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CONVERSION TO OPEN SURGERY AFTER ENDOVASCULAR ABDOMINAL AORTIC ANEURYSMS REPAIR

Petr Utikal[a], Martin Koecher[b], Jirina Koutna[c], Petr Bachleda[a], Petr Drac[a], Marie Cerna[b].

[a] *2nd Clinic of Surgery, University Hospital Olomouc, Czech Republic*
[b] *Clinic of Radiology, University Hospital Olomouc*
[c] *Clinic of Anestesiology, University Hospital Olomouc*
e-mail: petr.utikal@fnol.cz

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The authors describe experience with conversions to open surgery after endovascular abdominal aneurysm repair and evaluate the frequency, causes and results of a total of 7 cases in their series of 165 patients treated over a 10-year period.

INTRODUCTION

Based on lower operating risk, endovascular aneurysm repair (EVAR) is generally accepted as an alternative to abdominal aortic aneurysms (AAA) treatment despite its tendency to technical failure with a high re-intervention rate[1-3]. Fortunately, most EVAR complications can be and are treated successfully using endovascular corrections and conversions or open sugical corrections to achieve acceptable primary technical and longterm clinical success[4-5]. Nevertheless, the higher operating risk conversion to open surgery (OS) is sometimes necessary in serious cases[6-12].

METHODS

Conversion to OS after EVAR is defined as open aneurysm surgical repair with partial or total endovascular stentgraft removal. Any AAA open repair during or within 30 days from the initial EVAR procedure was defined as early conversion. Any AAA open repair with stentgraft removal in the 30 days following completed EVAR procedure was defined as late conversion. When the AAA open surgery during the initial EVAR procedure was performed, we talked about immediate - primary early conversion. Conversion during subsequent operation was a secondary one. The indication to conversion for OS can be classified as acute (urgent) or elective[12-15].

PATIENTS, METHODS

Between 1996 and 2005 we treated endovascularly 165 patients with asymptomatic AAA. One type of stentgraft system: Ella (ELLA CS, Hradec Králové, Czech Republic) was used for AAA exclusion in all patients. Stentgraft configuration included 3 aortic tubes, 136 bifurcated grafts, and 26 aortouniiliac grafts. Primary technical success of 93.9 %, primary assisted technical success of 98.8 % and secondary clinical success of 95.7 % was achieved. In 38 (23 %) patients a total of 51 immediate, early and late endovascular corrections (n = 15), endovascular conversions (n = 2) and surgical corrections (n = 34) were successfully used[16-19]. On the other hand, conversion to open surgery was indicated in 7 (4.2 %) patients. 4 (2.4 %) patients underwent early conversion. Immediate – primary conversion was done in 2 (1.2 %) patients due to type Ib endoleak (n = 1) and type IIIa endoleak (n = 1). Within the first three weeks, conversion was performed in 2 (1.2 %) patients for type Ia endoleak (n = 1) electively (Fig. 1) and for stentgraft thrombosis (n = 1) acutely. During the follow-up period (min 1 month, max 120 months) 3 (1.9 %) of the remaining 161 patients underwent late conversion to open surgery for late type Ia endoleak electively (n = 2) and for rupture acutely (n = 1) (Fig. 2). There were 4 unsuccessful endovascular reinterventions in 3 patients prior to decision for conversion. A total of 7 stentgrafts – aortic tube graft (n = 1), bifurcated (n = 5) and aortouniiliac (n = 1) – were removed. Open surgery was approached via a median laparotomy under general anesthesia in all patients. After exposure of the aneurysm, the aorta was cross – clamped infrarenally in 3 (43 %) and suprarenally in 2 (29 %) patients. In 2 (29 %) patients (with a short infrarenal neck and stentgraft fixation with uncovered segment across the renal artery origins) aorta clamping above the celiac trunk was necessary. The suprarenal and supraceliac aorta was clamped only temporarily for a short time (about 3 min) of stentgraft removal with infrarenal clamp reposition thereafter. All stentgrafts were removed completely via aneurysmal sac incision by manual compression of the aorta and temporary opening of the infrarenally positioned aortic clamp. Extraction of the iliac limbs was technically without dif-

