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CASE REPORT

Surgeon Modified Fenestrated Endovascular Abdominal Aortic Repair (F-EVAR) for Subacute Multifocal Mycotic Abdominal and Iliac Artery Saccular Aneurysms

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Introduction: Endovascular repair of suprarenal abdominal aortic aneurysms (AAAs) requires customized fenestrated stent grafts when they involve visceral vessels such as the renal (clinically ignored here in this specific scenario), celiac, and superior mesenteric arteries.
Report: On table fenestrated endovascular abdominal aortic aneurysm repair (F-EVAR), using a parallel endograft approach, was performed for enlarging saccular subacute mycotic suprarenal and left common iliac artery aneurysms in a 58 year old man with recent methicillin sensitive *Staphylococcus aureus* (MSSA) bacteremia, who was high risk for open surgical repair. Fenestrations were performed for the coeliac artery (CA) and superior mesenteric artery (SMA) using a Bovie® (Clearwater, FL, USA) cautery device. The initial procedure was complicated by a type II endoleak that resolved spontaneously within 6 months of surgery. The patient remained well on follow up a year post surgery.
Conclusion: On table surgeon modified F-EVAR is a safe and viable option for patients with subacute suprarenal mycotic abdominal aneurysms.

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INTRODUCTION

Multifocal saccular mycotic aortic aneurysms are an anatomical high risk for open repair.[1] Endovascular repair is an alternative option but requires fenestrated stent grafts in the case of suprarenal aneurysms. The time needed for factory customization can make this option impractical. The aim was to show that on table surgeon modified F-EVAR is a feasible solution when customized endografts are not readily available or practical.

REPORT

A 58 year old man with a past medical history of diabetes mellitus, dyslipidemia, ischemic heart disease post coronary artery bypass graft in 2007, end stage renal failure on dialysis, previous hepatic abscess 2005, previous retropharyngeal abscess with methicillin sensitive *Staphylococcus aureus* (MSSA) bacteremia 2012 and peripheral vascular disease status post left below knee amputation represented with MSSA bacteremia in September 2014. Despite his comorbidities, he worked in an office and was pre-morbidly ambulant with a prosthetic limb.

A diagnostic computed tomography (CT) scan of the thorax, abdomen, and pelvis showed new saccular mycotic aneurysms in the suprarenal abdominal aorta and proximal left common iliac artery that persisted and increased in size on follow up CT angiogram (CTA) in November 2014 (Fig. 1). Owing to the significant risk of possible aneurysm rupture, early elective on table surgeon modified F-EVAR was planned, as obtaining a factory customized aortic stent would take 3 months.

F-EVAR was performed in December 2014, 20 days after CTA diagnosis in a hybrid OR equipped with a flexible C-arm (Siemens Artis Zeego, Camberley, UK).

On the back table, a straight thoracic aortic covered stent graft (Zenith ZTEG 2p 26 134, Cook® Medical Aortic Intervention, Bloomington, IN, USA) was partially deployed until the first three stent-lines were unsheathed. The exact positions of the CA and SMA origins, based on prior CT measurements taken from the standard PACS workstation, were

