Repair of Extent III Thoracoabdominal Aneurysm in the Presence of Aortoiliac Occlusion

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ABSTRACT: Concomitant thoracoabdominal aneurysm and aortoiliac occlusion are extremely rare and present a unique surgical challenge. We report the successful reconstruction of a 9.2-cm extent III thoracoabdominal aneurysm and aortoiliac occlusion in a 54-year-old male. The surgery was performed using a trifurcated graft and total cardiopulmonary bypass. The combination of cerebrospinal fluid drainage, cold renovisceral perfusion, and reattachment of large segmental arteries resulted in a successful outcome in this rare presentation.

INTRODUCTION

Thoracoabdominal aortic aneurysms (TAAs) are uncommon, with an incidence of 5.9 per 100,000 person-years.[1] Concomitant TAA and aortoiliac occlusion are even more rare and present a unique surgical challenge. Although both share a common etiology involving atherosclerosis, extension of aortoiliac disease seldom progresses to the thoracoabdominal aorta or vice-versa.[2,3] Herein we describe a successful reconstruction of a 9.2-cm extent III TAA and aortoiliac occlusion.

CASE PRESENTATION

A 54-year-old man with a history of an enlarging TAA, failed aortobifemoral bypass for aortoiliac occlusive disease, and single functioning right kidney presented with back pain and severe disabling claudication, which he had been experiencing for 9 months. A computed tomography (CT) scan demonstrated a 9.2-cm TAA extending from the distal thoracic aorta to the aortoiliac bifurcation, an occluded aortobifemoral bypass, and obstructed inferior mesenteric and left renal arteries (Figure 1). Cardiac catheterization revealed right coronary artery obstruction with collateral filling from patent left anterior descending and circumflex arteries and an ejection fraction of 25%. He was referred to us for open repair.

A cerebrospinal fluid drainage catheter was introduced preoperatively into the L4 and L5 space. A long, curved thoracoabdominal incision was made through the sixth intercostal space with extension into the abdomen (Figure 2), and the left costal margin was transected. The diaphragm was divided circumferentially leaving 4 cm of peripheral margin. The infradiaphragmatic aorta was exposed through

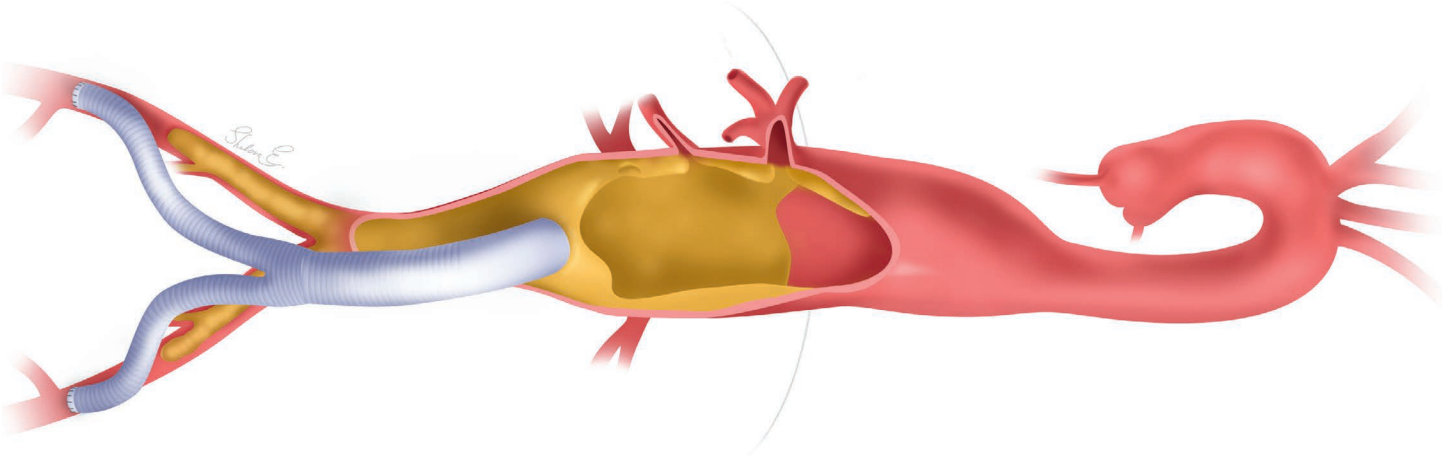

Figure 1.
A clot extends from the thoracoabdominal aorta to the aortoiliac bifurcation.

