Masters of Cardiothoracic Surgery

Aortic valve-sparing root replacement (David-I) for acute aortic dissection type A

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Clinical vignette

A fifty-year-old male patient presented with sudden acute chest pain and right lower leg pain to a regional hospital. He underwent thrombectomy of the right iliac artery by the local vascular surgeon. However, pain persisted and a subsequent computed tomography (CT) angiogram of the chest and abdomen was performed. The CT scan showed acute aortic dissection type A (AADA, DeBakey type I) with collapse of the true lumen in the descending aorta. The patient was then immediately transferred to our hospital.

Surgical technique of David procedure in AADA

Preparation

The patient was promptly transferred to the operating theatre. Under general anesthesia, he was intubated and arterial and venous lines were placed (femoral and bilateral radial artery lines, central venous lines via the internal jugular vein).

Exposition

In the supine position, the operative field was prepped and draped in standard fashion. Median sternotomy was performed and the pericardium opened.

Operation

Heparin was administered systemically. Cardiopulmonary bypass (CPB) was established with direct cannulation of the ascending aorta using Seldinger technique under trans-esophageal echocardiographic guidance for the arterial inflow, and the right atrium venous drainage (1).

The patient was cooled to 20 °C. A vent catheter was placed in the left ventricle via the right superior pulmonary vein.

During cooling, the ascending aorta was clamped and opened. Cold blood cardioplegia (Buckberg) was given directly into both coronary ostia. Careful inspection and evaluation of the aortic root and the aortic valve leaflets was undertaken. The aortic sinuses as well as the aortic annulus were dilated. The aortic valve leaflets were normal without any sclerosis.

As the patient was young and stable, the decision was made to proceed with combined valve-sparing aortic root replacement (VSARR, David I procedure) (2) and replacement of the total aortic arch with a frozen elephant trunk. The decision to proceed with the latter was due to malperfusion of the lower part of the body (including right lower leg ischemia) caused by the collapse of the true lumen in the descending aorta.

VSARR

After mobilizing the root from the outside, the coronary

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ostia were excised as buttons and the dilated aortic sinuses were resected, leaving a remnant of about 5 mm. Using stay sutures, the commissures are elevated. The valve leaflets were carefully inspected and coaptation of the aortic valve cusps was evaluated. The size of the aortic root was measured using a Hegar dilator (28 mm). We took a straight tube Dacron graft that was one size (=2 mm) larger than the size of the Hegar dilator. In our experience, it is usually a 30 mm Dacron graft.

The aortic root was carefully mobilized. It is of utmost importance that the aortic root is mobilized from outside down to a level of the insertion of the aortic valve leaflets, even at the right coronary side.

Thereafter, 12 polyester threads were placed from inside out below the insertion of the leaflets. The Dacron prosthesis was anchored to the aortic root by tying these sutures loosely, taking care not to cause a purse-string effect. These are only to anchor the graft to the aortic root, not for hemostasis.

The commissures were maximally elevated and sutured into the straight tube Dacron prosthesis using polypropylene sutures, taking care not to pull on the grafts. The remnants of the aortic sinuses and the aortic annulus were fixed to the prosthesis using three additional 4-0 polypropylene sutures, thus creating small neo-sinuses. Coronary ostia were reimplanted to the Dacron graft using polypropylene sutures.

In addition to the root procedure, total aortic arch replacement with a frozen elephant trunk graft was performed, under deep hypothermic circulatory arrest (temperature 20 ℃) and bilateral selective antegrade cerebral perfusion. Nowadays, we perform the aortic arch repair with the beating heart technique as described previously by our group (3).

Completion

During the re-warming phase, a transesophageal echocardiography was performed to evaluate the aortic valve. The patient was rewarmed and gradually weaned from the CPB without difficulty. A thorough hemostasis was done. After chest tubes were placed, the chest was closed in standard fashion.

Post-operative course

The patient tolerated the procedure well and could be discharged from hospital in good general condition. An additional echocardiography as well as a CT angiogram was performed before discharge. In addition, consent was obtained from the patient to allow for follow-up examinations.

Comments

Clinical results

Our group has significant experience with VSARR, both in the elective setting and in emergent situations for acute type A aortic dissection (4,5). Over a time period of 25 years, a total of 677 David-I procedures were performed at our center. Of these, 133 (20%) were performed emergently for AADA (5). The perioperative mortality in this group was 12.8%. We could not only show that early results are acceptable, but also that VSARR can be applied to acute type A dissection with sustainable long-term results (4). The 1-, 5-, 10- and 15-year survival rates were 97%, 93%, 82% and 66%, respectively (5). Furthermore, we could demonstrate that the long-term outcome in terms of survival and valve durability is not inferior when applied in elective settings (4).

Advantages

The David procedure prevents the disadvantages of removing the native aortic valve. Namely, replacement with a tissue valve prostheses will have the risk of early deterioration and mechanical valve prostheses carry the possibility of thromboembolic and bleeding complications. The American Association of Thoracic Surgery's expert consensus statement on acute aortic dissection considers VSARR a feasible option in acute aortic dissection.

Caveats

Patient selection is of utmost importance when evaluating patients with aortic dissection for VSARR. It should only be performed in patients with dilated or completely dissected aortic root in clinically stable and young patients or those with connective tissue disease. Both the surgeon and the team should have gained sufficient experience with this technique in elective settings. The quality of the initial valve repair should be excellent. Aortic valve regurgitation should be ideally either zero or minimal, in order to obtain adequate long-term durability of the repaired valve.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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