

Hybrid treatment of an ascending aortic pseudoaneurysm following multiple sternotomies

Vito Giovanni Ruggieri, MD,^a Romain Malezieux, MD,^b Najeebullah Bina, MD,^a and Jean-Pierre Favre, MD, PhD,^a *St. Etienne, France*

Ascending aortic pseudoaneurysm following prior cardiac or aortic surgery is a rare entity that requires reoperation. Surgical repair is a complex procedure associated with high operative mortality. We report the case of a 76-year-old male patient with an ascending aortic pseudoaneurysm developing from distal anastomosis of a Dacron aorto-aortic prosthesis. This high-risk patient had previously undergone multiple cardiovascular operations and was treated by performing an extra-anatomic bypass between the descending thoracic aorta and supra-aortic vessels, followed by endovascular stent graft placement, avoiding median re-sternotomy. (*J Vasc Surg* 2010;51:729-31.)

False aneurysm is a rare complication after ascending aorta replacement.¹ Surgical repair is normally performed by femoro-femoral cardiopulmonary bypass and may require deep hypothermia and total circulatory arrest.¹⁻⁴ The disadvantages of this method are well known. In order to overcome these drawbacks, some groups have preferred to use selective cannulation of both carotid arteries.^{5,6} However, thorax re-entry is a complex procedure, even with safe techniques avoiding extensive blood loss or life-threatening mediastinal wounds, and hospital mortality remains high.^{1,4,7}

Endovascular treatment of aortic diseases associated with surgical revascularization of the supra-aortic vessels currently represents a safe, feasible, and less invasive alternative approach.^{8,9} However, a surgical approach through median sternotomy could represent a technical limitation in cases of reoperation, particularly in high-risk patients. Other hybrid techniques involving endovascular stent graft placement associated with extra-anatomic bypass of the supra-aortic vessels avoiding median sternotomy have recently been reported in the literature and have been shown to be feasible.¹⁰

We report the case of an ascending aortic pseudoaneurysm developing from distal anastomosis of a polyester aortic prosthesis in a high-risk patient who had previously undergone multiple cardiovascular operations. The patient was treated with a novel approach involving extra-anatomic bypass of the supra-aortic vessels followed by endovascular stent graft placement, avoiding median re-sternotomy.

CASE REPORT

Our 76-year-old male patient had a complex surgical history. He initially underwent aortic valve replacement followed, 12 years later, by ascending aorta replacement associated with coronary artery bypass grafting (left internal thoracic artery [LITA] anastomosed to the left anterior descending coronary artery [LAD] and saphenous vein graft [SVG] anastomosed to the right coronary artery [RCA]). Four years later, he underwent reoperation for a pseudoaneurysm of a distal anastomosis of the aortic prosthesis. Three months later, he developed a bleeding skin ulceration at the upper end of the sternal wound. A computed tomography (CT) scan showed a voluminous pseudoaneurysm of the distal anastomosis of the aortic prosthesis (14 cm × 9.6 cm), responsible for erosion of the skin on the chest and for compression of the trachea, pulmonary vessels, and aortic arch. Endovascular repair using an Amplatz device (Medical Corp., Golden Valley, Minnesota, USA) was initially proposed at another institution. However, this procedure was not sufficient because of multiple communications discovered during angiography. After a new CT scan (Fig 1), the patient was admitted to our institution for surgical treatment.

Twelve hours later, he presented with respiratory insufficiency associated with hemoptysis, probably due to compression of the trachea. Oro-tracheal intubation and mechanical ventilation were necessary. There were no signs of infection in the patient. Because of significant comorbidities, the anatomy of the pathology, and previous multiple sternotomies, conventional surgical repair was felt to be inappropriate. It was finally decided to carry out a hybrid technique involving extra-anatomic bypass of the supra-aortic vessels associated with placement of an aortic stent graft.