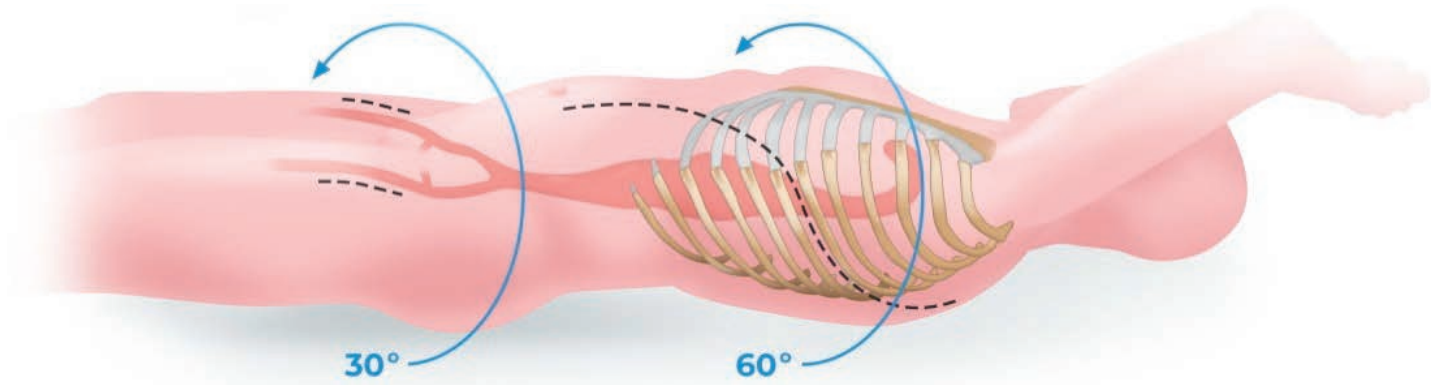

Figure 2.
An S-shaped thoracoabdominal incision with bilateral groin exposure is demonstrated.

a retroperitoneal approach using left-to-right medial visceral rotation, and bilateral longitudinal groin incisions were performed. A 28F long Bio-Medicus NextGen cannula (Medtronic Inc.) was inserted through the left common femoral vein, and the tip was positioned in the right atrium using the Seldinger technique with transesophageal echocardiographic guidance. The proximal descending thoracic aorta was cannulated with a 24F short DLP cannula (Medtronic Inc.).

Total cardiopulmonary bypass with mild (32 °C) hypothermia was established, and the aorta was clamped distal to the arterial cannula. The aorta was opened, and the clot was removed. Selective cold (4 °C) blood perfusion at a flow rate of 300 cc/min

