Hybrid Three-Stage Repair for Extended Thoracoabdominal Aortic Aneurysm: Report of A Case

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A 67-year-old man complicated with back pain was referred to our hospital for management of extended TAAA. He had severe emphysema and a 45-year history of smoking. On admission, his vital signs showed blood pressure, 121/81 mmHg; heart rate, 96 beats/min; and, oxygen saturation, 89%. The computed tomography (CT) scan demonstrated an extended TAAA, ranging from the aortic arch to the infra-renal abdominal aorta. The maximal diameters were 65 mm in the aortic arch and 76 mm in the descending thoracic aorta (Fig. 1). Also, the lung field of the CT scan revealed significant emphysematous change. Therefore, we scheduled a three-stage hybrid procedure, including endovascular approach, excluding left thoracotomy, for this extensive aortic aneurysm. Three days after admission, we performed Y-grafting with visceral debranching through the peritoneum for infra-renal abdominal aortic aneurysm with a 20 mm × 10 mm Y-shaped dacron graft (Gelsoft, VASCUTEK, TERUMO Company, Scotland, UK) as a first stage procedure. The superior mesenteric artery (SMA) was reconstructed in an end-to-side fashion with an 8 mm expanded polytetrafluoroethylene graft (Goretex, W. L. Gore & Associates, Inc., Newark, DE). The right limb of the Y-shaped graft was selected for the inflow site. Renal artery bypasses were subsequently performed in an end-to-end anastomosis using the saphenous vein grafts (Fig. 2). Nine days after the initial operation, we performed total arch replacement (TAR) with elephant trunk (ET) technique using a four-branched Dacron graft (J-graft, Japan Lifeline Co., Ltd., Japan), followed by antegrade delivery of the stented endografts. Two pieces of 37 mm × 20 mm endograft (Gore Tag, W. L. Gore & Associates, Inc., Newark, DE) were deployed to the level of the 11th thoracic vertebral body (Fig. 3A). The left accessory renal artery (LARA) was embolized using the coil materials to prevent type 2 endoleak after endovascular aortic repair at 43 days after the second operation. Although coil embolization to the celiac artery (CA) was scheduled beforehand, Fluorescent abdominal aortic angiography demonstrated obstruction of the CA. We considered this was...
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probably due to increased retrograde blood flow through the bypassed SMA and entirely calcified lesion in the orifice of the CA identified on admission.

Fifty days after the second operation, three stent grafts (Cook Zenith TX2 40 mm × 208 mm, 34 mm × 197 mm and 30 × 80 mm, Cook Medical, Bloomington, IN) were deployed in a retrograde fashion through the femoral access. Postoperative CT scan showed no endoleaks (Fig. 3B). The patient was transferred to another hospital for rehabilitation on the 84th day after admission.

Discussion

Despite improvement of surgical techniques and strategies, open surgery for TAAA is still highly invasive. In fact, thirty-day mortality after surgery has been reported to be 5–14%. In addition, mortality is higher in patients with Crawford extent II TAAA; also, co-morbidities such as renal dysfunction, cardiac disorders, and chronic obstructive pulmonary disease are critical issues to resolve. In itself, morbidity of conventional TAAA repair which may include paraplegia is significant. On the other hand, the hybrid approach for TAAA has been reported as an alternative for high-risk patients. Hughes et al. have reported the effectiveness of a thoracoabdominal endovascular repair with the debranching technique of visceral and renal arteries. Of the 53 patients who underwent thoracic endovascular treatment, 13 patients were suitable for the debranching technique. After surgery, third-day mortality was 0% and neurological deficit
is feasible and provides a promising alternative to surgical repair in suitable patients but it is not an advisable procedure for patients with Crawford II extent TAAA with inadequate landing zones.

Another most serious complication of TAAA repair is spinal cord injury. And, Crawford extent II TAAA is especially a risk factor for paraplegia after surgery. Bischoff et al. reported that a staged hybrid approach could help to preserve the collateral network pressure of the lumbar segmental artery. This procedure reduces the risk of spinal cord injury in porcine models. Therefore, a three-stage hybrid approach might be a feasible strategy for an extended TAAA so as to prevent spinal cord injury, as our case exemplifies. We usually keep in mind the placement of spinal drainage catheter (SDC) for cases with increased risk of spinal cord injury (SCI) after operation. However, considering the risk of complications related to the insertion of SDC such as direct injury to the spinal cord and formation of hematoma around it, indications of this neuroprotective technique should be carefully determined, and depending on the individual cases, we postoperatively perform the placement of SDC as immediately as possible following the onset of SCI. We consider that strictly maintaining the mean arterial pressure of more than 85 mmHg, blood oxygen concentration of more than 98%, and blood hemoglobin concentration of more than 10 g/dl in the intensive care unit (ICU) is more important to prevent SCI.

Disclosure Statement

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