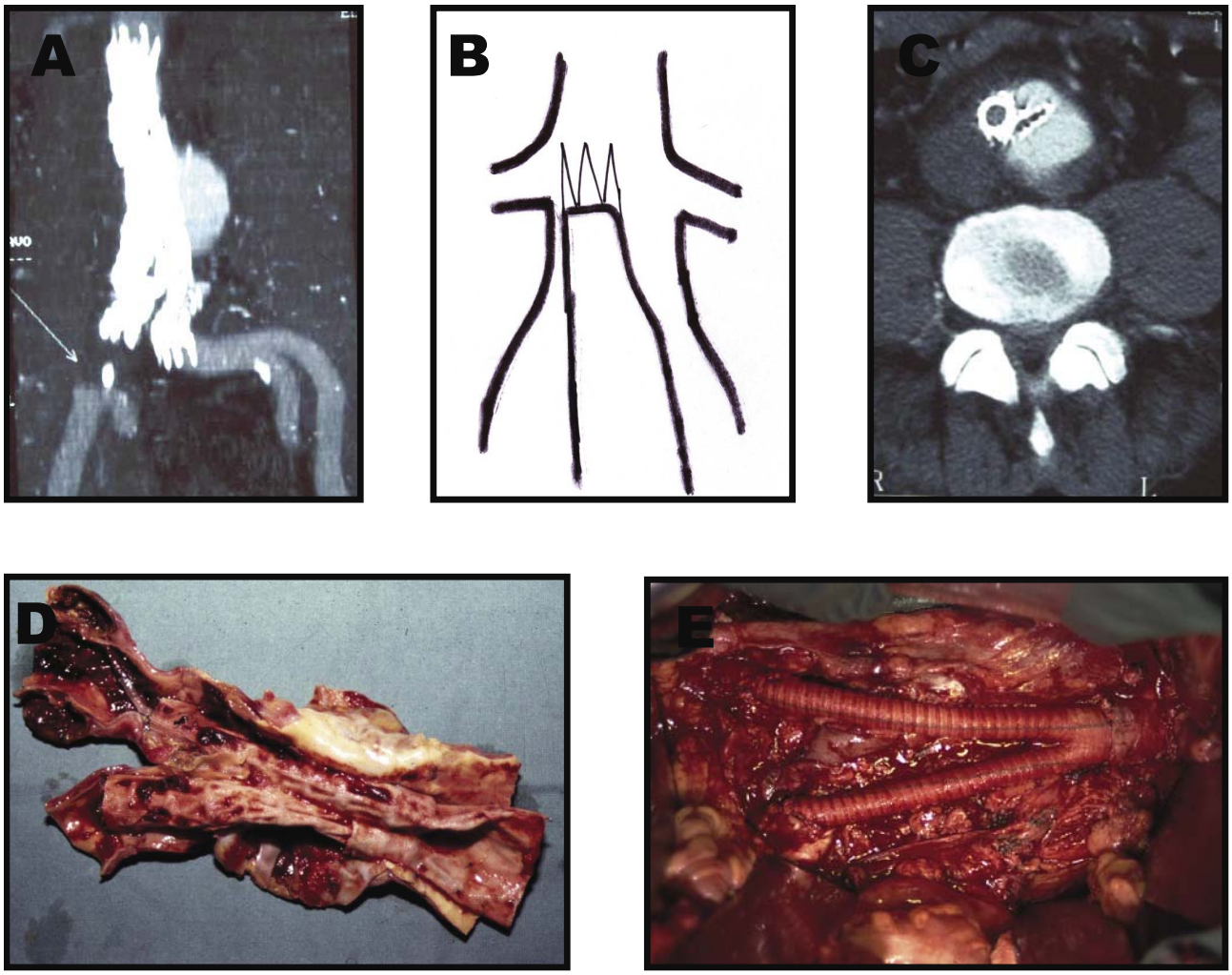

Fig. 1. A 52year old man was indicated for elective early secondary conversion to open surgery 3 weeks since primary EVAR.
A, C: CT angiography after the primary endovascular procedure. Endoleak Ia, collapsed and thrombosed body of bifurcated stentgraft.
B: Drawing of type Ia endoleak caused by collapsed stentgraft body
D: Removed aneurysmal sac with implanted stentgraft. The body of the stentgraft is not fully expanded, it is collapsed.
E: Open surgical aorto-biiliac reconstruction using bifurcated dacron prosthesis

