Hybrid aortic arch repair for dissecting aneurysm

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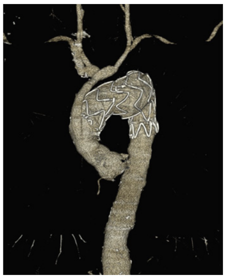
ABSTRACT

Objective: This study analyzed the outcome of a combined endovascular and debranching procedure for hybrid aortic arch repair in patients with chronic dissecting aortic aneurysms involving the aortic arch.

Methods: We reviewed all consecutive patients who underwent hybrid aortic arch repair for dissecting aneurysm at the Arnaud de Villeneuve Hospital.

Results: A total of 33 consecutive patients between March 2005 and September 2015 were included. Patients' mean age was 65.1 ± 12.2 years. Mean aneurysm diameter was 60.3 ± 14.2 mm. Patients were treated for aneurysm diameter 55 mm or greater (n = 28), aortic growth more than 1 cm/year (n = 3), or rupture (n = 2). Eleven complete supra-aortic debranchings were performed in zone 0, with 2 concomitant replacements of the ascending aorta. Partial aortic arch debranching was performed in 22 patients (zone 1 = 8; zone 2 = 14). Technical success was achieved in 97% of patients. There was no in-hospital death. One patient died of decompensated cirrhosis on day 20, resulting in a 30-day mortality of 3%. One patient had major cerebrovascular complications (3%). Spinal cord ischemia was observed in 1 patient (3%), with complete recovery after spinal fluid drainage. Retrograde dissection occurred in 1 patient (3%). After a mean follow-up of 24.3 months (range, 0.6-104.8 months), the overall mortality was 12% (n = 4) with 3 additional deaths. Endoleak was reported in 6 patients (18%), of whom 2 required reintervention. Overall, 8 reinterventions were performed (24%), with a mean time from intervention of 8.7 months (range, 1.2-24.6 months).

Conclusions: Hybrid aortic arch repair for dissecting aneurysm is associated with acceptable early and midterm major morbidity and mortality, even for patients treated in zone 0. However, given the high rate of reintervention and endoleak, close follow-up is required. (J Thorac Cardiovasc Surg 2016;■:1-7)



Zone 0 debranching and endovascular repair for dissecting aneurysm of the aortic arch.

Central Message

HAR is a safe alternative for dissecting aneurysm of the aortic arch even for patients treated in zone 0.

Perspective

Few reports are available concerning HAR for dissecting aneurysm, and the best therapies for this pathology remain debated. This study is the largest series to date on HAR for dissecting aneurysm. We report an acceptable morbidity-mortality rate, even in zone 0, and we assume that HAR is a safe alternative for dissecting aneurysm of the aortic arch.

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In case of aneurysmal degeneration of aortic dissection, 25% of patients with type B aortic dissection have aortic arch involvement.[1] However, the best therapies for dissecting aneurysm involving the aortic arch remain debated.[2,3] Conventional surgical open repair offers durable results but requires arch replacement during deep hypothermic circulatory arrest. Despite advances in surgical techniques and postoperative management, this open procedure is still associated with a significant in-hospital mortality rate.[4] Thoracic endovascular aortic repair (TEVAR) offers a less-invasive surgical procedure but requires hybrid surgery that includes the use of open surgical procedures, such as debranching for revascularization of cervical branches to provide an adequate landing zone in different segments of the aortic arch. Hybrid aortic arch repair (HAR) has been reported mainly for degenerative aneurysms, traumatic aortic injuries, or penetrating ulcers of the aortic arch. Few reports currently are available in the literature regarding HAR for chronic dissecting aneurysms,

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Abbreviations and Acronyms

CT	= computed tomography
HAR	= hybrid aortic arch repair
LCCA	= left common carotid artery
LSA	= left subclavian artery
TEVAR	= thoracic endovascular aortic repair

although HAR in this particular context is faced with several problems: a higher risk of both early complications, such as retrograde dissection,[5] and late complications, such as endoleak and reintervention,[6] compare with HAR for other aortic arch disease. If some promising early results have been recently reported,[7] larger series and long-term reports are lacking.

The purpose of this study was to evaluate the midterm outcome of HAR for patients with chronic dissecting aneurysms involving the aortic arch in the largest series reported.

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MATERIALS AND METHODS

The study was approved by the institutional review board.

Patients

We performed a retrospective review of our single-center results of all patients who underwent HAR for a dissecting aneurysm. Patients were included from 2005 (first HAR for dissecting aneurysm in our institution) to March 2015. Inclusion criteria for HAR included dissecting aneurysm with maximal diameter 55 mm or greater, aortic growth 1 cm/year or more, or rupture, and involvement of the aortic arch or an inadequate landing zone for TEVAR at the proximal descending aorta (<20 mm).

