Extravascular Endoconduit for Compromised Access Route in Patients with Ruptured Thoracic Aortic Aneurysm

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Abstract

Some patients who undergo thoracic endovascular repair (TEVAR) for a thoracic aortic aneurysm have a compromised or unfavorable access route that requires additional intervention or another access route approach. We experienced a case involving an 80-year-old woman who developed a ruptured thoracic aortic aneurysm with an unfavorable access route characterized by a narrow external artery and severe atherosclerosis. She was severely frail due to a history of fractures and extensive intestinal resection for necrosis of the intestine. Although we planned to perform TEVAR following establishment of an internal endoconduit (IEC) of the common and external iliac arteries, the stent graft sheath did not pass IEC. We resolved the issue of the unfavorable access route with extravascular deployment of a stent graft following establishment of IEC (so-called extravascular endoconduit technique).

Keywords: Compromised access route, extravascular endoconduit, thoracic endovascular repair

INTRODUCTION

Thoracic endovascular repair (TEVAR) for the treatment of thoracic aortic aneurysms has gradually increased in recent years and is becoming a main treatment option, especially for descending aortic aneurysms. Some patients with thoracic aortic aneurysms have a compromised or unfavorable access route. Alternative techniques in such patients include the internal endoconduit (IEC) technique, abdominal aorta or common iliac artery approach through an open abdomen or retroperitoneal approach, transapical approach through a left minithoracotomy, and others.[1-4] In patients with a ruptured thoracic aortic aneurysm that requires expeditious maneuvers, an easy approach such as the IEC technique through the femoral artery may be favorable. However, we experienced a case in which the IEC technique for a ruptured thoracic aortic aneurysm could not resolve the issue of the patient’s compromised access route. We herein describe extravascular deployment of a stent graft following IEC (so-called extravascular endoconduit technique), which enabled TEVAR for a ruptured thoracic aortic aneurysm.

CASE REPORT

An 83-year-old woman with hypertension and diabetes mellitus was transferred to our hospital because of a ruptured thoracic aortic aneurysm and aortobronchial fistula. She had been treated for thoracic and lumbar vertebral fractures in the other hospital. She had also undergone bilateral femoral fracture repair. At 80 years of age, she had undergone jejunostomy and colostomy with extensive small intestinal resection for necrosis of the intestine caused by nonocclusive mesenteric ischemia, which required adjunct parenteral nutrition by a peripherally inserted central catheter. During the other hospitalization, she developed hemoptysis. Computed tomography angiography showed the ruptured proximal descending aortic aneurysm with a diameter of 75 mm (saccular type) and the aortobronchial fistula [Figure 1a]. The artery was severely atherosclerotic, and the external iliac arteries were small (diameter of 6.6 and 6.7 mm on the right and left side, respectively) [Figure 1b]. We planned TEVAR with a Conformable GORE® TAG® Thoracic Endoprosthesis (W. L. Gore and Associates Inc., Flagstaff, AZ, USA) following the IEC technique through the left femoral artery on an emergency basis because of the patient’s compromised access route.

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How to cite this article: Morisaki A, Etsuji S, Takashi M, Toshihiko S. Extravascular endoconduit for compromised access route in patients with ruptured thoracic aortic aneurysm. Indian J Vasc Endovasc Surg 2018;5:179-81.

Received: April, 2018. Accepted: May, 2018.
Intraoperative findings. (a) Fluoroscopic finding of the extravascular endoconduit. The solid arrow shows extravascular endoconduit, and the broken arrow shows the stent graft sheath that passed the endoconduit to the abdominal aorta. (b) Schema of extravascular endoconduit. (c) Direct repair of the left femoral artery to the extravascular endoconduit

Figure 1: Computed tomography angiography. (a) The solid arrow shows the proximal descending aortic aneurysm with saccular change. (b) Severe calcification and stenosis of the iliac artery

