Hybrid treatment of thoracic aortic aneurysm in a patient with associated coronary pathology: a case report

Tratamiento híbrido de aneurisma de aorta torácica en paciente con patología coronaria asociada: reporte de caso

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ABSTRACT

Aortic aneurysms (AA) are a localized dilation exceeding 50% of its diameter. Its chest location is rare (12% of AA), being more common in the aortic root, ascending aorta, or both (60%). Less than 10% of patients present with symptoms, and the rupture may constitute their first clinical manifestation. We present the case of a 67-year-old male patient with dysphonia and a tomographic diagnosis of aneurysmatic dilation at the medial level of the aortic arch with signs of contained rupture, associated with severe coronary disease and its resolution by hybrid technique.

Keywords: aneurysm, thoracic aorta, debranching, aortic endoprosthesis.

RESUMEN

Los aneurismas de aorta (AA) se definen como una dilatación localizada que supera el 50% de su diámetro normal. Su localización torácica es poco frecuente (20% de los AA); es más habitual en la raíz aórtica, aorta ascendente o ambas (60%). Menos del 10% de los pacientes presentan síntomas, y la ruptura puede constituir su primera manifestación clínica. Se presenta el caso de un paciente masculino de 67 años con disfonía y diagnóstico tomográfico de dilatación aneurismática a nivel medial del cayado aórtico con signos de ruptura contenida asociado a enfermedad coronaria severa, y su resolución por técnica híbrida.

Palabras clave: aneurisma, aorta torácica, debranching, endoprótesis aórtica.

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INTRODUCTION

Aortic aneurysms are defined as localized dilations that exceed 50% of their normal diameter. They are typically described by their location, size, morphological appearance, and origin. Aneurysms may be fusiform—the most common type—or saccular in shape. Thoracic AAs are rare (20% of cases)[3] and they most commonly involve the aortic root, the ascending aorta, or both (60%), followed by the descending aorta (30%), and the aortic arch (10%)[1].

Risk factors for aortic aneurysms include smoking, age, sex, genetics, hypertension, dyslipidemia, and atherosclerosis. The AA risk for men is 10 times greater than for women.

Less than 10% of patients experience symptoms, and rupture may constitute their first clinical manifestation.

This aortic pathology poses challenges in terms of both diagnosis and treatment. Treating aortic arch disease remains a challenge. Surgical replacement of the aortic arch is associated with high morbidity and mortality[1].

Open aortic arch surgery has a mortality rate of 7-17% and a stroke rate of 4-12%[6]. Factors such as extracorporeal circulation, circulatory arrest, and deep hypothermia directly impact morbidity and mortality, potentially causing myocardial injury, neurological damage, respiratory distress, renal failure, and systemic inflammatory response.

The hybrid technique, involving debranching of the supra-aortic trunks followed by thoracic endovascular aortic repair (TEVAR), offers a good alternative for patients with acute and chronic disease in the distal ascending aorta, the aortic arch, and the descending aorta[2]. About 30% of all TEVAR cases involve lesions affecting the origin of the supra-aortic vessels.

Endovascular treatment with fenestrated or branched endoprostheses has shown acceptable short-term results in patients at extremely high risk for surgery, but it remains controversial for younger, low-risk patients, for whom open surgery remains the gold standard[4].

Hybrid repair of the aortic arch has shown perioperative and medium- to long-term results comparable to those of conventional surgery. Complications (such as perioperative infarction, endoleak, or embolism) occur in approximately 5-10% of cases. Thirty-day mortality ranges from 5% to 14.9%; early neurological deficits are up to 7% and endoleaks are at 12%, and few cases of extra-anatomic bypass thrombosis have been reported[5].

According to the 2022 ACC/AHA guidelines, TEVAR is now the treatment of choice for descending thoracic aortic aneurysms and type B aortic dissection.