ficulties. There was no severe aortic or iliac wall damage due to the anchoring barbs. Reconstruction using bifurcated prosthesis with iliac or femoral connection was performed in 5 (72 %) patients (Fig. 1); aorto-iliac in two and aorto-femoral in three. Aortic tube graft was used in one patient and aortouniiliac graft in the last one (using the femoral femoral cross over bypass as a part of the prior aortouniliac exclusion). Despite the technical success of the conversion, both of our patients indicated for acute conversion died due to multiorgan failure. Elective conversion did not lead to any mortality and there were no severe cardial, pulmonary or renal morbidity.

DISCUSSION AND CONCLUSION

The total rate of conversions to open surgery in our patients series is low (7 of 165, 4.2 %). Early conversion to OS is connected with specific complications caused by severe tactical mistakes in EVAR indication due to incorrect morphology evaluation, in stentgraft measurement and stentgraft configuration planning. Access problems, technical – mechanical failure during stentgraft introduction and implantation can lead to immediate (primary) conversion to OS[7, 9, 13, 20–22].

Early primary conversion was indicated immediately in case of type Ib endoleak caused by failed aortic tube graft fixation in distal aortic neck too short for this type of stentgraft, and in case of type IIIa endoleak caused by failed contralateral bifurcated stentgraft limb implantation

