Korean J Thorac Cardiovasc Surg 2011;44:427-431 □ Case Report □
ISSN: 2233-601X (Print) ISSN: 2093-6516 (Online) http://dx.doi.org/10.5090/kjtcs.2011.44.6.427

Thoracic Endovascular Repair for Complicated Type B Acute Aortic Dissection with Distal Malperfusion

Suk Jung Choo, M.D.*, Sung Ho Jung, M.D.**, Ji Eon Kim, M.D.*, Juyong Lim, M.D.*, Min Ho Ju, M.D.*

Successful thoracic endovascular repair for complicated Stanford type B acute aortic dissection in two patients is herein reported. The true lumen flow was immediately restored following stent graft deployment in the descending thoracic aorta with subsequent resolution of the distal malperfusion syndrome. One patient is doing well more than 15 months after surgery and another patient who was treated more recently is also doing well 7 months postoperatively.

Key words: 1. Aortic dissection
2. Endovascular stent

CASE REPORT

1) Case 1

A 56-year-old male patient with abdominal pain beginning 6 hours earlier was transferred after he was diagnosed with acute aortic dissection. Apart from leukocytosis, the laboratory findings were unremarkable. The patient exhibited clinical signs compatible with evolving visceral and lower body ischemia evidenced by unremitting abdominal pain, gaseous distention, and diffuse bowel ileus on plain abdomen radiography. The left femoral and dorsalis pedis arterial pulsations were weak with progressive ischemic discoloration of the corresponding leg. Aortic dissection computed tomography (ADCT) showed a Stanford type B aortic dissection starting just distally to the left subclavian artery and extending to the terminal aorta. The pressurized false lumen encroached on the central true lumen of the aorta, and the celiac axis and superior mesenteric artery true lumen were also compressed by the thrombosed false lumen (Fig. 1). An emergency thoracic endovascular aortic repair (TEVAR) procedure was subsequently performed, for an evolving visceral malperfusion syndrome, to close the proximal entry site, relieve the aortic false lumen pressure, and reestablish central true lumen flow. Single-vessel, two-point wire insertion was performed through the femoral artery. A 13 cm 34～30 mm tapered covered stent graft constructed over a nitinol (Ni+Ti) framework (S&G Biotech Inc, Seoul, Korea) was deployed to obliterate the proximal entry site that was just distal to the left subclavian artery. Immediate intraoperative postprocedural aortography showed restoration of central true lumen flow and enhanced flow to the visceral vessels. On postoperative day #2 (POD #2), the patient complained of transient intermittent abdominal pain attributed to acalculous cholecystitis for which cholecystectomy was performed uneventfully. Prior to dis-

*Department of Thoracic and Cardiovascular Surgery, Seoul Asan Hospital, University of Ulsan College of Medicine
**Division of Pediatric Cardiac Surgery, Department of Thoracic and Cardiovascular Surgery, Seoul Asan Hospital, University of Ulsan College of Medicine
Received: February 18, 2011, Revised: August 6, 2011, Accepted: August 24, 2011
Corresponding author: Suk Jung Choo, Department of Thoracic and Cardiovascular Sugery, Seoul Asan Hospital, University of Ulsan College of Medicine, 126-23, Pungnap-dong, Songpa-gu, Seoul 138-736, Korea
(Tel) 82-2-3010-3954 (Fax) 82-2-3010-6966 (E-mail) sjchoo@amc.seoul.kr

