Endograft Treatment of Anastomotic Aneurysms Following Conventional Open Surgery for Infrarenal Aortic Aneurysms

F. Liewald,1 X. Kapfer,1 J. Görich,1 G. Halter1, R. Tomczak2 and R. Scharrer-Pamler1

1 Department of Thoracic and Vascular Surgery, University of Ulm, 2 Department of Radiology, University of Ulm, Germany

Objective: to evaluate the use of endograft therapy for treating anastomotic aneurysm following open surgical repair of infrarenal aneurysms of the abdominal aorta.

Methods: four male patients (age 47–75 years) at high surgical risk (ASA IV: n = 3, ASA III: n = 1) developed secondary aneurysms at the site of the central (four aneurysms) and additional peripheral (two aneurysms) anastomosis of their tube or bifurcation prosthesis an average of 13 years (range 1–23 years) after conventional open surgical correction of infrarenal aneurysm of the abdominal aorta. In two patients, there was covered rupture of the aneurysm sac. The aneurysm diameter was 4.8 cm, 8.0 cm, 7.4 cm, 7.0 cm, respectively (mean 6.8 cm). Follow-up included helical CT imaging at 1 week, 3 months and 6 months postoperatively.

Results: anastomotic aneurysm was successfully treated in all four cases. No evidence of endoleak was observed during the follow-up period. Two patients died 14 and 18 days after surgery due to myocardial infarction and cerebrovascular accident. The endovascular repair of the two patients who died was intact.

Conclusion: although no long-term results are available, the use of a graft-in-graft method to repair anastomotic aneurysms following conventional implantation of tube or bifurcation prostheses appears to be effective, particularly in patients at high surgical risk.

Key Words: Endograft; Endovascular grafting; Anastomotic aneurysms; Abdominal aortic aneurysm.

Introduction

The use of stent-graft prostheses in the treatment of infrarenal aneurysms of the abdominal aorta (AAA) has been shown to be less invasive and therefore more suitable for other patients and those at increased surgical risk.1–11 The advantages of the method relate primarily to the fact that it is less invasive, which makes it more suitable for older patients and those at increased surgical risk. The major disadvantages are the high rate of intra- and postoperative complications,12–17 as well as the need for regular follow-up examinations, which not infrequently result in a recommendation for further interventional measures. Another disadvantage associated with the endovascular method is that long-term results are not yet available. Hence, conventional open surgery for repair of AAA remains the gold standard.

However, in cases in which anastomotic aneurysms develop following conventional open surgical repair of AAA with implantation of a tube or bifurcation prosthesis, the question arises of whether endoluminal stent-graft procedures might not offer significant advantages over a second laparotomy should surgical repair become necessary.

The present retrospective study presents four patients whose anastomotic aneurysms were repaired using endoluminal stent-graft methods.

Patients and Methods

Between May, 1999 and March, 2000, four male patients (age 47–75 years) underwent endovascular stent-graft implantation for the treatment of anastomotic aneurysms developing after conventional open surgical repair of infrarenal aneurysms of the abdominal aorta. Primary operation consisted of implantation of an aorto-bi-iliac bifurcation prosthesis or a tube prosthesis in two patients each. The site of anastomotic aneurysm development was the proximal (central) end of the prosthesis in all patients, with additional development...
Endograft Treatment of Anastomotic Aneurysms

of anastomotic aneurysm at the distal end of the prosthesis in the two patients who had received tube prosthesis (Fig. 1).

Pre-operative risk assessment showed three of four patients to be ASA IV based on pre-existing disease, while the fourth patient was assigned to ASA III.

All four patients underwent pre-operative CT measurement (Elscent, Haifa, Israel) in order to diagnose their anastomotic aneurysms. In all cases, the length of the aneurysm neck (the distance from the renal artery to the upper margin of the anastomotic aneurysm) was >8 mm. In the two patients with bifurcation prostheses, the distance from the renal artery to the branching off of the prosthesis limbs was 35 mm and 40 mm, respectively. The diameters of the original prostheses were 20 mm and 22 mm, respectively.

The diameters of the anastomotic aneurysms were 4.8 cm, 8.0 cm, 7.4 cm, 7.0 cm, respectively (mean: 6.8 cm). The time interval from the primary operation to diagnosis of anastomotic aneurysm ranged from 23 years down to 1 year (average interval: 12.7 years).

