TECHNICAL REPORT

A Ruptured Abdominal Aortic Aneurysm Repaired with a Bifurcated Unibody Endoluminal Graft


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Introduction

Patients with ruptured abdominal aortic aneurysms (RAAAs) often die before they reach the hospital. Even with emergent surgical intervention, in-hospital operative mortality rates range from 22% to 48%1-6 and are considerably higher than those associated with elective repair of non-ruptured aneurysms (<5%).7 While elective repair may seem an attractive solution to prevent rupture, the patient with co-morbid disease may be denied open surgical intervention.8 Percutaneous endovascular treatment is often considered an alternative for elective repair of a variety of lesions in elderly and high-risk patients. While the appropriateness of elective endovascular repair of AAAs remains a matter for debate, endoluminal grafts (ELGs) have recently been used for emergency repair of ruptured false9 and true abdominal aortic aneurysms.8,10-13

In this case study, we document the use of a ready-made bifurcated unibody ELG in the successful treatment of an RAAA.

Case Report

An 85-year-old female with a previously diagnosed AAA who had refused surgical treatment was found lethargic and hypotensive at her nursing home. A computed tomography (CT) evaluation at a nearby emergency room documented an RAAA with maximum diameter >8 cm. The rupture was contained, and a huge retroperitoneal haematoma extending to the level of the kidneys was evident (Fig. 1). The patient consented to endovascular repair and was placed on a beta-blocker by the transferring facility, transfused with 2 units packed red blood cells, and sent via air transport to our hospital. At the time of arrival, she was conscious but hypotensive with a systolic blood pressure of 70. The anti-hypertensive agent was discontinued and her pressure stabilised.

The procedure was conducted with minimal sedation and local infiltration of anaesthetic agent to the bilateral groins. It was not necessary to place an aortic occlusion balloon because the patient remained hemodynamically stable. We did not use general anaesthesia and, hence, did not experience the sudden drop in blood pressure often encountered with induction. Bilateral sheaths (Cordis, Warren, NJ, U.S.A.) were placed percutaneously in the common femoral arteries (CFA) (12-F on the right and 9-F on the left). An

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Postdeployment aortogram demonstrating successful exclusion of the RAAA and preservation of renal artery flow.

A bifurcated unibody endograft (Endologix, 26 mm × 155 mm, Phoenix, AZ, U.S.A.) was selected based on the anatomy of the aorta and measurements obtained from the preoperative CT. A Microvena snare catheter (Microvena, White Bear Lake, MN, U.S.A.) was placed via the left groin to capture the contralateral Glidewire (Medi-tech/Boston Scientific, Natick, MA, U.S.A.) and externalise it through the left sheath. A dual-lumen catheter was advanced left to right and externalised on the right. This catheter served as a tracking system for the wire connected to the contralateral limb of the device and as a channel for the main wire directed proximally into the aorta for the main body.

The Endologix catheter was advanced into the right CFA as the peel-away sheath was removed. The system was advanced proximally over a 0.035-inch stiff wire (Microvena) so that the distal portions of the limbs were well above the aortic bifurcation. The contralateral limb was then freed from the main body, and both limbs were deployed into the common iliac arteries. The device was lowered to the level of the aortic bifurcation. The proximal end of the prosthesis was positioned at the level of the renal arteries, and the main body was released up to the top stent. Once the graft position was verified, the contralateral limb was fully deployed via the pull wire. The main body was then completely deployed, and the ipsilateral limb was released. A completion angiogram visualised both renal arteries and demonstrated the absence of any endoleaks (Fig. 3). Both sheaths were removed and bilateral primary repair of femoral arteries were done.

Deployment of the device took 40 min, and the entire procedure lasted 90 min. Procedure-related blood loss was <200 ml, but the patient received 4 units packed red blood cells due to the contained retroperitoneal haematoma. Approximately 300 ml of contrast was used. Upon transfer to the recovery room, the patient was awake and in stable condition. Postoperatively, the patient remained haemodynamically stable with a creatinine of 1.0 mg/dl. An abdominal CT on postoperative day 1 showed a successfully excluded aneurysm with no endoleaks (Fig. 4). Postoperative recovery was uneventful.

**Discussion**

The appropriateness of endoluminal grafting for treatment of AAAs remains controversial because periodic
imaging is required and long-term outcomes are unknown. Nevertheless, elective morbidity and mortality tends to be lower for endoluminal AAA repair as compared to open surgical repair. In one study, Brewster et al. studied 48 patients with infrarenal AAAs were treated with ELG (n = 30), or with open repair (n = 28). Patients who received endovascular treatment had significant reductions in blood loss, time to extubation, and days in the ICU and hospital. Results such as these may have encouraged the use of ELGs in emergency endovascular repair of RAAAs. In one series, 12 ruptured aortoiliac aneurysms were treated using custom ELGs with an in-hospital mortality rate of 17%, a rate that is considerably lower than that reported for surgical management of RAAAs.

Intravenous contrast was necessary during the procedure, as well as in postoperative studies. A considerable amount of IV contrast (approximately 300 cc) was used intraoperatively during deployment of the endoluminal graft. Precautions, including IV hydration and dopamine infusion, were implemented in an attempt to maintain renal perfusion and function. Although the latter is controversial regarding its ability to prevent acute tubular necrosis (ATN), we were successful at maintaining renal function with a creatinine of 1.0 mg/dl during and after the procedure.

Rapid treatment is a primary consideration for the patient with an RAAA, and ideally, only experienced operators in a well-equipped facility should attempt endovascular repair. The need for an abdominal CT scan may delay treatment, and haemodynamically unstable patients should go directly to the operating room instead so that measurements of the vessels and aneurysm may be made via intravascular ultrasound (IVUS). A variety of endovascular equipment may be needed in routine or emergent procedures, and various sizes of commercially available devices should be on hand.

It should be emphasised that general anaesthesia was not necessary for this procedure. Often following induction, the patient becomes significantly hypotensive. In these instances, an aortic occlusion balloon has been implemented to gain proximal control and stabilise the blood pressure. Only local sedation was used during this procedure and hypotension secondary to anaesthesia was not encountered. If the patient was to become haemodynamically unstable, an aortic occlusion balloon could have been placed quickly via the femoral or brachial artery. Because this device requires a large sheath (12F or greater), open repair of the brachial artery is advised.

A legitimate concern after endoluminal RAAA repair is the persistent retroperitoneal haematoma, which may cause compression. If necessary, the haematoma may be aspirated under ultrasound guidance. In general, though, the endovascular procedure avoids the procedures that typically are associated with postoperative complications following surgical repair. For example, there is no need to cross-clamp the aorta. In addition, renal ischaemia from suprarenal clamping is also avoided. Significant retroperitoneal dissection is not needed for endovascular repair, leading to shorter hospitalisation and a faster recovery than after open surgical intervention.

In summary, endovascular repair of RAAAs is feasible when performed by experienced clinicians in institutions that are well equipped for these procedures. New devices, such as the bifurcated unibody ELG used in our patient, should increase the likelihood of successful intervention in the emergency situation.

References