

## Fenestrated stent-graft after previous open surgical repair of abdominal aortic aneurysm: case report and review of the current literature

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### Abstract

Fenestrated endovascular repair (F-EVAR) is a new endovascular technique, in which a specially designed, custom made graft device ("endograft") is used for the treatment of pararenal and juxtarenal abdominal aortic aneurysms (AAA), especially in high-risk patients. The endograft has fenestrations on the graft body to maintain the vessel patency of the visceral arteries. F-EVAR has low operative morbidity and mortality and limited time hospital care. We present a case of F-EVAR for a pararenal AAA after a primary open surgical repair that failed, with a current review of the literature.

### Keywords

fenestrated after open repair; Pararenal abdominal aortic aneurysm

### Introduction

Open surgical repair (OSR) was used in the past as the gold standard for the treatment of abdominal aortic aneurysm (AAA). Despite the increase in use of endovascular repair techniques (EVAR) for the treatment of such cases in the last 20 years, there are still indications that point towards open repair as the preferred treatment method over an endovascular one [1].

In the performed PubMed research for manuscripts, from 2005 to 2016, under headings, 'Fenestrated after open repair' and 'Pararenal abdominal aortic aneurysm repair' were used. The aim of this report is to improve the knowledge exchange among surgical trainees in vascular surgery and vascular surgical specialists about the fenestrated technique as an alternate treatment method for the repair of juxtarenal and pararenal abdominal aortic aneurysms. We will also review current literature about the technical success rate of this treatment modality in various medical centers.

### Case Presentation

A 71 year old male with a 6.6cm asymptomatic pararenal AAA was referred to our department for endovascular repair. Past medical history included benign prostate hyperplasia, hypercholesterolemia, glaucoma and bipolar disorder. The patient had been treated four years before for an AAA. He OSR with a tube graft implantation. One year later there was a proximal extension of the aneurysm including both renal arteries. In the last year there was a 10mm increase in the diameter, leading to a pararenal AAA. Aortic diameter at the level of the renal arteries was 3.9cm.

The surgeon decided to refer the patient to our hospital for treatment of the pararenal AAA, in order to evaluate the applicability of a fenestrated device. In view of the patient's level of activity, comorbidity and his age, it was decided to attempt to rescue the proximal open surgical failure using a fenestrated device.

A fenestrated stent-graft device was customized based on the Cook Zenith system (William A. Cook Australia, Ltd., Brisbane, Australia) according to preoperative measurements with a 100mm long fenestrated cuff incorporating two small fenestrations (6 X 8mm) for the renal arteries (RAs), one large fenestration (8 X 8mm) for the superior mesenteric artery (SMA) and a deep scallop (10 X 12mm) for the celiac artery (CA) (Figure 1).

Under general endotracheal anesthesia, surgical exposure of both femoral arteries was carried out. After the full deployment of the fenestrated stent-graft, two 7 x 26mm balloon expandable stent-grafts were introduced and deployed into both RAs and an 8 x 37mm balloon expandable stent-graft into the SMA (Lifestream stent-grafts, Bard Peripheral Vascular inc., Europe). All stent-grafts were flared distally with a 12 X 40mm balloon (Powerflex P3, Cordis Europa, Roden, The Netherlands), to achieve good sealing in the visceral arteries.

After ballooning, an angiogram was performed which demonstrated the perfusion and patency of all the target vessels (Figure 2).

Total operative time was 320min and blood loss 430mL. Fluoroscopy time was 77min and total contrast volume used was 450ml (Visipaque 270mg/ml, GE Healthcare B.V., Athens, Greece).

The patient's recovery was uneventful. Renal function remained unchanged. He was discharged home on the eighth postoperative day. At six weeks and 6 months, the patient was doing well, without buttock or lower extremities claudication and CTA examination revealed patent all visceral vessels without endoleak.

## Discussion

Open surgical repair of juxtarenal and pararenal AAA is challenging and often requires suprarenal clamping and renal artery revascularization [1].

After open surgical repair of AAAs, proximal extension of the aneurysm, aneurysm rupture, renal insufficiency and ischemic colitis are some of the most common postoperative complications [6,9]. Alternative solution in dealing with proximal extension of the aneurysm in high risk patients, came with the use of F-EVAR technique, a newly developed concept of endovascular repair of pararenal and juxtarenal AAAs.

F-EVAR seems to be best suited for high-risk patients with significant comorbidities because of its low operative morbidity and mortality [2-5,8]. A variety of techniques from different centers exist, but not all stent-graft designs are available. The simplest standard device is a fenestrated tube with two or three fenestrations for each renal artery and superior mesentery artery and a scallop to incorporate the celiac artery (Figure 3). An additional distal bifurcated stent graft is always used in cases which conservation of the old surgical graft has been decided. Devices are customized depending on each patient's preoperative measurements, making each case unique in treatment.

