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Case Report

Hybrid Repair of Suprarenal Abdominal Aortic Aneurysm: Antegrade Debranching with Endovascular Aneurysm Repair

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We report a hybrid repair approach to the treatment of abdominal aortic aneurysm in patients with complex anatomies when typical endovascular aneurysm repair is limited due to juxtarenal involvement. A 63-year-old man presented with a 3-day history of fever and abdominal pain. He was diagnosed with acute cholecystitis along with incidental findings of two separate aneurysms of the abdominal aorta: a 3.7 cm saccular aneurysm at the suprarenal level, and a 6.6 cm fusiform aneurysm above the iliac bifurcation. He was treated with a hybrid technique involving an open approach for antegrade debranching of the superior mesenteric artery, and renal arteries and endovascular stent placement for treatment of an abdominal aortic aneurysm. The procedure was successfully completed with no adverse events as of the most recent 6-month outpatient follow-up.

Key Words: Hybrid endovascular repair, Abdominal aortic aneurysm, Visceral debranching

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INTRODUCTION

We present a case involving a 63-year-old man with two separate aneurysms: a 3.7 cm saccular aneurysm at the suprarenal level, and a 6.6 cm fusiform aneurysm above the iliac bifurcation. Both aneurysms were repaired using a hybrid technique involving an open approach for antegrade debranching of the superior mesenteric artery (SMA), and renal arteries and an endovascular stent placement for treatment of an abdominal aortic aneurysm (AAA).

CASE

A 63-year-old man with a history of hypertension presented to our emergency department with a 3-day history of a high fever (39°C) and abdominal pain. Initial laboratory results and computed tomography (CT) images suggested the presence of acute cholecystitis with a perforated gallbladder, which was initially treated with percutaneous drainage of the gallbladder and administration of intravenous antibiotics. However, the CT images also revealed a complex AAA comprising two separate aneurysms: a 3.7 cm saccular aneurysm at the suprarenal level, and a 6.6 cm fusiform aneurysm above the iliac bifurcation. The suprarenal aneurysm began at the level of the SMA, and exhibited a saccular shape, protruding from behind the right renal artery (Fig. 1). The maximum diameter measured 3.7 cm, and the aneurysm showed partial involvement of the right renal artery. The distal flow of these arteries and each of their corresponding organ perfusions remained intact.

The second aneurysm was an infrarenal dumbbell-shaped fusiform aneurysm starting 4.8 cm inferior to the level of the renal artery (Fig. 2). The superior dumbbell

Fig. 1. (A) The protruding saccular aneurysm and its relationship to the renal arteries. (B) The sac protrudes just behind the right renal artery (arrow).

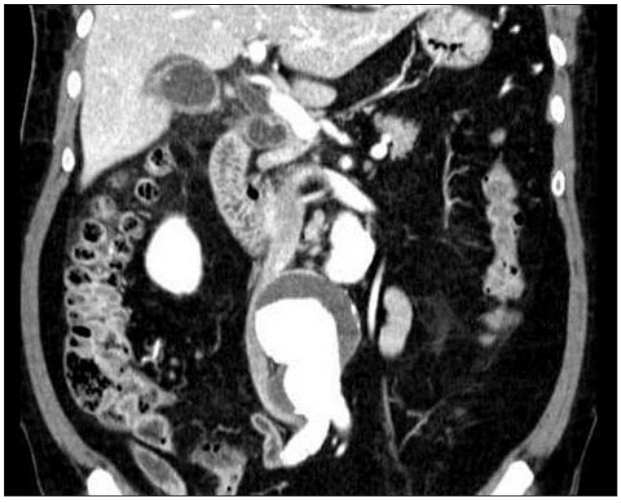

Fig. 2. The fusiform aneurysm had a dumbell shape. This computed tomography image also shows gall bladder wall thickening consistent with acute cholecystitis.

portion was the larger of the two, and was 6.6 cm in maximum diameter. The inferior dumbbell measured 5.2 cm in maximum diameter. The aneurysm did not involve the common iliac arteries, and extended just above the iliac bifurcation.

Endovascular aneurysm repair (EVAR) was not considered a first treatment option because of the unfavorable anatomy of the proximal neck. Instead, we utilized a hybrid technique in which an open approach was used to clear the main branching arteries adjacent to the first aneurysm, followed by correction of the remaining aneurysms with an endovascular stent covering both aneurysms (Fig. 3).

For the antegrade debranching method, we used a bifurcated Dacron Y-graft to reconstruct the vasculature. Using a midline incision, sufficient aortic exposure was achieved by dissecting the diaphragmatic crura, and creating downward traction on the thoracic aorta. After proximal and distal (infrarenal) clamping, proximal end-to-side anastomosis was performed on the supraceliac aorta on the anterior surface. A smooth take-off angle was ensured when performing the proximal anastomosis. The graft was positioned retropancreatically, and the distal anastomoses involved the SMA and renal arteries. The left limb was anastomosed in an end-to-end fashion to the SMA, and the right limb was simultaneously anastomosed to both renal arteries; the right renal artery in an end-to-side fashion, and the left renal artery in an end-to-end fashion.