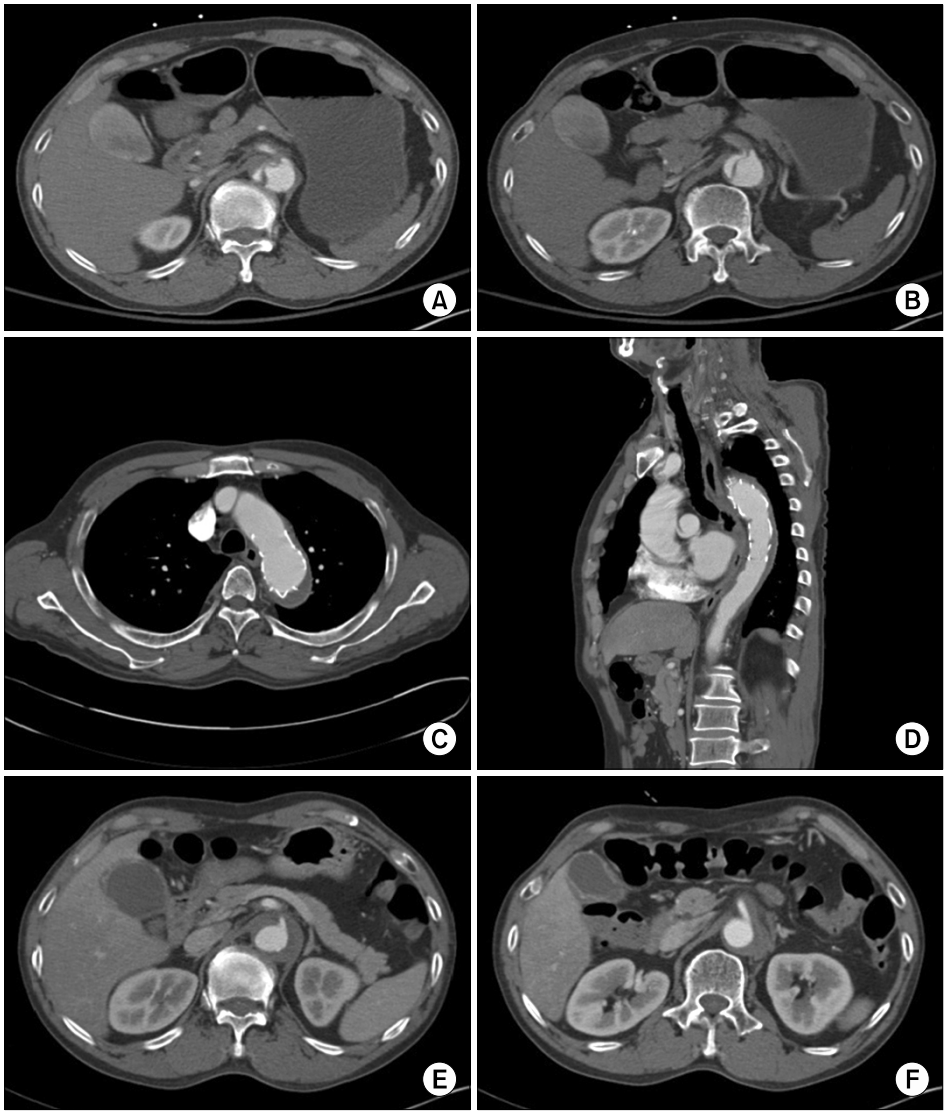

Fig. 1. Case 1, pre- and post-operative aortic dissection computed tomography (ADCT) scan. Note (A) the true lumen collapse and obstructive false lumen thrombosis near the celiac os. The aortic true lumen is larger at the superior mesenteric artery (SMA) level, but (B) the thrombosed false lumen is causing the SMA flow obstruction. The (C) axial and (D) sagittal sections of the successfully deployed stent graft in the proximal descending thoracic aorta can be seen. Postoperative ADCT scan shows enlargement of aortic true lumen with (E) celiac and (F) SMA true lumen enlargement.

charge, a follow up ADCT showed the TEVAR procedure was successful by indicating an enlargement of the aortic and visceral true lumen size, thrombosis of the aortic false lumen, absence of bowel ischemia, and apparent restoration of the lower extremity flow (Fig. 1). No endo-leakage of any subtype was detected. After an uneventful postoperative course the patient was discharged and is doing well 15 months postoperatively.

2) Case 2

A 59-year-old female patient presented with chest and diffuse abdominal pain beginning 1 day prior to admission, with an elevated systolic blood pressure of 170 mmHg. On the right side a 100 mmHg systolic pressure differential was noted between the upper and lower extremities while on the left side the pressure in the lower extremity was undetectable and that in the upper extremity was 179/73. The patient's history was remarkable for chronic long-standing hypertension. Laboratory findings showed mild leukocytosis of 12,500 cells/uL, a creatine (Cr) level of 2.7 mg/dL, and estimated GFR (eGFR) of 18 mL/min with progressively worsening oliguria. At the time, the clinical diagnosis of visceral malperfusion was not clear due to the absence of lactic acidosis, metabolic acidosis, and abdominal distention or tenderness. However, the ADCT revealed a pressurized aortic false lumen causing a slit-like compression of the true lumen at the level