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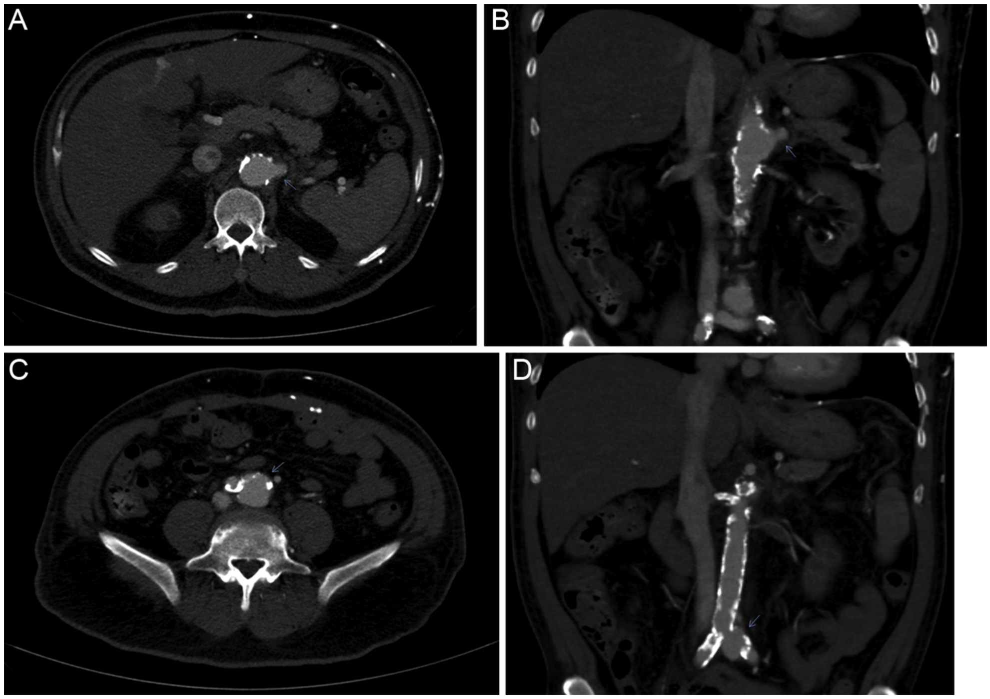

Figure 1. (A) Suprarenal abdominal aortic aneurysm measuring 1.3 × 0.9 cm (axial). (B) Suprarenal abdominal aortic aneurysm measuring 1.3 × 0.9 cm (coronal). (C) Left proximal iliac artery aneurysm measuring 2.6 × 1.3 cm (axial). (D) Left proximal iliac artery aneurysm measuring 2.6 × 1.3 cm (coronal).

marked on the graft. Fenestrations (8 mm wide) were created at the 12 o'clock position accordingly with a Bovie® cautery device. Each fenestration was lined with the soft nitinol end of a Command 0.014 inch wire (Abbott Vascular, Abbott Park, IL, USA) secured by prolene 7/0 sutures. The graft was then resheathed (Fig. 2). The process took 30 minutes.

F-EVAR was performed under general anesthesia via bilateral open common femoral artery (CFA) access with systemic heparinization. With the angiographic aid of a descending thoracic aortic pigtail catheter introduced via percutaneous left brachial artery access, the fenestrated graft was introduced through the right CFA. The vertical position and rotational anatomy of the fenestrations were confirmed on angiography. The graft was then partially deployed.

Using a larger 14F sheath via the left CFA which was free, the CA and SMA were sequentially cannulated with Terumo 0.035 inch wires over Van Schie Beacon® 3 catheters (Cook, Bloomington, IN, USA), which were then exchanged for stiff Rosen wires (Cook) followed by 7F Flexor® Ansel guiding sheaths (Cook). Atrium 7 mm × 22 mm and 9 mm × 38 mm covered stents were then deployed through the sheaths and respectively flared out (Fig. 3).

The fenestrated stent graft was then fully unsheathed. Another endograft (Cook® Aortic 28 mm × 80 mm) introduced via the right CFA was deployed inferiorly as far as the aortic bifurcation and unsheathed. Bilateral CIA Atrium stents (16 mm × 61 mm on the right and 12 mm × 61 mm on the left) were deployed using a parallel endograft approach (Fig. 4). The aortic body was balloon molded after each deployment. Final check angiography revealed type II endoleaks arising from the suprarenal aorta and left CIA (left lumbar and median sacral branches respectively). Both CFAs were closed primarily, and the brachial sheath removed with manual compression hemostasis.

The patient received 48 hours of intravenous cefazolin post-operatively and was monitored clinically for any infection. He was discharged well on the fifth post-operative day. Both endoleaks had resolved on 6 month follow up CTA.