Adequate sealing and anchoring of the endoprosthesis requires appropriate diameter (<40 mm), adequa-

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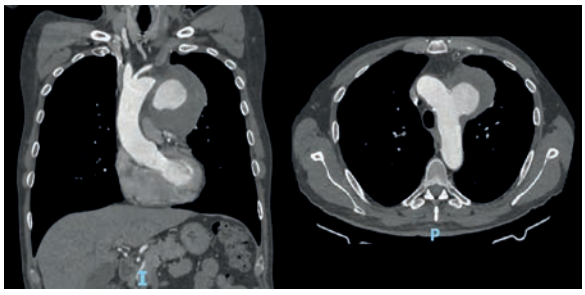

Figure 1. *Chest CT angiogram. Coronal and axial views showing a saccular aneurysm in the medial portion of the aortic arch. Maximum diameter: 71 mm. Lumen diameter: 42 mm. Neck diameter: 25 mm. Fluid collections consistent with contained rupture.*

te length coverage (3-5-cm overlapping), and a healthy >20-mm sealing zone (landing zone)[4], among other characteristics.

The need for supra-aortic trunk (SAT) debranching in hybrid surgery arises as a treatment alternative to increase sealing and anchoring zones for endoprostheses in aortic arch and proximal descending aorta lesions, thus avoiding endoleaks.

There are different options for connections between the aorta and the SATs: intrathoracic bypass (anatomic bypass), extra-thoracic bypass (extra-anatomic bypass), or a combination of both. Hybrid treatment can be performed in a single stage (SAT debranching + TEVAR in the same surgical session) or in two stages (SAT debranching followed by TEVAR within two weeks).

This report discusses the case of a 67-year-old man with dysphonia and a CT diagnosis of aneurysmal dilation at the medial level of the aortic arch, with signs of contained rupture associated with severe coronary disease, and its resolution through a hybrid technique.

CASE REPORT

The patient was a 67-year-old man, smoker with a sedentary lifestyle, who had previously been diagnosed with chronic obstructive pulmonary disease and no prior pharmacological treatment. He was admitted to the Emergency Room in our institution after being referred by an imaging specialist. His clinical presentation included 45 days of progressive dysphonia. A chest CT angiogram revealed a saccular aneurysmal dilation in the medial portion of the aortic arch with a 71-mm diameter and a 42-mm patent lumen, reduced by concentric atheromatous changes. The neck of the aneurysm measured 25 mm and showed heterogeneous atheroma, indicating plaque instability. There were at least three fluid collections in the anterior mediastinum, the largest measuring 2 mm; these were interpreted as contained aortic rupture **(Figure 1).**

At the time of examination, the patient had a blood pressure of 168/104 mmHg, mean arterial pressure (MAP) of 125 mmHg, heart rate of 70 bpm, respiratory rate of 18 breaths/min, axillary temperature of 36.1 °C, and pulse oximetry of 97% while breathing ambient air. The patient was admitted to the Coronary Care Unit for vasodilator and beta-blocker therapy. Complementary studies were performed. An electrocardiogram showed complete right bundle branch block. A color Doppler echocardiography revealed normal left ventricular dimensions and a left ventricular ejection fraction (LVEF) of 31%.

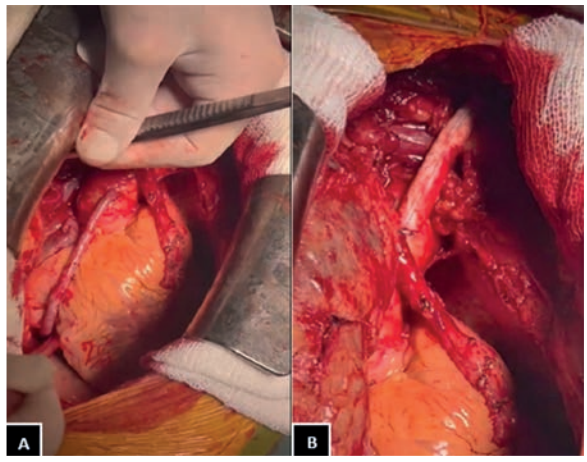

Figure 2. *Myocardial revascularization surgery with a right mammary artery bypass graft to the anterior descending artery and a venous bypass graft to the right coronary artery (A). Debranching of the LSA with a polytetraflouroethylene (PTFE) bypass graft from the ascending aorta (B).*

