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Case Report

Rescue Technique for Malposition Caused by Mislabeled Stent Graft in Thoracic Aneurysm

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The aim of this paper is to report a salvage treatment for malpositioned stent graft due to mislabeled product during thoracic endovascular aortic repair (TEVAR) in descending thoracic aneurysm (DTA). A 78-year-old male presented with 6.7×4.1 cm sized saccular DTA and 7.1×7.3 cm sized abdominal aortic aneurysm (AAA). DTA was initially treated by TEVAR and 2 months later AAA was treated by open aortic repair. Unfortunately, although the stent graft was correctly labeled for DTA, the actual size of product wrapped in a box was different contrary to our expectations. On completion angiography, proximal sealing zone showed no endoleak, however, celiac trunk and superior mesenteric artery (SMA) was found to be accidentally occluded. Through an emergent thoracotomy, distal part of stent graft was removed by cutting distal segment of stent graft and pulling out maneuver to restore blood flow. The completion angiography presented no endoleak, and celiac trunk and SMA were secured. Cutting distal segment of stent graft and pulling out maneuver is one of feasible rescue technique to maintain blood flow of occluded celiac trunk during TEVAR.

Key Words: Thoracic endovascular aortic repair, Malposition, Mislabel, Rescue technique

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INTRODUCTION

Accidental coverage of celiac trunk or superior mesenteric artery (SMA) during thoracic endovascular aortic repair (TEVAR) presents one of the most terrible complications. Several rescue techniques for endovascular aneurysm repair (EVAR) have been reported in the literatures [1,2], however, there are no reports of unintentional coverage of celiac trunk and SMA due to mislabeled stent graft during TEVAR. Herein we report unintentional coverage of celiac trunk during TEVAR and present rescue technique to salvage occluded celiac trunk.

CASE

A 78-year-old male with 6.7×4.1 cm sized saccular descending thoracic aneurysm (DTA) and 7.1×7.3 cm sized abdominal aortic aneurysm (AAA) was admitted for operation. The patient's past history was remarkable for hepatoma and hypertension. The hepatoma was surgically removed in the past. Patient's renal function was upper normal limit (creatinine level of 1.03 mg/dL). Preoperative computed tomography angiography (CTA) presented 6.7×4.1 cm sized saccular DTA in descending aorta and 7.1×7.3 cm sized infrarenal AAA (Fig. 1). We planned to treat DTA first through endovascular method and to treat AAA 3 months later by open repair due to its short neck.