After completion of the antegrade debranching technique and closure of the midline incision, endovascular stenting was performed in the traditional manner. The stent was deployed just below the celiac axis to the common iliac arteries, covering both the saccular and fusiform aneurysms. After stent deployment, a final angiographic examination was performed to confirm the distal flow of the graft segment and to ensure that there were no endoleaks. The final angiographic images confirmed patent vessels (Fig. 4) and no endoleaks.

The surgery lasted 10 hours and 20 minutes, including anesthesia and application of intraoperative monitoring devices. Aorta clamping was performed 2 hours into the surgery, and the total clamping time was 67 minutes. The open approach lasted 360 minutes, including abdominal wall closure, and the EVAR procedure lasted 200 minutes. Estimated blood loss was 2,700 mL, and intraoperative transfusions were performed with 5 units of red blood cells and 2 units of fresh frozen plasma. After the surgery, the patient was admitted to the intensive care unit for close monitoring, where he stayed overnight. The next day, he was transferred to the general ward and was discharged on postoperative day 14. Antiplatelets (aspirin, clopidogrel) were administered as soon as the patient could take oral medication. After confirmation of total recovery from surgery, the patient underwent elective laparoscopic cholecystectomy 3 months after the procedure. The patient is

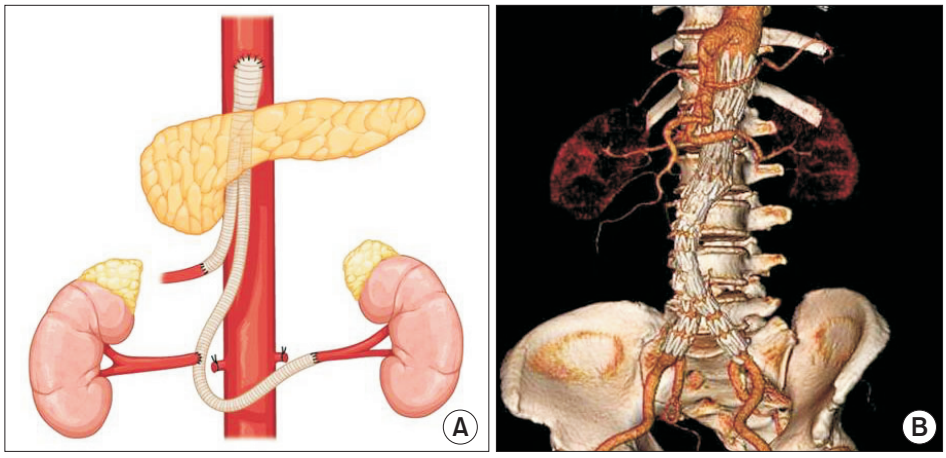

Fig. 3. (A) Diagram showing the debranching technique. (B) Follow-up computed tomography three-dimensional computed tomography reconstruction of the hybrid graft repair. There is patent flow to the superior mesenteric artery and both renal arteries.

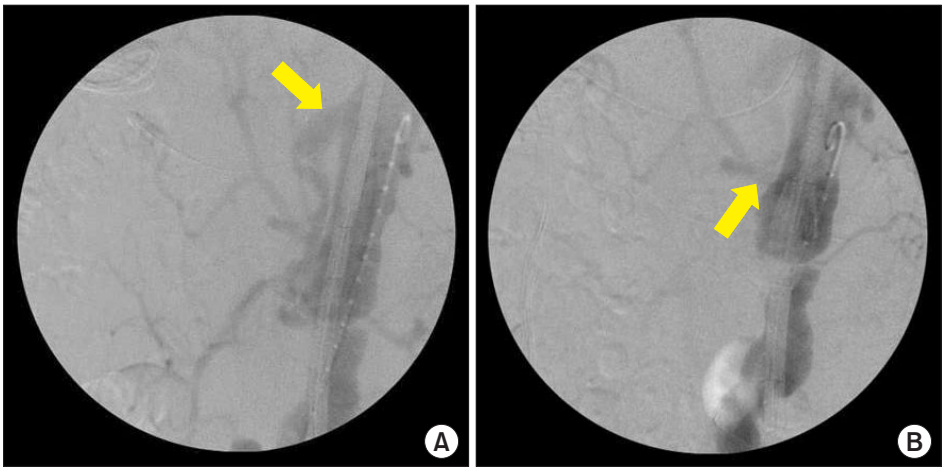

Fig. 4. Final angiography images comfirming the patent flow of the antegrade graft (A, arrow) and celiac trunk (B, arrow).