The aortic root measured 36 mm. Neck vessel Doppler ultrasound showed flat atheromatous plaque at the carotid bifurcation and the proximal internal carotid arteries bilaterally, without hemodynamic compromise. Routine preoperative cardiac catheterization revealed severe stenosis in the proximal segment of the anterior descending artery, with tandem plaque and parietal calcification, as well as severe stenosis in the proximal segment of the right coronary artery. Neck vessel angiography showed a patent brachiocephalic trunk, and patent right subclavian, vertebral, and common carotid arteries without lesions. The left common carotid artery was free of lesions, and the left vertebral artery originated from the left subclavian artery (LSA). Both vessels were patent and lesion-free. The EuroSCORE II was calculated at 3.49%.

The case was evaluated by the heart team, who chose a two-stage hybrid treatment approach. The patient underwent myocardial revascularization surgery with a right internal mammary artery bypass graft to the anterior descending artery and a venous bypass graft to the right coronary artery, along with a left subclavian artery bypass using an anatomic graft from the ascending aorta. The procedure was successfully completed without the need for extracorporeal circulation. There were no postoperative complications **(Figure 2).** An anatomic bypass from the ascending aorta to the left subclavian artery was chosen due to the need for surgical revascularization of the associated coronary lesions, based on their anatomical and angiographic characteristics. The patient was discharged five days after the procedure with outpatient cardiovascular surgery follow-up, showing good progress.

The patient was readmitted three weeks after the surgical procedure. Embolization of the left subclavian artery was performed using two 12-mm × 20-cm 0.035" Interlock 2D (Boston Scientific Corporation, USA) controlled-release coils, followed by endovascular repair of the thoracic aorta with the implantation of a Valiant thoracic stent graft with a 36/36/179-mm Captivia delivery system (Medtronic, Ireland) using transfemoral access. Hybrid access was achieved through right femoral artery arteriotomy and left femoral artery puncture using the Seldinger technique and a 7-Fr introducer. The landing zone was in Zone 2. Angiographic control demonstrated patency of the brachiocephalic trunk and left common carotid artery, as well as exclusion of the aneurysm and the LSA. The procedure was completed wi-

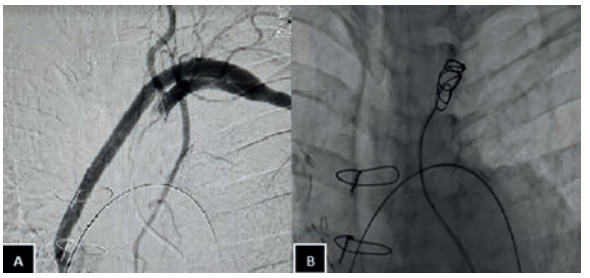

Figure 3. *Angiography showing anatomic aorto-left subclavian bypass patency (A). Embolization of the left subclavian artery using controlled-release coils (B).*

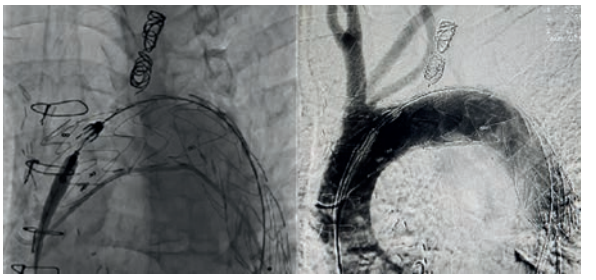

Figure 4. *Implantation of the Valiant thoracic stent graft with a 36/36/179-mm Captivia delivery system using transfemoral access. The landing zone was in Zone 2.*

thout complications. The patient is currently under outpatient follow-up with good progress **(Figures 3 and 4).**

CONCLUSION

A hybrid strategy for the treatment of thoracic aortic aneurysms involving the supra-aortic vessels offers a less invasive alternative compared to conventional surgical treatment.

In the presented case, the combination of endovascular and open surgical procedures allowed for complete revascularization of the supra-aortic and coronary vessels. This approach is a valid and safe option for moderate-risk patients, reducing surgical trauma and cardiac stress, and minimizing the time with reduced cerebral and spinal cord circulation.

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