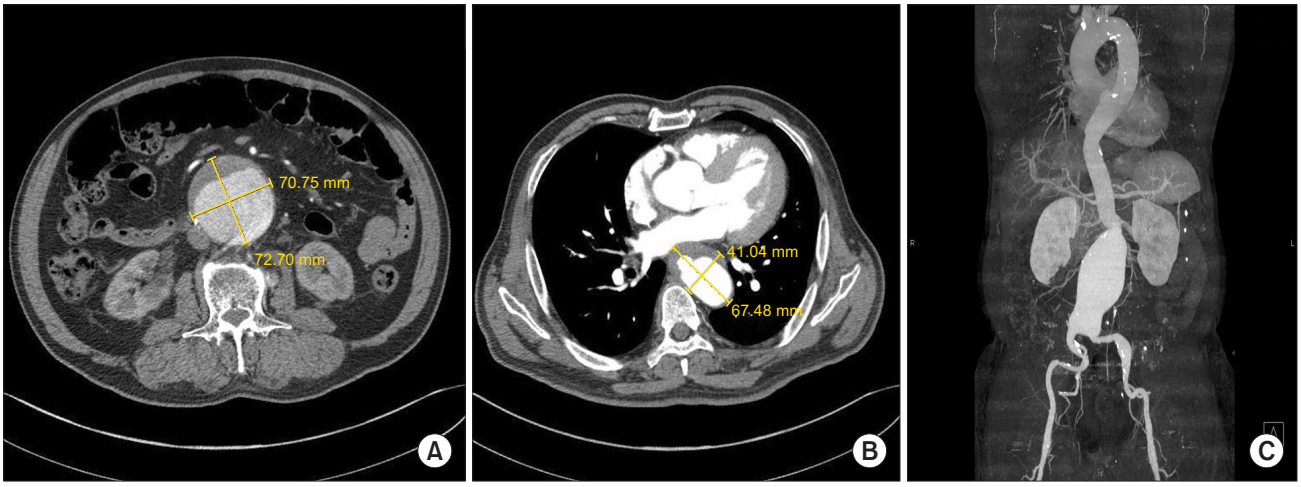

Fig. 1. Preoperative computed tomography angiography (CTA) showing 6.7×4.1 cm descending thoracic aneurysm (A) and 7.0×7.2 cm abdominal aortic aneurysm (B), and three-dimensional reconstruction CTA shows both aneurysms (C).

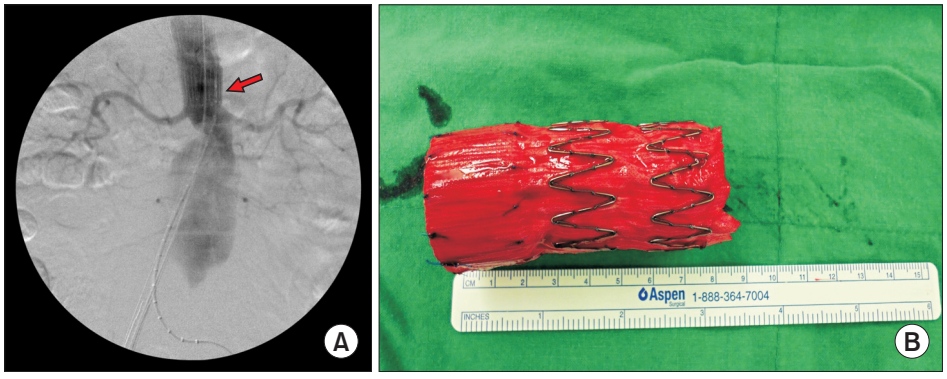

Fig. 2. (A) Completion angiography after stent graft deployment showing occlusion of celiac trunk and superior mesenteric artery (arrow). (B) A 8 cm sized removed distal segment of stent graft.

A 38×127 mm Zenith TX2 thoracic stent graft (Cook, Bloomington, IN, USA) was chosen for repairing DTA. We decided to use only proximal component of this stent graft. The label printed out side of product's box was the correct size as we planned. In the operating room, the patient was under general anesthesia and the access was accomplished using femoral cut down. Preoperative angiography showed adequate landing zone for both proximal and distal ends. With the fluoroscopic guidance of mobile C-arm, the stent graft was deployed covering the saccular DTA. However, contrary to our expectations, distal part of stent graft kept deploying enough to cover celiac trunk and SMA. Unfortunately, the real size of stent graft was 38×200 mm. A subsequent angiography presented 80 mm over-sized stent graft covering both celiac trunk and SMA (Fig. 2). Through an emergent thoracotomy with patient in right lateral decubitus position, descending aorta was immediately exposed. After both proximal and distal clamping of descending aorta, over-sized distal segment was cut and removed. The remnant distal segment of proximal stent graft sealing with accurate proximal landing zone was sutured with descending aorta during closure of descending aortic wall. Suturing with aortic wall can prevent distal migration of remnant stent graft. As proximal sealing of stent graft was perfectly positioned, distal segment was easily removed by cutting and pulling out maneuver. After chest tube was inserted in left thoracic cavity, the patient was transferred into the intensive care unit. The postoperative course was uneventful, and postoperative CTA revealed no evidence of endoleak with patency of celiac trunk and SMA. The patient was discharged without any complications. One month later, the patient underwent open aortic repair for AAA with short infrarenal neck. Another 1-month after open AAA repair, CTA revealed patency of visceral arteries with no evidence of any types of endoleak nor surgical complications (Fig. 3).

The operative picture providing illustrated schematic diagram was shown in Fig. 4.