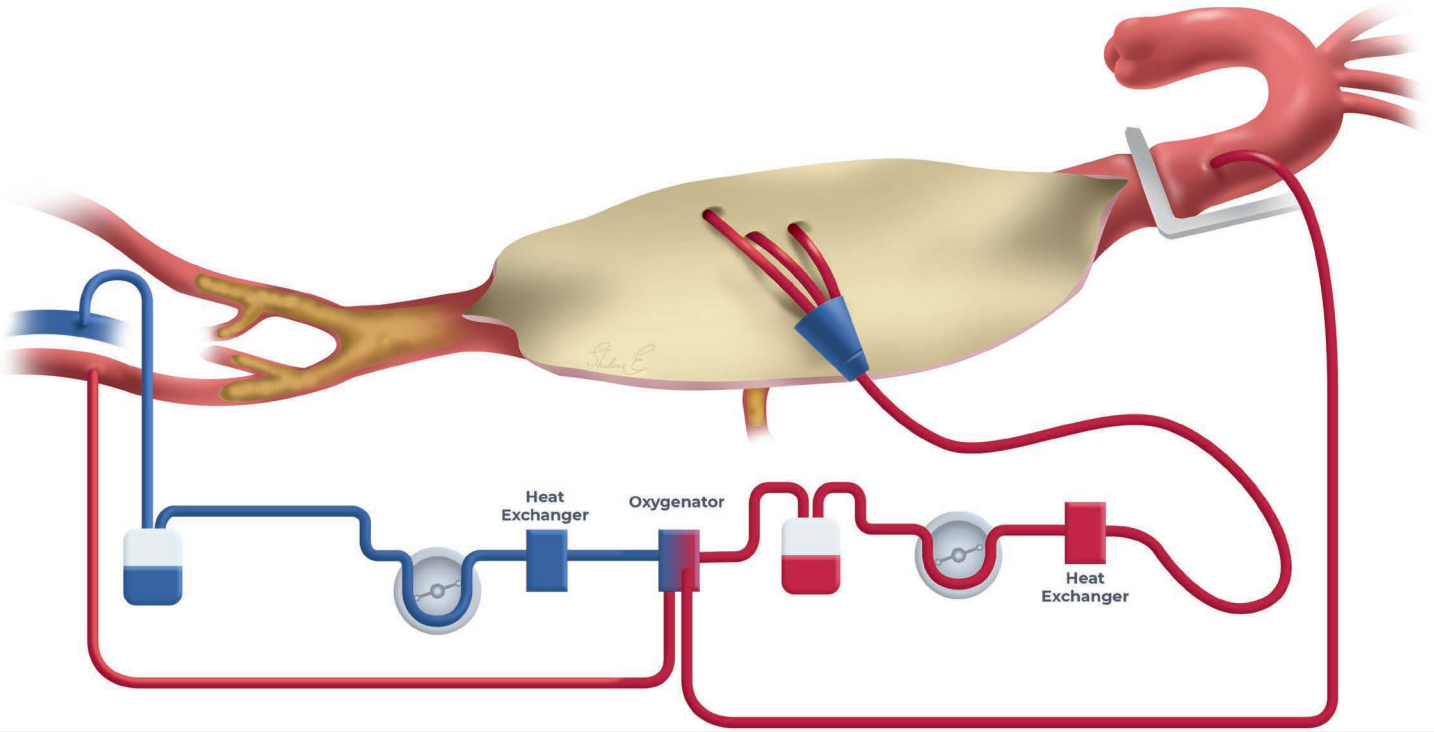

Figure 3.
Selective perfusion of the celiac axis, superior mesenteric artery, and right renal artery with cold blood using a pump oxygenator.

was continuously delivered to the celiac, superior mesenteric, and right renal arteries using a pump oxygenator (Figure 3). A 14 x 10 x 10-mm trifurcated graft (Maquet) was sequentially anastomosed to the celiac, superior mesenteric, and right renal arteries. Continuous perfusion was maintained via the main limb of the trifurcated graft. A 30-mm Dacron graft was then anastomosed to the descending thoracic aorta in an end-to-end fashion. Patent T9 intercostal arteries identified on preoperative CT angiography were reimplanted to an opening in the 30-mm graft, and the main limb of the trifurcated graft was anastomosed to the 30-mm graft in an end-to-end fashion. Renovisceral perfusion was then fully restored. An 8-mm Gore-Tex graft was anastomosed to the Dacron graft in an end-to-side fashion using 5-0 Prolene. The 8-mm Gore-Tex graft was tunneled retroperitoneally into the left and then right groin and directly anastomosed to the right common femoral artery using running 6-0 Prolene. A 6-mm Dacron graft was anastomosed to the 8-mm Gore-Tex graft in an end-to-side fashion in the left groin using running 6-0 Prolene. Because the failed graft was densely adherent to the left common femoral artery, the 6-mm Dacron graft was anastomosed to the left superficial femoral artery in an end-to-side fashion (Figure 4). Target cerebrospinal fluid pressure was set to 10 mm Hg by draining 10 mL/h for 72 hours (visit journal.houstonmethodist.org to watch a video of the operation).

The next day, a CT scan of the abdomen and pelvis showed that the patient had developed anuria, likely from an embolic occlusion. Two 5 × 40-mm and 10 × 40-mm Innova self-expandable bare metal stents (Boston Scientific) were placed into the right renal artery graft using radial access. The patient required temporary dialysis, but his kidney function fully recovered before discharge. No neurological or cardiac events occurred during the perioperative period, and he was discharged on aspirin.