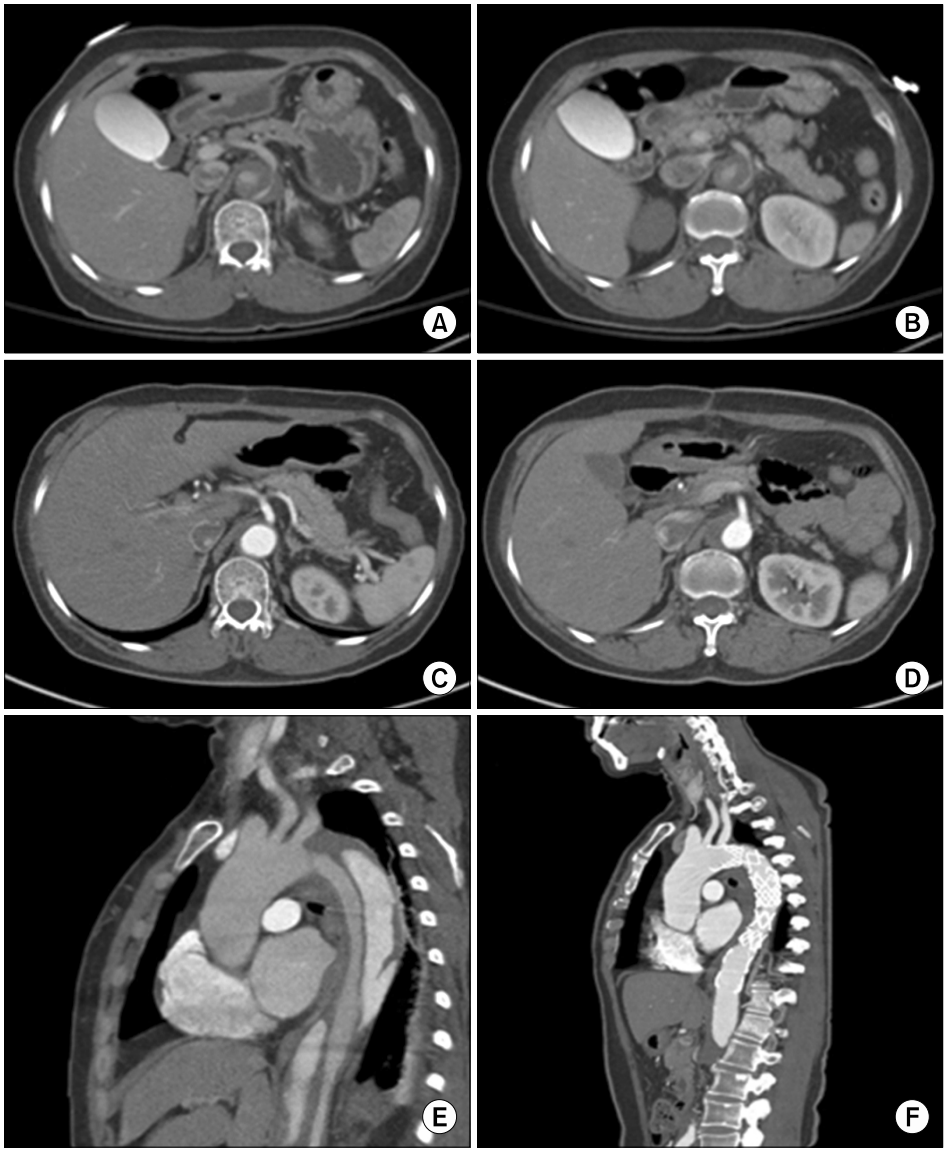

Fig. 2. Case 2, pre- and late post-operative aortic dissection computed tomography (ADCT) scan. Note the collapsed slit-like aortic true lumen at the (A) celiac and (B) superior mesenteric artery (SMA) levels. The follow up ADCT scan shows a significantly restored true lumen of the central aorta at the (C) celiac and (D) SMA levels. The sagittal view (F) shows excellent remodeling of the descending aorta with complete obliteration of the false lumen and near normalized restoration of the true lumen.

of the visceral branch vessel origins. The abdominal aorta showed a near total collapse of the central true lumen (Fig. 2). The dissection revealed a complex lesion with multiply dissected false lumen in the thoracic aorta, which suggested the aortic wall to be extremely friable. Therefore, performing a TEVAR procedure in this situation was judged as having a high risk of causing major adverse aorta-related events. Accordingly, a right axillo-femoro-femoral bypass operation was initially performed in an attempt to bypass the stenotic distal abdominal aorta. Apart from an exploratory reoperation of the axillary cannulation incision site to control bleeding, the immediate postoperative course was uneventful with apparent resolution of the ARF and peripheral perfusion. However, on the second postoperative day, the patient again developed signs of lower body ischemia, abdominal tenderness and ileus, abdominal girth enlargement, and worsening oliguria. With no further recourse, TEVAR was performed using a 15 cm and 13 cm covered 30 mm stent grafts (SEAL thoracic limb stent grafts, S&G Biotech, Seoul, Korea). Although the proximal entry site appeared to be occluded by the 15 cm stent graft, which was initially deployed, the immediate post-procedural angiogram showed only a marginal increase in the true lumen size and equivocal improvement in the visceral vessel perfusion. Therefore, to close suspecting another

major reentry site distal to the first stent graft, a second overlapping 13 cm stent graft was deployed. The postprocedural follow up aortogram showed the second graft deployment successfully induced a significantly greater enlargement in the aortic true lumen and allowed for brisk visceral flow. Late follow up ADCT showed excellent remodeling of the aorta with excellent restoration of the central aortic true lumen and visceral artery patency (Fig. 2). Although the right renal artery appeared to be occluded, the left kidney showed excellent dye enhancement without the need forpostoperative hemodialysis. The patient is currently in normal postoperative recovery and doing well 7 months postoperatively.

