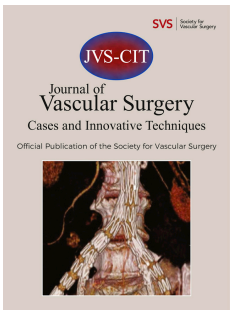

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Transapical total aortic arch replacement with three branched endograft for penetrating aortic ulcer

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Abstract

An 80-year-old man with chronic penetrating atherosclerotic ulcer was not a candidate for open surgical repair due to diffuse vascular atherosclerosis and a deep ulcerative lesion originating at the level of the aortic arch concavity. There was no appropriate endovascular landing zone in arch zones 1 or 2 but a totally endovascular branched arch repair involving transapical delivery of the three branches was successful.

Keywords

Transapical, access, endovascular, aorta, arch, branch,

Introduction

In the last decade, thoracic endovascular aortic repair (TEVAR) for the treatment of aortic arch pathologies has advanced to include hybrid approaches, parallel grafts, scalloped and fenestrated configurations.[1] In particular, branched arch TEVAR has attracted interest as the best possibility of totally endovascular repair and thus reduce invasiveness in patients for whom conventional open surgery would present a prohibitive risk.

TEVAR is typically performed with retrograde deployment via the femoral arteries and there has been emphasis in recent years to improve that route by reducing the profile of delivery systems. However, alternative access routes have been reported in the literature.[2]

Percutaneous transapical access (TAA) has been used for aortic endovascular graft deployment for the first time in a pig model 2008. With the development and general adoption of transcatheter aortic valve implantation (TAVI), large device delivery using TAA has become a well-defined technique.[3]

We report a patient with chronic penetrating atherosclerotic ulcer (PAU) successfully treated with totally endovascular branched arch TEVAR involving TAA of the three branches.

The patient consented to this report.

CASE REPORT

The patient is an 80-year-old male, a heavy smoker with chronic obstructive pulmonary disease and a history of minor stroke. A PAU was discovered during work up for recurrent laryngeal nerve palsy. The computed tomography (CT) scan showed diffuse vascular atherosclerosis and a deep ulcerative lesion originating at the level of the aortic arch concavity. There was no appropriate endovascular landing zone in arch zones 1 or 2.

Preoperative echocardiography showed good left ventricle (LV) function, severe LV hypertrophy, and mild aortic insufficiency.

Due to age, impaired lung function and the poor general conditions, the patient was considered too high risk for a conventional surgical aortic arch replacement.

After a multidisciplinary case evaluation, a decision was made to perform an endovascular repair with a three-branched custom-made Relay Branch device (Terumo Aortic, Sunrise, Fla, USA). The prosthesis had a 44 mm proximal diameter non-bare stent configuration, a 32 mm distal diameter closed end configuration and a length of 255 mm. The fenestration was 65 mm in length and 38 mm in width, located at 45 mm from the proximal end. There were two inner tunnels oriented in antegrade position without lock stents: a 9-mm diameter anterior tunnel for the LCCA and a 12-mm diameter posterior tunnel for the IA. A third inner tunnel (9-mm diameter) oriented retrogradely in posterior position was for the left subclavian artery (LSA).

Intervention

With the patient in a supine position, slightly rotated on the right side, left femoral artery access was prepared with a small groin incision. Guided by transthoracic ultrasound, an anterior-left minithoracotomy exposed the LV apex at the 5th intercostal space and the LV puncture site was identified and marked with methylene blue. TAA was managed with two full thickness double felt-pledgets 2-0 polypropylene purse-string sutures.

Two temporary epicardial leads were placed for rapid ventricular pacing and tested before the implantation of the prosthesis. A second arterial access was achieved percutaneously from the right femoral artery.

After systemic heparinization, a 5F catheter was positioned in the LV apex and a guidewire passed through the aortic valve (AV) under fluoroscopic control. A trough-and-through (TT) wire was positioned between the apex and the left femoral artery and then replaced with a soft 400 mm Jagwire (Boston Scientific).

The graft main body was carefully prepared and advanced from the groin and Relay's soft inner sheath allowed partial expansion and atraumatic navigation into the arch, maintaining tension on the

TT wire. A lateral pre-implant arch angiography allows accurate deployment under rapid ventricular pacing.

To complete the procedure, the apical 5Fr-catheter was replaced with 16Fr DrySeal introducer sheath (W. L. Gore & Associates, Flagstaff, Ariz, US) to deploy the branches for the supra-aortic trunks (SAT). The AV was therefore crossed by two wires: the TT main guide and second guide wire for SAT catheterization. Crossing the AV with these two wires produced a moderate aortic regurgitation that was easily managed by the anesthesiologists, with augmentation of heart rate, through the ventricular epicardial leads.

The graft for the innominate branch (Cook Medical ZLSE 16-56-ZT) had been previously removed from its delivery system and reverse-mounted for antegrade deployment; it was then advanced and released in the desired position (the choice of a Cook branch was due to sizing and relative ease of reverse mounting). Using the same access, the LCCA was cannulated and stented with a 10×10 mm Viabahn (Gore). Finally, a 11×100 mm Viabahn (Gore) was deployed from below in the LSA and reinforced with a 10-94 mm wall stent (to prevent bending), by creating a TT wire between the femoral artery and the left radial artery.

Final angiography control showed a perfect positioning of the main graft and branches, with optimal perfusion of the cerebral vessels and no signs of endoleak. The patient's hemodynamic condition remained stable throughout the intervention.

Echocardiography at discharge revealed normal function of the AV with a mild insufficiency and no signs of LV aneurysm formation at the apex. Postoperative CT showed complete exclusion of the PAU, no signs of endoleak or other complications. The patient was discharged home in a satisfactory condition 10 days after the procedure on aspirin only.

Discussion

Open surgical repair is the gold standard for aortic arch pathology in our institution.[4] However, despite improvements in surgical techniques and outcomes, there is a group of fragile patients for whom open surgical intervention presents a prohibitive risk and who require a less invasive approach. In this case, we chose TAA to achieve a smooth passage of the main body of the graft despite the significant angulation of the arch.[5] Moreover, the use of transapical TT wire allows the passage of the main body at the center of the aorta, reducing the possibilities of scraping arch plaque and the risk of embolization (Figure 1).

Last but not the least, transcranial doppler monitoring during arch TEVAR has shown that wire and catheter manipulation, as well as device deployment, generate the greatest number of microembolic signals, so an important advantage of this approach is to avoid surgical manipulation of the SAT vessels. Furthermore, three branches represents a totally anatomical repair without extra-anatomical reconstruction.

TAA has been reported previously for debranching or fenestrated TEVAR, or for double-branched arch TEVAR, but to our knowledge a transapical triple-branched endograft has never been reported yet. TAA is associated with some complications—the formation of a LV apex pseudoaneurysm or late ventricular septal defect—and requires follow-up echocardiography, but it does not appear to compromise the AV or LV function. However, it remains a technique of cardiac surgeons and requires ample experience and a closely collaborating aortic team.

Conclusions

We report the successful case of a totally endovascular aortic arch replacement using transapical access to deploy all three inner branches. The procedure is safe and feasible, especially in fragile patients with complex arch's angulation that presents a high risk of embolization. The collaboration between specialties as part of an aortic team is the key to success to ensure the best strategy for patients.

Conflict of Interest

None declared

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