DISCUSSION

Total cardiopulmonary bypass offers several advantages over other techniques when clamping the proximal aorta is unsafe or when extensive thoracoabdominal aortic disease is present,[4,5] particularly in a patient with atherosclerotic heart disease, baseline renal dysfunction, and aortoiliac occlusion. The technique provides optimal hemodynamic stability and allows for rapid return of shed blood into the perfusion circuit.[5] In this case, the proximal descending thoracic aorta and common femoral vein were cannulated to avoid atriofemoral or femoral-femoral bypass, which is difficult to establish in aortoiliac occlusion. Epiaortic ultrasound scanning and transesophageal echocardiography were used to identify areas on the anterior wall of the proximal descending thoracic aorta that were devoid of atherosclerotic plaque. The clamp and sew technique was avoided because cross-clamping would have resulted in increased left ventricular afterload, which is particularly devastating in a patient with low ejection fraction.

Robust spinal cord perfusion was important since the patient had no collateral flow from his bilateral internal iliac arteries to the spinal cord perfusion network.[6] A pair of large intercostal arteries were identified and reimplanted as a Carrel patch. To further reduce the risk of spinal cord ischemia, the patient's cerebrospinal fluid was drained (≤ 10 mm Hg) and mean arterial pressure (85 to 95 mm Hg) was increased for 72 hours postoperatively.

To reduce renovisceral ischemia, an "octopus" (Medtronic, Inc.) attached to three balloon-tipped catheters allowed for direct perfusion of the celiac, superior mesenteric, and right renal arteries with a pump oxygenator at a rate of 300 cc/min at 4 °C. Although the patient suffered right renal artery occlusion, likely from embolization of atheromatous debris from the area

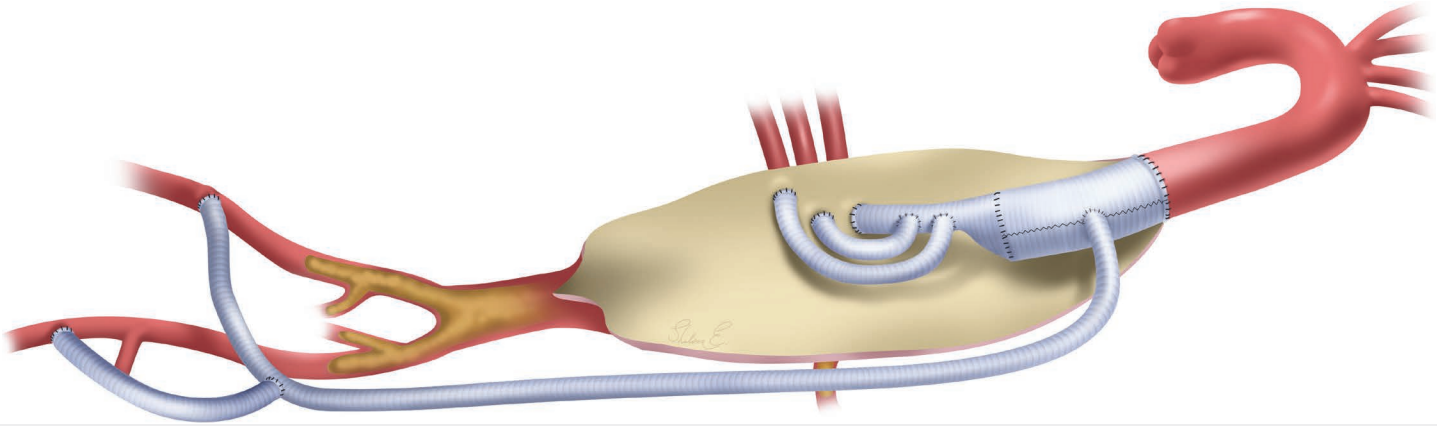

Figure 4.
Final repair using a trifurcated graft and lower extremity bypass.

of the cross-clamp, his kidney function recovered after prompt endovascular stenting.

The trifurcated graft technique is technically straightforward and adaptable to a variety of pathologies and reconstructions.[7] An alternative method of repair may have entailed a bifurcated aortic graft, with the trifurcated graft based off of one limb and the lower-extremity graft based off of the other limb.

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Conflict of Interest Disclosure:
The authors have completed and submitted the *Methodist DeBakey Cardiovascular Journal* Conflict of Interest Statement and none were reported.

Keywords:
aortoiliac, thoracoabdominal aneurysm, reconstruction, trifurcated graft

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