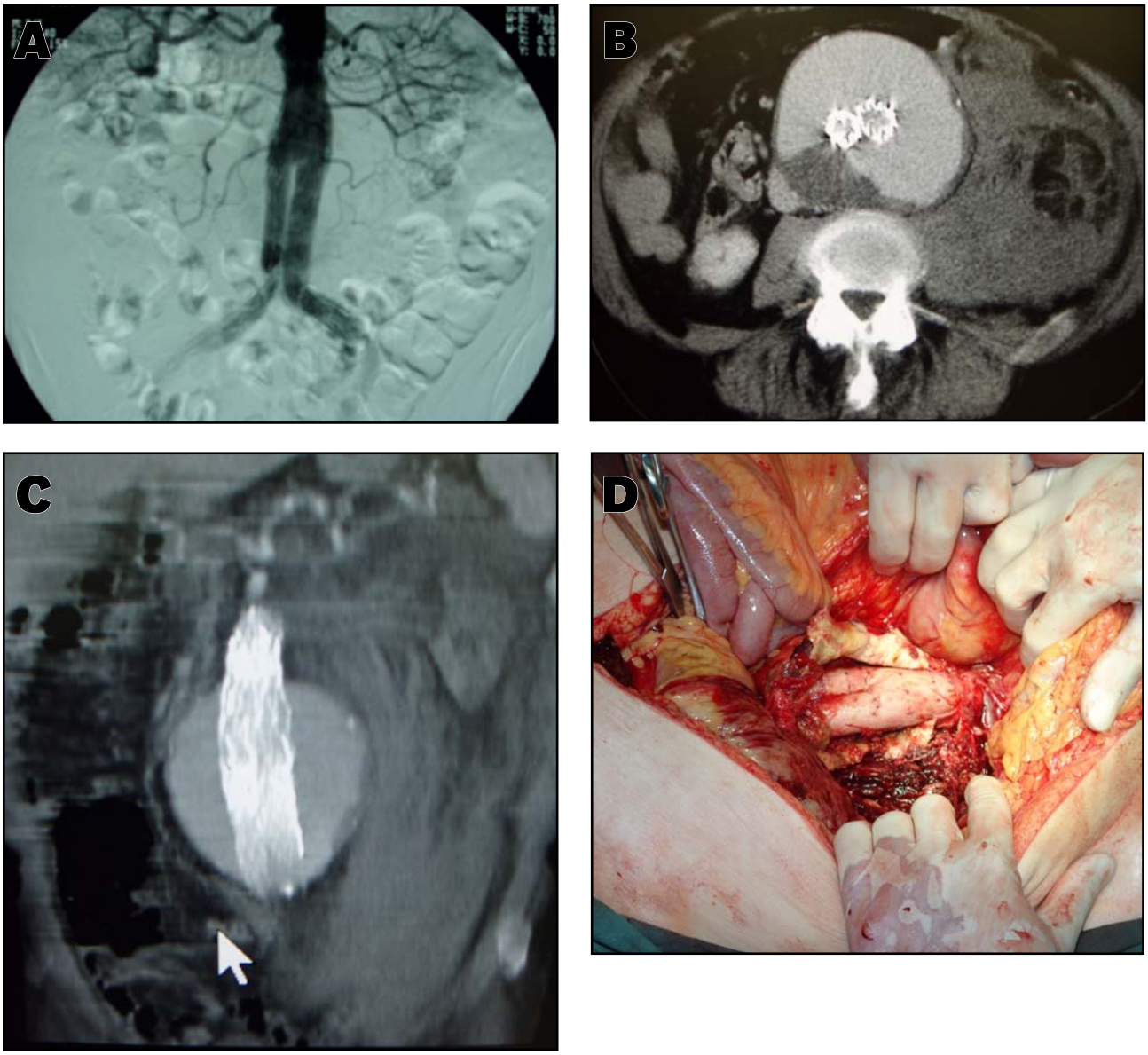

Fig. 2. An 84year old man was indicated for acute late conversion to open surgery 2 years since primary EVAR.
A: DSA. Successful EVAR using bifurcated stentgraft
B,C: CTA. Not thrombosed aneurysmal sac with perigraft blood lood-flow (type Ia endoleak) ruptured to the left with retroperitonal haemathoma
D: Peroperative view. Aneurysmal sac ruptured on the left side with retroperitoneal haemathoma

due to total unfavourable stentgraft body rotation. There were no access problems requiring conversion to OS in our patients. Early secondary conversion due to primary type Ia endoleak was indicated electively one week after the primary endovascular procedure. The cause of EVAR failure was an unexpanded (collapsed) stentgraft body due to incorrect (large) stentgraft body diameter (Fig. 1). In these three patients, endovascular repair was also technically possible. In the begining of our experience, we decided for OS conversion as the easier and safer repair option, especially when the patients were of low operating risk. Acute secondary conversion in case of aortouniliac stentgraft thrombosis caused by graft kinking in angulated aneurysmal sac three weeks after the implantation, was neccessary.

Late conversions are indicated for specific EVAR complications, which accompany aortic and stentgraft changes over time. A higher rate of late conversion was observed especially in patients with extreme morphological indications; large aneurysm diameters, short or large proximal neck and significant neck or aneurysmal angulation[4–5, 8–10, 13, 22]. Proximal aortic neck dilatation with secondary hemodynamic high flow type Ia endoleak in one patient and neck dilatation followed by stentgraft migration and kinking were our indications for elective late conversion to OS. AAA rupture after EVAR is not a frequent, but also not a rare complication requiring conversion to OS[8, 23–24]. AAA rupture in our urgent OS indicated patient was secondary due to distal graft migration into the aneurysmal sac owing to proximal aneurysmal neck