Two patients (nos 3 and 4, Table 1) who had previously undergone surgical treatment in their community hospitals exhibited covered ruptures of their anastomotic aneurysms (site of rupture at the proximal and distal prosthesis ends in one patient each) (Fig. 2). Neither clinical, radiological or laboratory parameters suggested that infection was contributory to these ruptures.

The other two patients underwent elective surgery, though they presented symptoms of lower limb ischaemia. In these patients, the diagnosis of anastomotic aneurysm was made a few days after occlusion of one limb of their bifurcation prosthesis had occurred. In one patient, implantation of the endograft was performed after thrombectomy in the occluded prosthesis limb (patient 2). In the other patient (patient 1), an unsuccessful attempt at thrombectomy was followed by endograft implantation. The unsuccessful attempt led to a decision to implant an aorto-mono-iliac stent with consecutive cross-over bypass.

Three types of endograft prostheses were used in this patient group (Table 1). The neck of the aneurysm in patient 2 was short at 8 mm, resulting in a decision to use a Cook prosthesis with corresponding suprarenal anchoring using bare stents. In two patients with tube prostheses, the distance between the renal arteries to the origin of the iliac arteries was so short that we were only able to use a short endograft (AneuRx).

Median fluoroscopy (Siremobil 2000 imaging system, Siemens, Erlangen, Germany) time was under 10 min with a median contrast medium application of 117 ml. Duration of the entire procedure ranged from 65 min to 155 min.

Patients did not experience a fall in systolic arterial pressure either pre- or intraoperatively. Circulation was stable in both patients with contained ruptures. In both patients there was a delay of about 12 h from the time of diagnosis necessitated by the fact that the endograft prosthesis had to be delivered by the distributor.

All procedures were performed by a multidisciplinary team consisting of interventional radiologists and vascular surgeons integrated into a single surgical unit. Follow-up examinations, which included CT evaluation, were performed during the first postoperative week and then at 3 and 6 months.

**Results**

Anastomotic aneurysms were successfully treated in all four patients. Endoleak was not present on intraoperative digital subtraction angiography (DSA) or the first postoperative CT scan.

The two patients who underwent follow-up CT examination at 3 and 6 months postoperatively also showed no evidence of endoleak (Fig. 3).

Two patients died on the 14th and 18th postoperative day, respectively, from sequelae of their pre-existing, generalised arteriosclerotic disease after postoperative clinical course initially free of complications. Autopsy in patient 1 revealed cardiac decompensation following recurrent myocardial infarctions as the cause of death. The operative situs
<table>
<thead>
<tr>
<th>Pat. no.</th>
<th>ASA risk class</th>
<th>Diagnosis</th>
<th>Primary surgery</th>
<th>Secondary surgery</th>
<th>Prosthesis</th>
<th>Contrast medium applied (ml)</th>
<th>Duration of fluoroscopy (min)</th>
<th>Clinical course</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IV</td>
<td>Proximal anastomotic aneurysm with occlusion of the limb of the bifurcation prosthesis</td>
<td>Aorto-bi-iliac bifurcation prosthesis</td>
<td>Aorto-mono-iliac stent and cross-over bypass</td>
<td>Talent 160/26/12</td>
<td>100</td>
<td>7</td>
<td>Myocardial infarction, died on 14th postoperative day</td>
</tr>
<tr>
<td>2</td>
<td>IV</td>
<td>Proximal anastomotic aneurysm with occlusion of the limb of the bifurcation prosthesis</td>
<td>Aorto-bifemoral bifurcation prosthesis</td>
<td>Thrombectomy of the occluded prosthesis limb and Y-stent graft</td>
<td>Cook 120/22/14</td>
<td>150</td>
<td>15</td>
<td>CVA, died on 18th postoperative day</td>
</tr>
<tr>
<td>3</td>
<td>III</td>
<td>Covered rupture of a distal anastomotic aneurysm</td>
<td>Tube prosthesis</td>
<td>Y-stent</td>
<td>AneuRx 135/20/12</td>
<td>100</td>
<td>8</td>
<td>No complications</td>
</tr>
<tr>
<td>4</td>
<td>IV</td>
<td>Covered rupture of a distal anastomotic aneurysm</td>
<td>Tube prosthesis</td>
<td>Y-stent</td>
<td>AneuRx 135/28/16</td>
<td>120</td>
<td>7</td>
<td>No complications</td>
</tr>
</tbody>
</table>
Endograft Treatment of Anastomotic Aneurysms

49

include technical errors such as extensive thrombendarterectomy in the area of anastomosis or placement of the central anastomosis at a site too far below the renal arteries, such that there may be renewed aneurysm formation in the remaining infrarenal aortic wall. In cases considered for endoluminal repair, infection as a cause of rupture must be excluded.