DISCUSSION

Complex aortic pathologies remain a challenge for suitable endovascular repair without compromising visceral perfusion.[2] The largest series of surgeon modified F-EVAR for aortic disease including acute cases showed less perioperative morbidity and mortality compared to open repair. In the study, 27% had evidence of endoleak on outpatient follow up, of which 70% were type II.[3]

In vivo laser fenestration has been described in the literature but this was not considered due to non-availability of the laser catheter and appropriate sheath.[4] Access to the Ovation device (Trivascular, Inc., Santa Rosa, USA), a low profile stent that may be considered for use with a chimney graft technique (ChEVAR), was also not available.

ChEVAR is an option that has been recommended for patients who are high risk for open repair and in the emergent setting. This was considered for treating the AAA, but due to the SMA and CA arising from the same clock position, and the SMA arising from the pseudoaneurysm, it

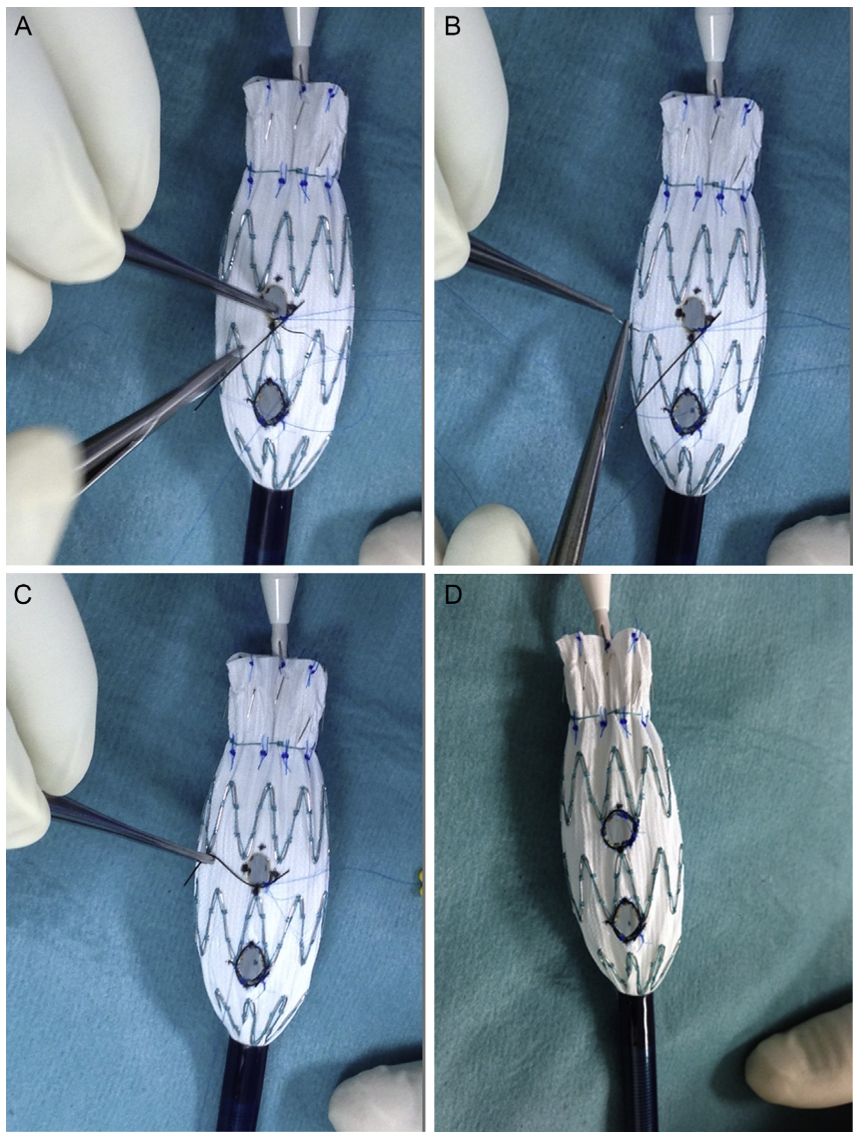

Figure 2. (A,B) Rimming the fenestrations by securing a 0.014 inch soft Command wire (Abbott Vascular) end with prolene 7/0 suture. (C) Molding the wire along the circumference of the fenestration. (D) Wire reinforced fenestrations 8 mm wide 17 mm apart at the 12 o'clock position made on a partially deployed Cook thoracic stent graft based on accurate CT measurements.