access route and severely frail condition. In the operation room, the patient developed shock caused by re-rupture of the thoracic aortic aneurysm. After improving her hemodynamics by massive blood transfusion, an IEC was established with a stent graft leg (PXL161007J + 161007J, GORE® EXCLUDER® AAA Endoprosthesis; W. L. Gore and Associates Inc.) from the left common iliac artery to external iliac artery through the left femoral artery with advancement of the stent graft sheath. After repeated 10-mm balloon dilatation, however, a 22 French GORE® DrySeal Sheath (W. L. Gore and Associates Inc.) could not be passed through the left external iliac artery because it became stuck in the distal end of IEC due to severe calcification. Additional balloon dilatation of the distal IEC may have led to rupture of the external iliac artery between the distal end of IEC and the native external iliac artery without coverage by the stent graft. Therefore, we deployed the stent graft leg (PXC121200J, GORE® EXCLUDER® AAA Endoprosthesis; W. L. Gore and Associates Inc.) outside the vessels from the left femoral artery following IEC [Figure 2a and b]. Repeated 10-mm balloon dilatation provided good dilatation of the stent graft leg from the common iliac artery to the femoral artery without bleeding. We could then advance the sheath through the extravascular endoconduit, tie the distal end of the endoconduit to prevent bleeding, and advance the stent graft through the sheath to the thoracic aorta. Deployment of the Conformable GORE® TAG® Thoracic Endoprosthesis (TGU282810J) in the descending aorta was followed by deployment of a TGU343410J from the left subclavian artery to the descending aorta because of the difference in the diameters of the aortic arch and descending aorta. After TEVAR, the stent graft covered the ruptured thoracic aneurysm completely without endoleakage. The left femoral artery was repaired with direct anastomosis to extravascular endoconduit adjusted the length [Figure 2c]. The day after the operation, she developed acute left lower limb ischemia due to occlusion of the left femoral artery. We performed femorofemoral artery bypass to improve the blood flow of the left lower limb. Although the lower limb ischemia did not thereafter significantly aggravate her condition, she needed intensive care for disseminated coagulopathy, acute renal failure, liver failure, and respiratory failure caused by the ruptured thoracic aortic aneurysm and thromboembolic events based on the severe aortic atherosclerosis. On postoperative day 30, she died of multorgan failure caused by sepsis associated with the aortobronchial fistula and severe conditions of her previous medical history.

**DISCUSSION**

Approximately 9%–21% of patients undergoing TEVAR for thoracic aortic aneurysms have a compromised or unfavorable access route.[6] An iliac conduit through a retroperitoneal or open abdominal approach is commonly used. However, some adverse events associated with this technique include retroperitoneal bleeding, iliac artery injury, and others.[2,3,5] A novel IEC technique was recently reported by Peterson and Matsumura.[1] van Bogerijen et al.[2] reported that the IEC technique had lower rates of early mortality and late iliofemoral complications than an open iliac conduit in patients with an unfavorable access route. Moreover, the IEC technique can reduce the time required to advance the stent graft by permitting the femoral artery approach compared with the use of an open iliac conduit; this may be significantly beneficial for rupture thoracic aneurysm repair. In the present case, however, it was difficult to advance the stent graft sheath to the abdominal aorta because it became stuck in the distal end of IEC due to insufficient dilatation caused by severe atherosclerosis. Moreover, a forceful maneuver with repeated balloon dilatation may lead to rupture between the distal end of IEC and native external iliac artery without coverage by a stent graft. Therefore, we performed extravascular deployment of the stent graft leg following the IEC technique, which enabled advancement of the stent graft sheath to the abdominal aorta.

The extravascular endoconduit technique may have some disadvantages that require an additional surgical intervention. In the present case, the femoral artery was repaired with direct anastomosis of the stent graft leg deployed outside the artery. However, the repaired femoral artery was occluded because of severe atherosclerosis of the native artery, and the hard stent of
the stent graft led to an unfavorable fit between the native artery and stent graft, inducing technical difficulty. Therefore, direct anastomosis using another stent graft with a flexible stent, such as the GORE® VIABAHN® (W. L. Gore and Associates Inc.), or femorofemoral artery bypass grafting may help to prevent arterial occlusion. Furthermore, closing of the internal iliac artery associated with claudication and intestinal ischemia has been reported in some cases.\(^2\) Although we covered the internal iliac artery with the stent graft because of stenosis of the common iliac artery in the present case, uncovering the internal iliac artery may help to prevent pelvic ischemia.

**Conclusion**

The extravascular endoconduit technique may be an alternative approach for a ruptured thoracic aorta, especially when the IEC technique cannot resolve an unfavorable or compromised access route.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

**Acknowledgment**

We thank Angela Morben, DVM, ELS, from Edanz Group (www.edanzediting.com/ac), for editing a draft of this manuscript.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

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