Masters of Cardiothoracic Surgery

Type B dissection with retrograde progression of intramural haematoma managed with frozen elephant trunk surgery

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Clinical vignette

A 43-year-old-male presented with acute chest pain and mediastinal widening on chest X-ray. His medical history included hypertension, non-compliant with treatment. Computed tomography (CT) aortogram demonstrated acute type B aortic dissection (TBAD) with an intimal tear originating from the distal aspect of left subclavian artery (LSA) and extending distally to the left common iliac artery. The true lumen supplied the coeliac axis, superior mesenteric and renal arteries and the false lumen the inferior mesenteric artery. A small pericardial effusion was noted.

Due to clinical stability without any signs of malperfusion, the decision was made to treat conservatively (invasive blood pressure control) and imaging surveillance at 48 hours.

Repeated CT aortogram demonstrated retrograde intramural haematoma extension to the origin of the brachiocephalic trunk and a new left side haemothorax. Urgent surgical repair with frozen elephant trunk (FET) technique was offered to the patient.

Surgical technique

Preparation

Invasive monitoring consisted of right radial and left femoral arterial lines, right jugular vein and pulmonary catheters. Near infra-red spectroscopy (NIRS) probes were attached to monitor cerebral & lower limbs oxygen saturations, bladder and nasopharyngeal temperature probes were used.

Exposition

The patient was positioned supine for a median sternotomy approach.

Operation

After the median sternotomy was performed, the innominate vein, innominate artery, left carotid and LSA were mobilised and taped. The pericardium was opened (inverted T) and hitched.

Heparin (1 mg/kg) was given and a 10 mm Dacron graft (Gelatin impregnated woven vascular prosthesis—Vascutek, Terumo, Inchinnan, UK) was anastomosed end-to-side to the innominate artery to accommodate a 24 Fr Elongated One-Piece Arterial (EOPA) cannula for arterial perfusion during cardiopulmonary bypass (CBP) and antegrade cerebral pefusion (ACP). A two-stage venous cannula was placed into the right atrium.

CPB was commenced, and core temperature cooled to 28 degrees Celsius. A right superior pulmonary vent was inserted, as well as a DLP root cannula.

Once the desired temperature was reached, the ascending aorta was cross-clamped and continuous blood (200–250 mL/min aiming for pressures of 100–120 mmHg) at 28 degrees Celsius was given via a root cannula throughout

the surgery until the proximal anastomosis was completed to minimise cardiac ischemia.

Distal circulatory arrest was started, and antegrade cerebral perfusion was started via the innominate artery (6 mL/kg adjusted if needed by NIRS variations). The LSA was divided with vascular stapler (EndoGia 12 mm).

The distal ascending aorta and the arch were transected to anatomical zone 2. Two Teflon strips were placed internally and externally in the distal arch suture area and secured with three interrupted 3.0 prolene sutures. Inspection of the descending thoracic aorta was performed with a single use bronchoscope (Ambu® aScope™ 4 Broncho) and the entry tear in zone 3 was identified. A Thoraflex Hybrid Plexus 30/36 mm × 10 cm device was deployed into the descending aorta and sutured in place with four 2.0 Ethibond pledgeted stitches sutured with Cor-knot.

Lower body perfusion (blood at 400 mL/min) was then started by introducing a ballooned cannula through the FET lumen while constructing a double suture layer (continuous 3.0 prolene and 3.0 pledgeted mattress sutures).

Once the anastomosis was completed, the aortic EOPA cannula was placed in the Thoraflex side arm and the Thoraflex graft clamped to resume visceral perfusion at increasing flows until reaching full flow.

Attention was then directed to the proximal anastomosis. Continuous blood perfusion in the root was then discontinued and a dose of antegrade cold cardioplegia was given. The proximal anastomosis to the sinotubular junction was completed in a similar fashion (double-layered continuous 3.0 prolene and, pledgeted 3.0 prolene sutures).

The cross-clamp was released after deairing, re-establishing myocardial perfusion.

The left subclavian, left carotid and innominate arteries were then anastomosed to Thoraflex hybrid side branches using 5.0 prolene while rewarming the patient.

Completion

Pacing wires were inserted and the patient was gradually weaned from with significant ionotropic and vasopressor support (0.01 mg/kg/min of noradrenaline, 0.2 mg/kg/min of milrinone). Heparin was reversed with protamine (1 mg/kg), and blood products (3 grams of Octaplex and two units of frozen plasma) were administered after decannulation. The Thoraflex perfusion branch was tied and left long enough to facilitate future cannulation if necessary.

The sternotomy was then closed routinely onto left pleural, mediastinal and pericardial 28 F chest drains.

Comments

Clinical results

Acute TBAD even after non-complicated presentation requires close radiological surveillance as it can retrogradely progress onto a type A or non-A non-B (NANB) aortic dissection, that will mandate urgent open surgical repair with arch/FET repair (1,2). In our institution, since 2015, 26 patients have been treated with this approach (22 complicated type B and 4 NANB aortic dissections), with in-hospital mortality of 19.2% and the following morbidity rates: stroke 23%, paraplegia 11%, haemofiltration 27% and tracheostomy 15%.

Advantages

The FET technique allows primary tear coverage as well as promoting distal aortic remodelling lowering the risk of aortic expansion (3,4).

Caveats

Implantation of FET is a surgically demanding technique, that requires specialised training and is ideally performed in aortovascular centres with tailored postoperative management; access to emergency implantation of spinal drain if spinal cord ischemia develops in the postoperative period, as well as access to endovascular techniques if distal extension is required (5).

Its use for TBAD does not come without mortality and morbidity, often influenced by the perioperative status of the patient; however, the rate of neurological and spinal cord complications remains significant.

Future devices, such as the Terumo hybrid subclavian approach currently being developed, could facilitate the management of the LSA during surgery in difficult orientations. Moreover, specific devices for sealing distal lumen after the deployment of FET and early reinstitution of distal circulation can be advantageous in reducing distal ischemic times and related complications.

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Footnote

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

References

1. Kreibich M, Berger T, Morlock J, et al. The frozen elephant trunk technique for the treatment of acute complicated Type B aortic dissection. Eur J Cardiothorac Surg 2018;53:525-30.
2. Li YL, Liu Y, Zhang H, et al. Thoracic Endovascular Aortic Repair for Type B Aortic Dissection Associated with Retrograde Type A Intramural Hematoma. J Vasc Interv Radiol 2020;31:1334-41.
3. Weiss G, Tsagakis K, Jakob H, et al. The frozen elephant trunk technique for the treatment of complicated type B aortic dissection with involvement of the aortic arch: multicentre early experience. Eur J Cardiothorac Surg 2015;47:106-14.
4. Ito H, Nakai H, Murakami T, et al. Long-term results of the frozen elephant trunk technique in primary chronic type B aortic dissection. Gen Thorac Cardiovasc Surg 2024;72:770-8.
5. Kozlov B, Panfilov D, Lukinov V. Frozen Elephant Trunk for Aortic Dissection Using Different Hybrid Grafts: Preliminary Results from a Prospective Study. J Pers Med 2023;13:784.

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