dilatation with type Ia endoleak that developed over the two years since EVAR (Fig. 2). The stentgraft configuration and stentgraft system type has a significant impact on the occurrence of late conversion to OS. Poor results of tube stentgrafts have been reported and some technical problems and structural failure especially in so called "first generation stentgrafts" have been mentioned[21-22, 25-27]. In these cases, prophylactic conversion is recommended in some reports[15]. We can state that the preferred bifurcated stentgraft configuration and the Ella stentgraft system (ELLA CS, Hradec Králové, Czech Republic) with custom-made stentgrafts we used for AAA exclusion in all the patients in our series contributed much to the low conversion rate in our series[16-18]. Sufficient follow-up is neccessary to identify all severe late EVAR complications in time. According to our current follow-up protocol, angiography (DSA) is done on the tenth postoperative day, computed tomography angiography (CTA) and plain abdominal X-ray is performed annually afterwards. Based on our 10-year experience, we considered the follow-up screening sufficient[18, 28]. Unfortunately, not all of the patients showed a responsible attitude to follow-up checks[8]. This was one of our acute rupture case causes. We do not confirm that OS is more risky due to the presence of stentgraft in the operating field. The complete stentgraft removal is technically the easiest and most successful, as in our cases. Suprarenal and supraceliac aorta clamping is only temporary for a short time of stentgraft removal with immediate infrarenal clamp reposition thereafter and does not lead to severe visceral or renal ischaemia with increased morbidity. In addition, partial stentgraft removal is possible where necessary. The stentgraft is transsected, the proximal body part is left in situ, and is incorporated in the suture line of the new graft. This technique seems to be an option in case of stentgraft incorporation in the aortic wall, especially with suprarenal fixation[13, 15, 29]. Revascularisations using in situ reconstruction after stentgraft removal is the best option. An alternative to in situ reconstruction is infrarenal aorta ligature and extraanatomical revascularisation using axillobifemoral bypass, which is the method of choice in cases of severe stentgraft infection[11]. We have no experience with this as no stentgraft infections were observed in our patients.

The reported experience shows high mortality (30–40 %) and morbidity rates associated with immediate (primary) or acute secondary conversions to OS especially in unfit patients and in cases of ruptured aneurysm in contrast to elective early or late ones[6, 8, 12, 24, 30]. The results of our 7 patients are not in contradiction with these reports. Two patients who successfully required immedate (primary) conversion were of acceptable operating risk for open aortic surgery (ASA II–III). On the other hand, both patients who died after acute (urgent) secondary conversion were high operating risk (ASA IV) patients and were admitted in a severe condition; the patient with AAA rupture was in hemorrhagic shock and the patient with stentgraft thrombosis had critical ischemia of both limbs. Successful elective early and late conversions in three patients (ASA III–IV) proved it to be a safe procedure. The decision in favour of conversion to open surgery should be considered very carefully. Conversion to OS is indicated in cases of EVAR complications where endovascular corrections or conversions as well as surgical corrections are not posssible or were unsuccessful. From the technical point of view, conversion to OS is possible in all cases and may be the safest option, but all procedures of conversion expose the patient to increased risk[7]. Therefore, a complete risk/benefit assessment is performed for each patient before conversion to OS is indicated[12]. In a patient of an extremely high risk it may be determined that it is safer to manage some cases conservatively (observation, endoleak monitoring) and conversion is indicated in case of aortic rupture or stentgraft thrombosis threat only[31]. On the other hand, elective conversion to OS is recommended in patients of acceptable surgical risk with unknown cause of AAA growth after EVAR. This can reduce the number of fatal urgent cases[12]. The current absolute indications for conversion to OS are determined; as primary (immediate) in case of stentgraft implantation failure leading to the inability to deploy the prosthesis and exclude the aneurysmal sac from the direct blood flow or resulting in aortic rupture or obstruction of both iliac arteries, and as secondary for hemodynamically high flow persistent endoleak, continued AAA growth without evidence of endoleak and infected stentgraft[7, 10, 13]. Appropriate patient selection, correct sizing of prostheses and good procedural technique are of importance in EVAR failure and thus in the prevention of the risk involved in the conversion to OS[32-34]. When extreme AAA morphological indication is neccessary (in high risk patients with acute AAA repair indication), the application of a combination of EVAR and primary planned associated surgery (combined strategy) is recommended to prevent complications[14, 35-39]. However, the basis of better EVAR results should be an improvement in the endovascular technique and stentgraft system construction in the future[40].

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