DISCUSSION

TEVAR has been widely used as safe alternative to open repair with low mortality, morbidity, and short hospital stay

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Fig. 3. The computed tomography angiography at 3-month follow-up shows no evidence of endoleak in thoracic endovascular aortic repair and patency of abdominal aortic graft.

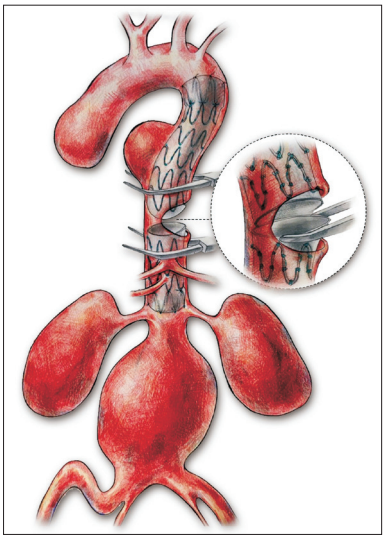

Fig. 4. The schematic diagram shows thoracic stent graft with gaps in between lying within the thoracic aortic aneurysm and the location of clamps.

for treating DTA [3]. Resembling to EVAR, incompetent proximal and distal landing zones are prevalent limiting factors for the implantation of thoracic stent grafts. If landing zones are not enough to deploy stent graft, important arteries, such as celiac and SMA can be covered because of operator's mistake or mislabeled stent graft just like in our case. Unintentional coverage of celiac trunk and SMA following stent graft implantation to treat DTA is the most terrible TEVAR complication and its treatment strategy is not well presented in the literature. Although the incidence is extremely rare, if not treated early, multiple organ failure can occur. Mesenteric ischemia and related complications caused by embolic event have been reported after TEVAR [4,5]. Mesenteric ischemia secondary to partial coverage of celiac trunk as possible cause for multiorgan failure for a single patient was reported in Grabenwöger et al. [4] series of TEVAR.

Sunder-Plassman and Orend [6] reported the possibility of covering the celiac trunk to extend distal landing zone in presence of collaterals from SMA for the treatment of distal type I endoleak after TEVAR. Mehta et al. [7] discussed coverage of the celiac trunk may be an acceptable endovascular approach in treating selected patients with DTA. As the extensive collateral circulation exists between celiac trunk and SMA, mesenteric ischemic symptoms rarely occur after covering the celiac trunk during TEVAR.

There are several operative methods in case of occlusion of both celiac trunk and SMA. First, removal of total stent graft and replacement with graft through open conversion can be considered. This is conventional open repair for DTA. It may cause long operating time, massive blood loss, and postoperative complications. Second, removal of oversized distal segment and putting additional endovascular stent graft is another option to solve unexpected situation. This is also a time consuming procedure, which is combined with open and endovascular technique. Third, cutting and pulling out technique with mini-thoracotomy can be considered. Its advantages are reducing the length of operative time through mini-thoracotomy, minimizing blood loss, and shortening bowel ischemic time. In addition, intra-operative angiography reveals precise measurement where and how long distal stent graft should be cut [6,7].

In our case, celiac trunk and SMA were accidentally occluded due to mislabeled thoracic stent graft. Emergent thoracotomy with cutting and pulling out technique for unexpected distal stent graft may be one of the possible rescue treatment to maintain visceral flow. The reason this technique can be put into practice is proximal component of Zenith TX2 thoracic stent graft is constructed of full-thickness woven polyester fabric sewn to self-expanding stainless steel with braided polyester and monofilament polypropylene suture. Unlike other stent graft, its segment is not connected by stainless steel. It makes possible to cut the polyester fabric and easily pull out distal segments of stent graft. With this rescue technique, we can preserve celiac trunk and SMA preventing multiorgan failure or mesenteric ischemia

In case of unintentional coverage of celiac trunk and SMA during deployment of stent graft, emergent thoracotomy with cutting and pulling out stent graft may be one of feasible rescue technique for saving operative time during TEVAR.

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