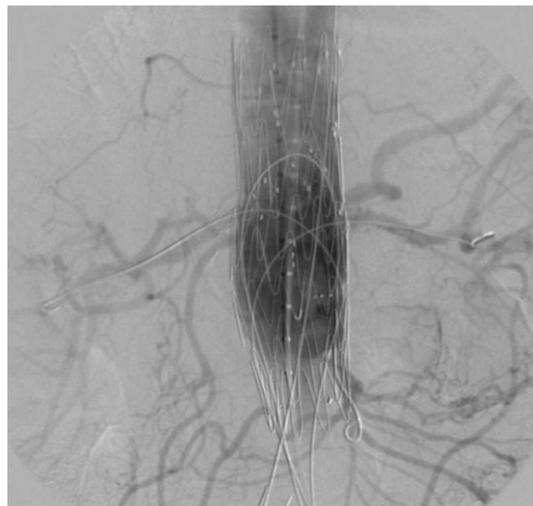
F-EVAR after open surgical repair can be time-consuming and technically difficult. This can be due to the complexity of the fenestrated device, the developed forces during the handling of the new device and the lack of an infrarenal neck as a proximal sealing zone [4]. These difficulties can be overcome by careful planning of the operation and by aligning the fenestrated stent-graft in the best possible way [4,7]. Spiral CTA can be very useful in estimating the diameter of the aorta and the other vessels.

Four case series with reported F-EVAR after OSR were found after the review of the literature (table). All case series agreed that F-EVAR technique offers a limited time hospital care with low perioperative morbidity and zero to low mortality rate [2,4,5,7]. Technical success had very high rates with target vessel patency reaching almost 100% and zero rates of 30day mortality. In addition, midterm follow up indicated that F-EVAR technique shows excellent durability.

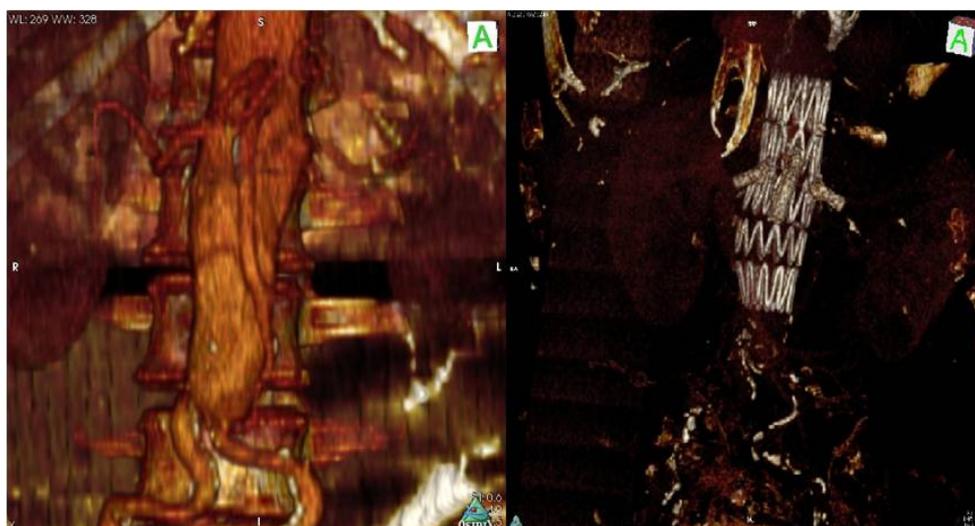
## Conclusion

F-EVAR can indeed provide a safe and effective alternative treatment after failed OSR and as the technology improves and more extensive follow up is made, many questions will be answered and the indications in favor of F-EVAR will expand.

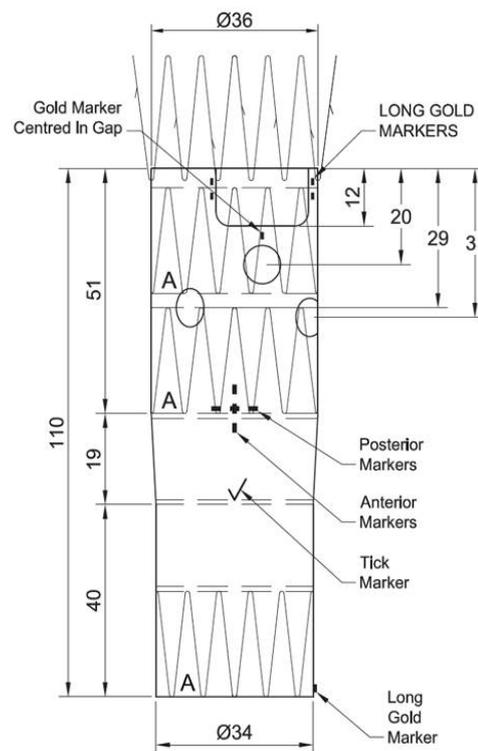
## Figures



**Figure 1:** Intraoperative angiogram showing catheterization of both renal arteries and superior mesenteric artery.



**Figure 2:** 3D reconstruction of the pararenal AAA preoperatively and after implantation of the fenestrated device.



**Figure 3:** Design of the fenestrated endograft implanted on the patient.

## Table

**Table 1:** Four case series with reported F-EVAR after OSR were found after the review of the literature. Note that cases reported in BeckAW. et al series are included in the Oikonomou K. et al series.

	No of cases	Primary technical success	Target vessel patency	Time after primary procedure	Open conversion	30-day mortality
Oikonomou K. [2]	35	97.1%	100%	126 months	2,9% (1 case)	0%
Gallitto E. [4]	15	95%	98.5%	126 months	-	0%
Adam DJ. [5]	3	100%	100%	120 months	-	0%
Beck AW. [7]	18	94%	100%	102 months	6% (1 case)	0%

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