Under general anaesthesia, both common carotid arteries and left axillary artery were exposed through bilateral cervical incisions and a left sub-clavicular incision. The descending thoracic aorta was then exposed through a left postero-lateral thoracotomy. After systemic heparinization (8000 IU), a bifurcated vascular Dacron (Intervascular Inc., Montvale, New Jersey, USA) graft (16/8/8 mm) was anastomosed from the descending thoracic aorta (end-to-side anastomosis) to the left axillary artery (end-to-side anastomosis) with the first distal end. The second rib was partially removed through the left sub-clavicular access to avoid graft compression. The second distal end of the graft was tunneled, first from the subclavian to the left cervical access

From the Cardiovascular Surgery Department^a and the Radiology Department,^b University Hospital.

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Reprint requests: Vito Giovanni Ruggieri, Centre Hospitalier Universitaire Pontchaillou, Centre Cardio-Pneumologique, Service de Chirurgie Thoracique et Cardio-Vasculaire, 2, rue Henri Le Guilloux, 35000 Rennes, France. (e-mail: gianvito_ruggieri@libero.it).

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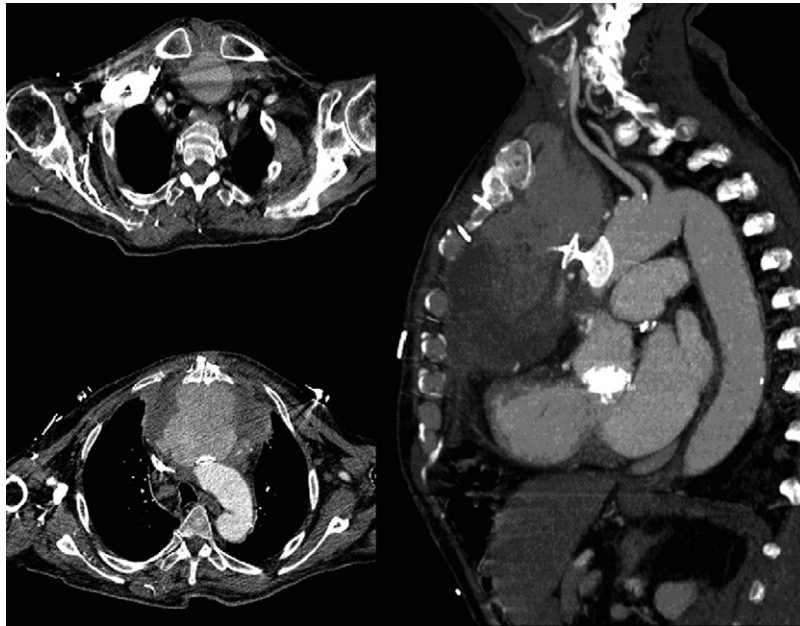


Fig 1. Preoperative computed tomography scan showing the voluminous pseudoaneurysm after failed tentative exclusion with Amplatzer devices.

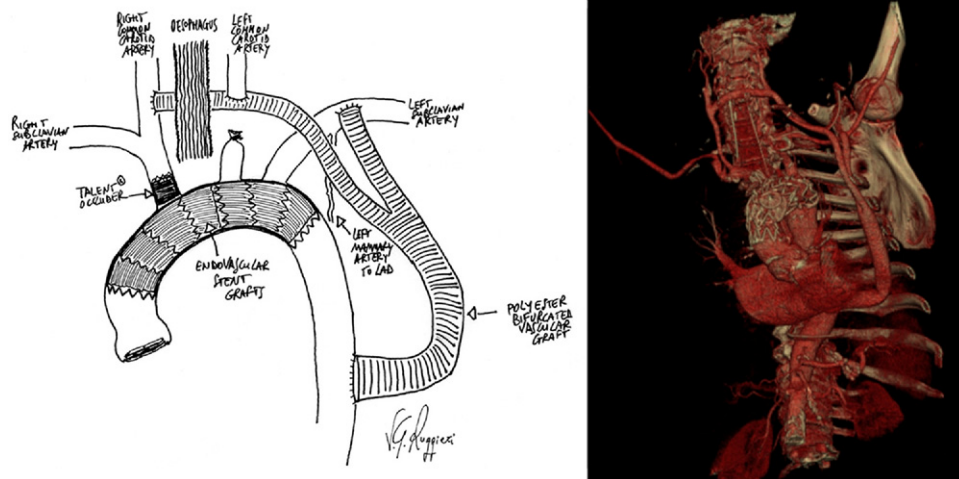


Fig 2. Illustration of the hybrid procedure and postoperative computed tomography scan showing the extra-anatomic bypass from the descending thoracic aorta to the left axillary and carotid arteries carried out before endovascular stent graft placement.