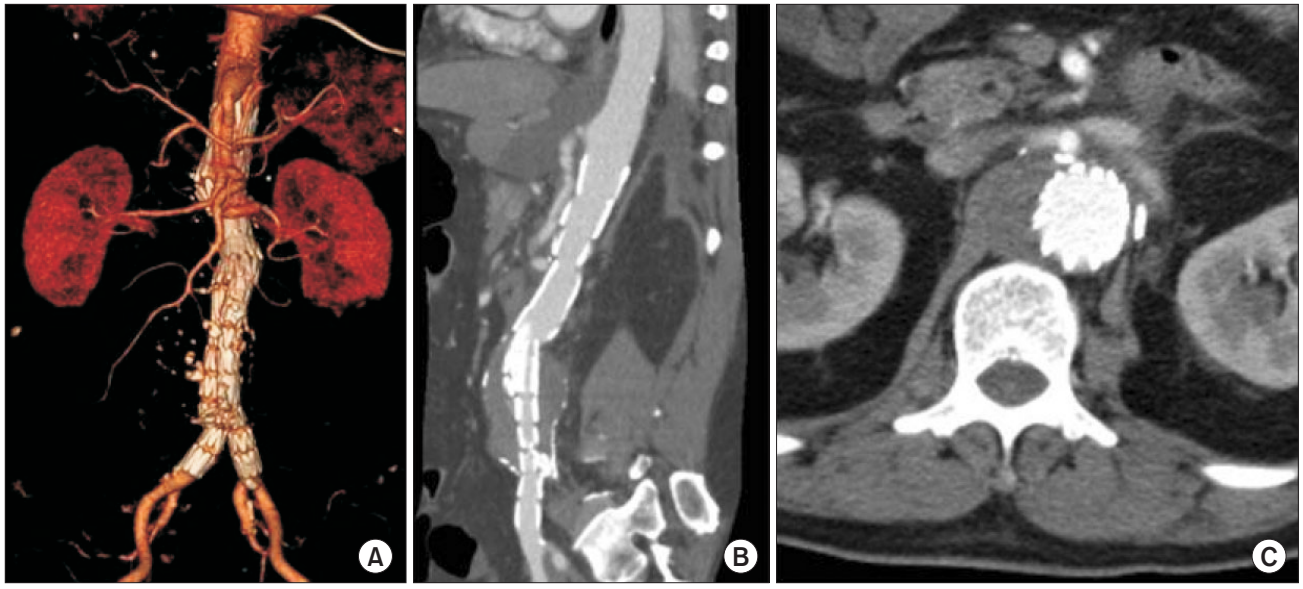

Fig. 5. Follow-up 6 month computed tomography image shows a patent graft (A). The fusiform aneurysm (B) and the saccular aneurysm (C) are shown.

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currently alive and well, and most recently had his 6-month follow-up visit. CT images at the 6-month follow-up (Fig. 5) showed patency in the debranched graft, no change in the saccular aneurysm, and regression of the fusiform aneurysm to 5.7 cm (from 6.4 cm).

DISCUSSION

EVAR has gained popularity over the years for treatment of AAA. Appropriate fixation and sealing in the proximal neck is one of the key factors for ensuring a successful procedure. Despite advancements in devices such as fenestrated EVAR or chimney EVAR, in the case of complex aneurysms with a hostile neck, open repair still remains the gold standard for the treatment of AAAs.

There are several cases of various hybrid techniques utilizing debranching techniques for patients with thoracoabdominal aneurysms (TAAs), who have aneurysms extending to the visceral and/or renal arteries [1-3]. However, these options were mainly used because the patients were at high risk for open repair due to either their underlying comorbidity and/or previous surgeries; thus, their endpoints were relatively different than patients with AAAs.

In our case, there are some considerations on deciding a specific approach. The main focus of our treatment was to maintain relatively minimal invasiveness while giving optimal EVAR results. While the traditional open approach might have obtained total sequestration of the aneurysm along with a potentially longer disease free survival, additional risks of post-operative complications due to extensive surgery were also to be considered. On the other hand, hybrid repair would ideally be beneficial due to the relative minimal invasiveness. However, an endovascular approach is required to conceal the aneurysm, thus the risks of endoleaks and sac enlargement are still at hand after a successful procedure, and may lead to additional re-interventions or in turn, an open surgery.

When planning the debranching method, the conventional retrograde debranching methods used in hybrid TAA repair would require additional dissection of the donor anastomosis site; either the iliac arteries or the infrarenal aorta [4]. Because the patient had another aneurysm in the infrarenal aorta, retrograde debranching would not have been beneficial in terms of invasiveness compared to conventional open repair due to additional dissection of the iliac arteries. With this in mind, we decided to opt for the hybrid approach with antegrade debranching method due to the added benefits of minimal invasiveness regardless of the fact that in retrospect the total surgery lasted over 10 hours.

The potential complications of hybrid repair are the collective sum of both the open and endovascular approaches. Graft patency of the debranching limbs, infection, endoleaks, and non-rupture survival are some of the main issues. Although there are no direct results comparing the patency of the antegrade approach, in the case of hybrid repair of TAAs, patency remained relatively good [5]. Continued regular follow-ups will indicate if there are any problems associated with this procedure.

We applied a hybrid technique to a difficult anatomical case of AAA. The patient was a 63-year-old male with two separate aneurysms: a 3.7 cm saccular aneurysm at the renal artery level, and a 6.6cm fusiform aneurysm above the iliac bifurcation. He was treated with an open approach for antegrade debranching of the SMA and renal arteries, and an endovascular stent placement for AAA treatment. Although this case report presents a single clinical situation, the hybrid approach shows a way to overcome the anatomical limitation barriers of EVAR, while being less invasive than conventional open AAA repair surgery.

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