Demographic and Procedural Data

Collected variables were categorized as demographic and preoperative (ie, age, sex, comorbidities, previous aortic surgery, dissecting aneurysm anatomy, and aortic dissection complications such as rupture), intraoperative (ie, debranching procedure, TEVAR procedure, and completion angiogram), and postoperative outcomes (stroke, spinal cord ischemia, reintervention, endoleak, aneurysm diameter, false lumen status, primary patency, and mortality). We used the Ishimaru classification to categorize the proximal landing zone of the stent-graft. Study follow-up time was defined as the date of the last postoperative clinical evaluation. All surviving patients underwent at least postoperative surveillance imaging at 1 month, 6 months, and then annually. All available preoperative and postoperative imaging results were reviewed, which included thoracic CT angiography performed within the Arnaud de Villeneuve University Hospital system and those performed at outside facilities, when available.

Debranching Procedure

All procedures were performed under general anesthesia in an operating room and with the use of intravenous systemic heparin.

- Debranching and revascularization in zone 0 were performed through a median sternotomy. Bifurcated Dacron grafts (14 × 7 mm or 16 × 8 mm) were inserted from the ascending aorta with partial crossclamping to the brachiocephalic trunk, left common carotid artery (LCCA), and left subclavian artery (LSA). For the past 2 years, partial crossclamping of the ascending aorta has been performed under rapid pacing to avoid retrograde dissection.
- Debranching and revascularization in zone 1 were mainly performed through cervico-manubriotomy with sequential transposition of the LCCA and the LSA as we previously described.[8] For patients deemed unsuitable for sequential transposition because of proximal atherosclerotic lesions of the supra-aortic trunks, extra-anatomic revascularization of LCCA and LSA was performed with a carotid–carotid bypass, followed by a left carotid–subclavian transposition.
- Debranching and revascularization in zone 2: Revascularization of the LSA was performed each time it was possible without regard to vertebral circulation.
- In case of aortic origin of left vertebral artery viewed on preoperative CT scan, revascularization of this artery was performed by transposition into the LSA.
- To avoid intraoperative complications, in particular retrograde aortic dissection, we used graft replacement of the ascendant aorta when the aortic diameter was greater than 40 mm.

Thoracic Endovascular Aortic Repair Procedure

All TEVAR procedures were performed in an operating room with patients under general anesthesia. In most cases, TEVAR was accomplished as a sequential concomitant procedure with supra-aortic debranching. In 2 zone 0 landing cases, because of a perioperative unstable blood pressure status, a staged procedure was chosen and TEVAR was performed in the following days (4–7 days). Spinal fluid drainage was performed postoperatively in case of spinal cord ischemia symptoms.

Through a transfemoral approach, a 0.035 Terumo (Tokyo, Japan) guidewire was used to catheterize the true lumen to the ascending aorta under fluoroscopy. Through a 5F pigtail catheter, the guidewire was exchanged for a thoracic stiff-wire (Lunderquist, Cook, France). Transesophageal echography was performed to control the placement of the wire into the true lumen. A 5F pigtail catheter was placed into the aortic arch through the transposed vessels for angiographies during the procedure. For the past 2 years, we have systematically used rapid pacing during stent-graft deployment to reduce blood pressure in the aortic arch and improve the stent-graft placement accuracy. Over the period of study inclusion, 5 different stent grafts were used: Excluder stent graft (WL Gore & Associates Inc, Flagstaff, Ariz); TAG stent graft (WL Gore & Associates Inc); Talent (Medtronic Inc, Sunrise, Fla); Valiant devices (Medtronic Inc), and Zenith TX2 stent graft (Cook, Bloomington, Ind). Stent graft selection was at the discretion of the surgeon. Stent-graft sizing was determined by measuring on the computed tomography (CT) angiogram the proximal and distal landing zone diameters in an orthogonal view using center-line reconstruction. The decision to perform HAR to extend the proximal landing zone was based on the location of the proximal entry tear, and the distal extension of the stent-graft was based on the distal extension of the aneurysm. In case of type 2 thoracoabdominal aorta dissecting aneurysm, a second-stage procedure for open repair of the abdominal aorta was planned. Stent-graft diameter was selected with an oversizing of approximately 10% compared with the proximal diameter of the native nondissected aorta to prevent a new intimal tear and retrograde dissection.[5] If the patient was previously treated for a type A dissection, the proximal anchoring zone was in the prior aortic graft. For other patients, the sizing of the stent-graft diameter was performed on preoperative CT angiogram with an oversizing of approximately 10%. Technical success was defined as exclusion of the dissecting aneurysm without endoleak at the final perioperative angiogram and on transesophageal echography.

Statistical Analysis

Data are reported as mean standard deviation. Discrete data are given as counts and percentages.