DISCUSSION

Open surgery and TEVAR remain the mainstay of life-saving treatment options for complicated acute type B aortic dissection [1,2]. Both methods pose a formidable challenge due to the high risk of complications and mortality rates in diagnosed patients [1-3]. The success of each approach depends on the ability to restore end organ perfusion prior to establishment of irreversible ischemic damage [4]. Therefore, TEVAR's speed and less invasive nature is particularly advantageous and well-suited to treating these patients [2,5]. Fenestration and branched stent grafting may be viewed as alternatives to TEVAR [6]. However, branched stent grafting in particular is technically challenging and is currently not widely available. Furthermore, there has been no prospective randomized study to show it to be unequivocally superior to TEVAR or fenestration. With regard to fenestration, TEVAR may be considered the more physiologic and durable treatment, as it is aimed to induce false lumen obliteration and increase true lumen patency, whereas the objective of fenestration is only to decompress the false lumen while actually preserving the false lumen patency itself.

In the present report, both cases presented with evolving ischemia requiring urgent revascularization. In case 1, visceral malperfusion was caused by dissection and central true lumen collapse at the level of the visceral branch vessel origins with thrombus formation of the SMA and celiac artery. Stenting of the proximal entry site resulted in false lumen decompression with redirection of flow into the aortic and visceral arterial true lumina (Fig. 2). In case 2, the lesion presenting as a complex dissection showing a second dissection within the false lumen suggested the aortic wall to be extremely friable and increased in risk for procedure-related adverse aorta-related events including rupture. Therefore, an axillo-femoro femoral bypass operation was initially performed. Athough the surgery was successful, the bypass procedure eventually failed to relieve the true lumen compression and resulted in subsequent progression of visceral and renal ischemia. As a result, TEVAR was then performed, successfully occluding the dissection entry site in the proximal descending thoracic aorta. The blood flow was redirected to the central true lumen and the false lumen was greatly decompressed. The clinical syndromes presented by the two cases in this report were ideal candidates for TEVAR treatment. Had TEVAR not been an available treatment option, then further prolongation of ischemia would have occurred until the true lumen flow could be surgically reestablished through open repair, which would have been an unavoidably long period with the increased risk of irreversible organ damage. Therefore, despite the limitations of being a case study, the present report anecdotally exemplified the usefulness of employing aortic stenting as the first line of treatment for acute type B aortic dissection complicated by distal malperfusion. Although the long term benefits of TEVAR for type B acute aortic dissection remain unproven, the relatively low morbidity rate and rapid nature of the TEVAR procedure appears to support it as a promising treatment for complicated acute type B dissections [2,5]. A caveat for situations where the stent cannot be anchored to normal non-dissected tissue is that stent deployment to the friable intima may cause new tearing and retrograde type A dissection, even if the landing zone is not dissected. Therefore, regarding these difficult situations, further studies are warranted to better guide an optimal treatment decision.

REFERENCES

1. Crawford ES, Svensson LG, Coselli JS, Safi HJ, Hess KR. *Aortic dissection and dissecting aortic aneurysms.* Ann Surg 1988;208:254-73.
2. Dake MD, Kato N, Mitchell RS, et al. *Endovascular stent-graft placement for the treatment of acute aortic dissection.* N Engl J Med 1999;340:1546-52.

3. Miller DC, Mitchell RS, Oyer PE, Stinson EB, Jamieson SW, Shumway NE. *Independent determinants of operative mortality for patients with aortic dissections.* Circulation 1984;70:I153-64.
4. Uchida N, Shibamura H, Katayama A, Aishin K, Sutoh M, Kuraoka M. *Surgical strategies for organ malperfusions in acute type B aortic dissection.* Interact Cardiovasc Thorac Surg 2009;8:75-8.
5. Parsa CJ, Schroder JN, Daneshmand MA, McCann RL, Hughes GC. *Midterm results for endovascular repair of complicated acute and chronic type B aortic dissection.* Ann Thorac Surg 2010;89:97-102.
6. Clair DG. *Aortic dissection with branch vessel occlusion: percutaneous treatment with fenestration and stenting.* Semin Vasc Surg 2002;15:116-21.