If the technical prerequisites, including exclusion of infection and sufficient length of the aneurysm neck (distance from the renal arteries to the proximal end of the anastomotic aneurysm >8 mm), were fulfilled, endovascular exclusion was possible.23–26 Implantation of endoluminal prostheses was successful in all four patients in the present collective; follow-up examinations excluded the occurrence of endoleaks.

and the condition of the prosthesis were regular. Patient 2 developed symptoms of severe cerebral ischaemia with a large infarct visualised on one hemisphere and died 24 h later from the effects of a secondary central haemorrhage.

Systemic reactions suggestive of post-implantation syndrome, such as impaired renal function parameters, fever or leukocytosis were not observed.

Discussion

Conventional open repair of AAA with tube or bifurcation prostheses may be followed by the development of anastomotic aneurysms. According to Waibel et al., the occurrence rate for anastomotic aneurysms following conventional open aneurysm repair lies between 1.7% and 5%.18–22 Causative factors implicated in the development of these aneurysms

include technical errors such as extensive thrombendarterectomy in the area of anastomosis or placement of the central anastomosis at a site too far below the renal arteries, such that there may be renewed aneurysm formation in the remaining infrarenal aortic wall. In cases considered for endoluminal repair, infection as a cause of rupture must be excluded.

If the technical prerequisites, including exclusion of infection and sufficient length of the aneurysm neck (distance from the renal arteries to the proximal end of the anastomotic aneurysm >8 mm), were fulfilled, endovascular exclusion was possible.23–26 Implantation of endoluminal prostheses was successful in all four patients in the present collective; follow-up examinations excluded the occurrence of endoleaks.

It is important to avoid stenosis of the limbs of the endograft prosthesis in those cases in which the anchoring site of the second limb falls within the old primary prosthesis, with the result that the diameter of the primary prosthesis may preclude proper deployment of the endograft prosthesis. In patients who have undergone implantation of a tube prosthesis, the current diameter of the primary prosthesis is of particular importance. In patients with bifurcation prostheses, the distance from the renal arteries to the site of prosthesis bifurcation is also important. If the distance is too small, the endoprosthesis may come to rest within only one limb of the primary prosthesis, with the result that proper deployment of the new prosthesis is precluded. In such instances, conversion to open repair is inevitable. An alternative procedure to avoid this problem is to place an aorto-mono-iliac stent graft and perform cross-over bypass with a closure of the contralateral primary limb.

It is surprising to note the extent to which implantation of the primary prosthesis had resulted in shortening of the aorta. In three of four patients, a significantly shorter endograft was required (Cook 120 mm, AneuRx 135 mm). A standard industrial prosthesis with usual length of 150–170 mm would have closed the internal iliac artery in three cases.

Follow-up examination included the search for possible primary or secondary endoleaks occurring either in the area of the insertion of the prosthesis (type I) or from retrograde flow from the spinal arteries (type II). While peripheral and central type-I endoleaks can usually be treated easily using interventional coils, the management of type-II endoleaks may prove more difficult. Since conventional open surgery normally includes ligation of the spinal vessels, however, the occurrence of type-II endoleak is unlikely.

The risk profile of the four patients in the present collective was very high, which is underscored by the
death of two patients within the first postoperative month. In our opinion, however, the endoluminal management option may be advantageous to this group of patients with a history of multiple abdominal operations or with serious cardiopulmonary risk factors as compared with the more invasive open surgical repair. The short duration of the procedure (65–155 min), the low contrast medium application (100–150 ml) and the reduce fluoroscopy time (7–15 min) confirms the minimally invasive nature of the procedure in comparison with re-laparotomy for open surgical repair.

The remaining open question is whether the primary success in treating anastomotic aneurysms with endoluminal stent-graft placement will be confirmed by long-term treatment results.

In conclusion, anastomotic aneurysms were successfully treated using endoluminal stent-graft placement in four patients who had previously undergone conventional open surgical repair with implantation of tube or bifurcation prostheses. Although long-term results are not yet available, the method appears to be especially advantageous in patients with a history of multiple abdominal operations and in those at increased surgical risk.

References


Accepted 24 October 2000