and then to the right cervical access, across the neck and behind the oesophagus. After its passage across the neck, it was anastomosed to the right common carotid artery (end-to-side anastomosis). Finally, an end-to-side anastomosis was performed between the left common carotid artery, which had previously been tied and cut, and the graft.

A Talent (Medtronic, Santa Rosa, California, USA) occluder, 14 mm in diameter, was placed at the origin of the brachiocephalic artery, under fluoroscopy, using a 16 F sheath inserted retrogradely

in the right common carotid artery, in order to avoid endoleaks after aortic arch endograft delivery.

Finally, the femoral arteries were exposed to carry out a double endovascular stent placement to totally exclude the pseudoaneurysm and to improve endograft stability. A super stiff wire was placed into the left ventricle across the mechanical aortic prosthesis. A temporary cardiac arrest was provoked by aortic insufficiency due to the nose cone of the introducer sheath being placed through the aortic valve, but this was quickly reversed. Two

overlapping Valiant (Medtronic, Santa Rosa, California, USA) thoracic endografts (diameter 34 mm, length 100 mm) were delivered from the sino-tubular junction, identified by aortography, to the aortic isthmus. A second aortography was necessary after graft delivery to verify coronary patency.

The patient was transferred to the intensive care unit with stable hemodynamic parameters. No other episodes of hemoptysis or bleeding were reported. He was extubated 15 days after surgery. A CT scan performed one month after the operation revealed graft patency with no endoleak and well-perfused brachiocephalic vessels (Fig 2). The follow-up period was short because the patient died four months later from septic shock.

DISCUSSION

Different surgical techniques have been described in order to achieve circulatory arrest or selective cerebral perfusion before reopening the chest in these complex cases. Some authors have also proposed a Heart-Port access technique involving cannulation of the right axillary artery and insertion and inflation of an endoclamp balloon in the ascending aorta, or simply positioning the balloon occlusion catheter at the level of the disrupted aortic anastomosis.¹¹ The results in terms of surgical mortality can be as high as 41%.⁷

In light of the poor surgical results, improvement of endovascular techniques has led to the development of hybrid procedures, which are useful in cases of high surgical risk. One of the problems of hybrid procedures is the choice of donor artery to revascularize the supra-aortic vessels. As described by Alhan et al,¹⁰ the left subclavian artery could be a good donor artery, but endoprosthesis release in the aortic arch is not a precise procedure and accidental cover of the left subclavian artery would compromise vascularization of the supra-aortic vessels. Moreover, steal syndrome with the left subclavian artery could compromise the flow of the LITA to the LAD. A hybrid technique can be carried out using an extra-anatomic bypass from the iliac or femoral artery to the supra-aortic vessels. With such a bypass, entire encephalic and superior limb vascularization depends on a prosthetic tube 8 mm in diameter and at least 70 cm in length, with a low patency rate.

The last solution we considered for the treatment of this particular case was the total endovascular technique, inserting a multi-branch endoprosthesis.^{12,13} However, the serious threat of mortality in our patient was incompatible with the manufacturing delay for this kind of endoprosthesis.

To our knowledge, this is one of only a few reports to describe endovascular stent graft placement in the ascending aorta associated with extra-anatomic reconstruction of the supra-aortic vessels from the descending thoracic aorta. This technique could be considered as a feasible treatment

option avoiding median sternotomy for an ascending aortic pseudoaneurysm developing after previous multiple cardiovascular operations.

AUTHOR CONTRIBUTIONS

Conception and design: VR, J-PF

Analysis and interpretation: RM

Data collection: VR, NB

Writing the article: VR

Critical revision of the article: VR, RM, NB, J-PF

Final approval of the article: VR, RM, NB, J-PF

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