cm long. A 7F-90cm (Arrow International, Inc, Reading, USA) was advanced through the right common femoral artery to the ascending aorta. An aortography was performed which revealed the supra aortic branches and the dissection. A 45mm-150mm thoracic endograft (GORE TAG, W.L, Flagstaff, AZ) was firstly introduced and positioned under fluoroscopy in the proximal part of descending aorta. Two Viabahn stent-grafts (GORE, W.L, Flagstaff, AZ) 11x39mm and 11x59mm deployed proximal to the origin of left vertebral artery to the endograft in the descending thoracic aorta after cannulation of the left subclavian artery (LSA). A second Gore Tag 45-100mm thoracic endograft was deployed in such a way that the proximal part of the endograft was across the origin of LCCA. The innominate artery was cannulated, and an "internal iliac side branch" 16-14.5 x70mm was temporarily placed in the ascending aorta through a 12Fr GORE sheath using an extrastiff double curved guidewire. The LCCA was subsequently cannulated and an 8x79mm Viabahn graft was placed in the ascending aorta using a PTFE covered guidewire (Rosenwire, Cook Medical, Bloomington, USA). A third Gore Tag 45mm-150mm thoracic endograft was deployed under fluoroscopy 3cm proximal to the origin of innominate in the ascending aorta. Overlap between thoracic endografts was 5cm.Then the chimney stent-grafts in the innominate and LCCA were deployed and postdilated. Final aortography confirmed exclusion of dissection and patency of the supra aortic branches (Figure 2). The patient was transferred to the intensive care unit and extubated the next day. He was discharged the 7th postoperative day under dual antiplatelet therapy for 3 months followed by lifelong single antiplatelet therapy and antihypertensive regimen. Post-operative CTA at 1 month depicted thrombosis of false lumen with patent supra-aortic branches and no endoleak (Figure 3,4).

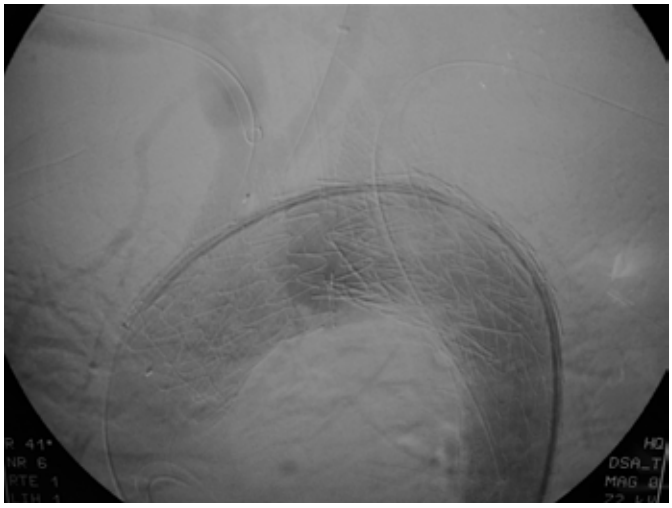
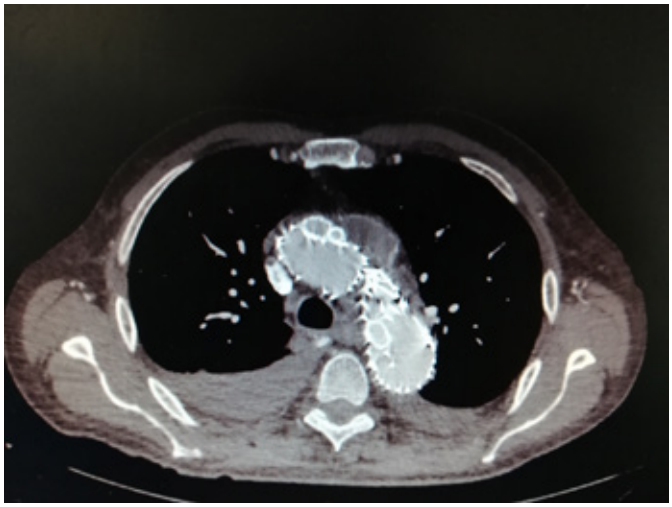


Figure 2. Final aortography confirmed exclusion of dissection and the patency of the supra aortic branches.



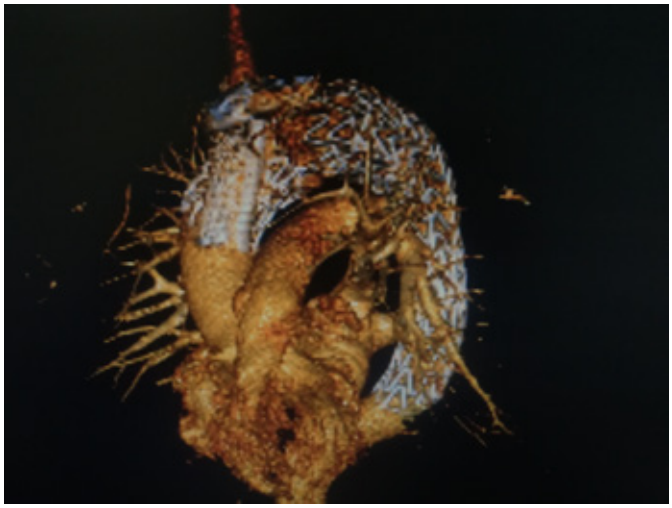


Figure 3,4. Follow up axial and 3D reconstruction images show exclusion of false lumen with patent parallel grafts.

DISCUSSION

The chimney technique was first described by Greenberg at 2003 used for the endovascular repair of juxtarenal/suprarenal abdominal aortic aneurysms[4]. It is a minimal invasive technique based on the implantation of parallel stent grafts. In the aortic arch, it was initiated as a bail out technique for preservation of left subclavian artery with proximal extension of the landing zone during TEVAR. Parallel graft technique in the aortic arch has been extended for preservation of all supra aortic branches especially in emergent situations[3,5]. In a recent meta-analysis of 379 patients Li Y et al showed that technical success rate of chimney technique was 91% the rate of 30-day mortality was 4%, the rate of patency was 93%, the rate of perioperative endoleak was 21%, and the rate of stroke was 5%[3]. Moulakakis et al published another meta-analysis reporting primary technical success was 99.2%. The perioperative mortality rate was 4.8% and the stroke rate was 4%, while the overall endoleak rate was 18.5%[6].

In our patient parallel graft technique was used as an emergent operation due to recurrent episodes of thoracic pain and refusal of patient for open or hybrid repair. Periscope grafting in left subclavian artery was used to preserve perfusion of arm and vertebrobasilar system to minimize the risk of proximal gutter and endoleak 1a as well as to preserve collateral circulation of the spinal cord.

CONCLUSION

Total endovascular repair using parallel graft technique is an effective treatment of aortic arch pathologies in emergency situations. Its long term efficacy needs to be defined due to anatomical and hemodynamic configurations of the aortic arch.

No conflict of interest.

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