Figure 3. (A) Initial angiogram showing the suprarenal abdominal aortic aneurysm. (B) Oblique angiogram confirming the rotational anatomy of the celiac artery and SMA fenestrations in relation to the deployed stents. (C) Contrast CT with CA and SMA stents in situ (sagittal view).

was felt that this was not feasible as an adequate seal may not have been achieved. This procedure is also marred by increased type 1a endoleaks due to limitations in fixation and seal and the creation of "gutters," delayed chimney stent thrombosis, and overall increased adverse events.[5] It is thus the authors' opinion that this be reserved for patients without FEVAR options.[6] Suprarenal aneurysms create an added challenge to on table fenestration due to the proximity of the CA, SMA and renal arteries. The use of wire exchange through Van Schie catheters helped to mitigate this. As the patient was already dialysis dependent, it was decided to occlude the renal arteries with the stent graft. In a non-dialysis patient, renal artery patency would need to be preserved. Wire cannulation of the desired aortic branches may also lead to dissection or thrombus formation. Visceral branch stent stenosis will also affect morbidity in the long term. A meta-analysis of FEVAR reported overall target vessel perfusion rates from 90.5 to 100%.[7] A single center study showed 88.6% patency at 4 years, which was better with the use of covered stents.[8]

This patient had previously completed 6 weeks of intravenous cefazolin for his MSSA bacteremia. Hence, perioperatively he was given the usual prophylactic dose of intravenous cefazolin on table which was continued for 48 hours post-operatively. The graft was not soaked in antibiotic solution as it was only partially unsheathed and there is no clear benefit of rifampicin soaking. The potential risk of prosthetic stent infection was explicitly discussed with him.

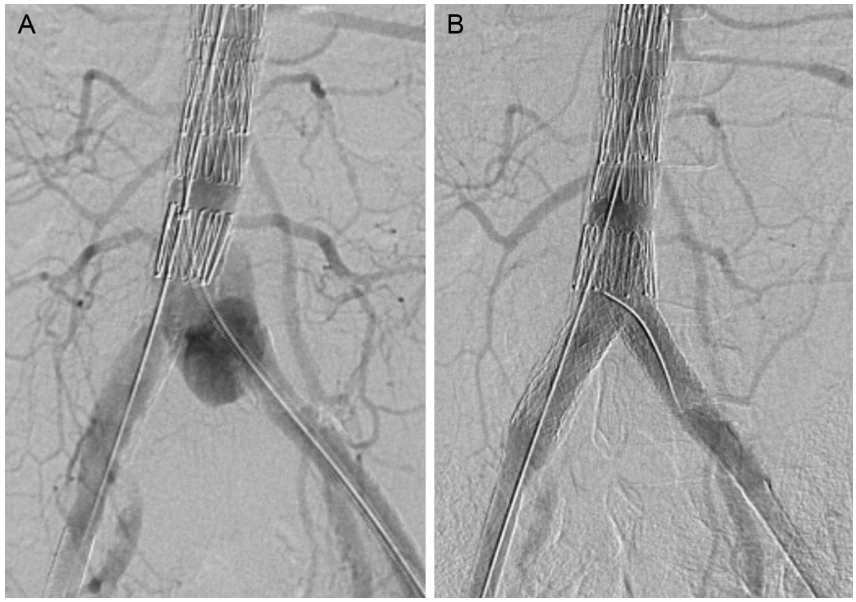

Figure 4. (A) Angiogram showing the proximal left common iliac artery aneurysm. (B) Bilateral iliac artery atrium stents deployed using a parallel endograft approach.

CONCLUSION

Surgeon modified endovascular stent grafting is a feasible alternative for the subacute or emergent treatment of complex abdominal aortic mycotic aneurysms in high risk patients.

CONFLICT OF INTEREST

None.

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