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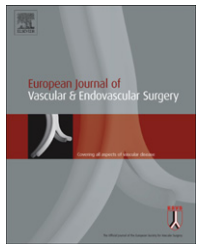

Conversion to Open Repair after Endovascular Aneurysm Repair: Causes and Results. A French Multicentric Study☆

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Abstract *Objective:* To evaluate the causes and results of conversion to open repair after aortic aneurysm endovascular treatment (EVAR).
Design: Retrospective study of open conversion after EVAR was performed in eight French academic centres. Primary conversion (PC) within 30 days after EVAR and secondary conversions (SC) were analysed separately.
Result: Between 1997 and 2007, open conversions were performed in 34 patients (most often in high-risk patients): 14 PC and 20 SC. Two main causes of PC were unfavourable iliac artery anatomy and renal artery coverage. In hospital mortality was 21%. SC occurred at a median of 44 months after primary EVAR. Nine were urgent cases for rupture or infection and 11 elective for aneurysm growth, infection or thrombosis. Early mortality was similar after emergent or elective SC (25%).
Conclusion: Open conversion, and, in particular, PC and urgent SC, was associated with a poor outcome. According to the literature, mortality after elective SC is low but remains high in high-risk patients.

Since the first successful endovascular treatment of an abdominal aortic aneurysm (AAA) in 1991, this procedure is performed with an increasing frequency.[1] This minimally invasive approach has lower early morbidity and mortality rates compared to open surgery, especially in high-risk patients.[2–4] However, there are some early and delayed failures leading to primary or secondary conversion to open repair.[5–7] Open repair is sometimes performed in an

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emergent manner (such as iliac rupture, stent-graft misdeployment and aneurysm rupture) or in an elective manner (primary or secondary endoleak with or without sac expansion). In most cases, operative risk may be considered higher than that of a primary open repair due to intra-aortic stent graft and emergent conditions.[8]

The aim of this study was to report outcomes of conversion to open repair during primary endovascular treatment or during follow-up in eight French academic centres. Until very recently, EVAR was still considered under evaluation, and follow-up was compulsory according to the AFSSAPS guidelines.[9]

Material and methods

Between September 1997 and September 2007, a total of 1588 patients were treated by endograft for AAA in eight French vascular surgery departments (University Hospital of Bordeaux, Grenoble, Lille, Lyon, Marseille, Nantes, Nice and Saint-Etienne). All patients who underwent open conversion peroperatively or during follow-up were included in this study. Data retrieved for these cases were collected retrospectively; however, data for the remaining patients who did not undergo open conversion were not collected.

Primary conversion (PC) has been defined by an AAA open repair with aortic cross clamping within 30 days following the primary EVAR. Secondary conversion (SC) has been defined by an AAA open repair performed at least 30 days after stent-graft placement. These SCs were either performed in an elective or urgent condition.

Data reviewed included demographic information, initial aortic aneurysm morphology at the time of EVAR, time to conversion and indications for conversion. The intra-operative variables (e.g., approach, clamp location, endograft explantation, blood transfusion, clamping and operative time) were also examined. The postoperative course data included major perioperative (<30 days) complications (such as myocardial infarction, renal failure, respiratory failure or pneumopathy, complications requiring re-operation and death), length of intensive care unit stay and hospital length of stay was obtained from the medical record.

Results are expressed as mean ± standard deviation (SD) (range) for continuous data and as percentage for categorical data.

Results

A total of 34 patients (2.1% of all cases treated by EVAR) required open conversion. Fourteen were PC and 20 were SC (0.9% and 1.3%, respectively, of all cases treated by EVAR). The study cohort included 33 male and one female patient, with a mean age of 73 years (range: 57—84 years). The cardiovascular co-morbidities were similar to those in patient suffering from AAA reported elsewhere. Twenty-nine patients suffered from at least one co-morbidity, according to the AFSSAPS (Agence Française de Sécurité Sanitaire des Produits de Santé) criteria,[9] and could thus be considered high-surgical-risk patients. Aneurysm morphology before stent-graft placement of these patients was analysed. Mean aneurysm diameter was 59.1 mm (range: 45—110 mm) and was comparable between both the groups. Only one patient who presented a rapidly growing aneurysm had an aneurysm diameter lesser than 50 mm.

Causes of PC

Thirteen PCs were performed peroperatively and one on the day following EVAR. The devices used were Talent® (Medtronic, USA) in eight cases, Zenith® (Cook, USA) in four and Vanguard® (Boston Scientific, USA) in one (Table 1).

Five causes of early failure could be described. Most frequently (six of 14), failure was due to impossiblity of endograft progression because of the morphology of the external iliac artery (calcification and tortuosity), leading to an iliac rupture in three cases. Devices concerned were four Talent® and one each of Zenith® and Vanguard®. The second most frequent cause of PC was an inappropriate stent-graft placement over renal artery in four cases (two each of Talent® and Zenith®). The remaining four causes of PC are detailed below. In one case, the angiographic catheter was locked in a suprarenal hook of a Zenith® endograft. Attempts to retrieve the catheter led to misplacement of the suprarenal bare stent. In the second case, impossibility to deliver the whole of a Zenith® endograft from its delivery shaft led to open conversion. In the third case, conversion was due to type 3 endoleak and the absence of additional endovascular material for additional treatment (Talent®). In the last case, conversion was performed after failure of endovascular treatment of a stent-graft thrombosis (Talent®) 2 h after successful deployment without difficulty. At open surgery, no cause could be defined.

Causes of SC

Twenty SCs were performed. Of these, eight were performed in urgent conditions and 12 electively. Mean interval between primary endovascular procedure and open

Table 1 Causes of open conversion.

	Causes	*n*
Primary conversion ($n = 14$)	Iliac calcification and tortuosity	6
	Renal artery occlusion	4
	Technical problem during graft deployment	2
	Type 3 Endoleak	1
	Immediate post procedure graft thrombosis	1
Urgent secondary conversion ($n = 8$)	Ruptured AAA	5
	Fissured AAA	2
	Endograft Infection	1
Elective secondary conversion ($n = 12$)	AAA diameter increase with endoleak	8
	Distal type I endoleak	1
	Endograft infection	1
	Endograft thrombosis	1
	Cross-over bypass infection	1