Conservative Treatment of Aortic Graft Infection

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Introduction

An infected prosthetic graft of the aorta is still among the most unwelcome and challenging complications that the vascular surgeon has to tackle. Despite being uncommon, the reported incidence ranging from 1 to 6%, aortic prosthetic graft infections invariably portend high mortality and significant risk of limb loss.

The conventional approach comprises total excision of the infected prosthetic graft, oversewing of the aortic stump and lower-limb revascularisation by extra-anatomic bypass. Although recent series show that this management has improved mortality and morbidity rates, it remains far from ideal.

When knowledge of the natural history of graft infections was scarce, conservative management used to be the procedure of choice. It has now largely been abandoned due to unsatisfactory results. Yet in selected cases, notably patients with high surgical risks, a conservative approach may still be a valid option. Conservative treatment consists of surgical debridement, drainage, and local antibiotic or povidone-iodine irrigation, with complete graft preservation or otherwise percutaneous computed tomography (CT)-guided drainage with local and systemic antibiotic therapy. In specific circumstances both strategies yield encouraging results.

In this study we have evaluated the few published reports and our own experience with patients treated conservatively for infected aortic prosthetic grafts. Our aim was to determine whether conservative treatment should be reserved for patients at high operative risk or might be a useful initial therapeutic approach for all patients.

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Case Reports

Case 1

A 76-year-old man with a rectal carcinoma underwent elective resection of a symptomatic aortoiliac aneurysm in August 1989. The aorta was reconstructed by inserting a knitted Dacron bifurcated graft extending from the infrarenal aorta to the right external iliac artery and to the left common femoral artery, under systemic antibiotic coverage (cefotaxime 2 g i.v. and vancomycin 500 mg i.v. on induction of anaesthesia). Recovery was uneventful. One month later the patient was readmitted for treatment of the rectal tumour. He had no symptoms or signs of aortic graft infection. At operation a perigraft fluid collection was noted. After evacuation of the fluid and povidone-iodine irrigation two drainage tubes were placed along the graft. The rectum was resected (Hartmann procedure). Initial cultures isolated a pure growth of Enterobacter cloacae and the patient received treatment with i.v. piperacillin (3 g three times daily), amikacin (500 mg every 12 h) and metronidazole (500 mg three times daily). Antibiotic solution (gentamycin) was instilled through the drainage tubes until the effluent became sterile. After a 24-day course of drainage with local and systemic antibiotic treatment the patient was discharged on a regimen of oral systemic antibiotic therapy (ofloxacin). He remained asymptomatic for 2 years before dying of non-graft-related causes.

Case 2

In April 1994 a 76-year-old man underwent elective repair of an abdominal aortoiliac aneurysm and reconstruction with a knitted Dacron bifurcated graft, under systemic antibiotic coverage (cefotaxime 2 g i.v. and vancomycin 500 mg i.v. on induction of anaesthesia). Postoperative recovery was uneventful.
Three weeks after discharge the patient was readmitted because of fever (up to 39°C), malaise, pain in the left iliac fossa and acute abdominal symptoms. Laboratory findings on admission included leukocytosis (12 800) and an erythrocyte sedimentation rate of 115 mm/h. An ultrasound scan showed a fluid collection in the left iliac fossa and a CT scan documented a large abscess (maximum diameter 10 cm) surrounding the left iliac graft limb and the psoas muscle. Exploratory laparotomy showed a perigraft fluid collection. The fluid was drained and two irrigation tubes were inserted along the graft. Cultures of purulent material isolated *Escherichia coli*. The graft was irrigated with antibiotic solution (cefotaxime) injected through the drainage tubes and the patient received concomitant antibiotic therapy with i.v. amikacin (500 mg twice daily) and cefotaxime (2 g three times daily). Drainage tubes were removed 20 days later, when the effluent became sterile and CT-scan showed no perigraft fluid collection. The patient was discharged on a regimen of oral antibiotic therapy (ciprofloxacin), which he continued for 3 months. A follow-up CT-scan 18 months after surgery revealed no further signs of graft infection.

**Case 3**

A 68-year-old man underwent elective repair of an abdominal aortic aneurysm, under systemic antibiotic coverage (cefotaxime 2 g i.v. and vancomycin 500 mg i.v. on induction of anaesthesia), in July 1992. The aorta was reconstructed using a straight knitted Dacron graft with the proximal anastomosis just below the renal arteries. No postoperative complications occurred. Two months later the patient was readmitted because of intermittent-remittent fever and tachycardia of 2 days’ duration. Temperature was 38°C, white cell blood count was 12 000 and he had an increased erythrocyte sedimentation rate. The abdomen was non-tender and femoral pulses were present bilaterally. Real-time ultrasound of the pelvis showed a
fluid collection around the graft and a CT scan of the abdomen and pelvis showed a non-homogeneous retroperitoneal fluid collection, surrounding the entire graft from the proximal anastomosis to the aortic bifurcation. A leukocyte-labelled technetium 99-m hexamine scan showed increased radiotracer uptake in the graft region. Because of the foreseeable technical difficulty in undertaking a conventional operation (proximal anastomosis just below the origin of the renal arteries) we began CT-guided percutaneous drainage. Initial cultures of the aspirate (60 cm³) showed a pure growth of Staphylococcus epidermidis. Antibiotic solution (rifampicin) was injected through the drainage tube, around the graft. After a 3-week course of drainage and irrigation, two consecutive cultures yielded negative results and the drainage tube was removed. The patient was discharged on a regimen of oral antibiotic therapy (600 mg clindamycin daily), which he continued for 6 months. Follow-up CT scans 1 and 3 months after drainage showed no perigraft fluid collections. The last follow-up CT scan, at 42 months, still showed nothing abnormal around the aortic graft.

Case 4

An 81-year-old man, with heart disease, bilateral chronic arteriopathy and diverticulosis, underwent elective repair of an abdominal aortic aneurysm (maximum diameter 8 cm) in June 1994, with a knitted Dacron bifurcated graft extending from the infrarenal aorta to the bilateral common iliac arteries. The operation was performed under systemic antibiotic coverage (cefotaxime 2 g i.v. and vancomycin 500 mg i.v. on induction of anaesthesia). The patient had an uneventful postoperative course. Three weeks after discharge he had to be admitted urgently because of fever, vomiting, and a tender swelling in the left iliac fossa. Laboratory findings included a white cell blood count of 20,000 and an increased erythrocyte sedimentation rate. A CT scan showed evidence of a fluid collection around the aortic bifurcation and the left psoas muscle. The patient received amikacin (500 mg i.v. every 12 h) and cefotaxime (2 g i.v. three times daily). CT-guided percutaneous drainage yielded 1200 ml of purulent material. Cultures grew Escherichia coli. Antibiotic solution (cefotaxime in sterile saline) was infused through the drainage catheter. Local antibiotic therapy was continued for 21 days, two cultures resulted sterile and drainage was removed. A follow-up CT scan showed that the perigraft fluid had disappeared. On postoperative day 23 the patient was discharged from the hospital and continued taking oral antibiotic (500 mg ampicillin daily). He remained asymptomatic for 10 months when he died suddenly of liver failure. Post-mortem examination showed no evidence of prosthetic graft infection.

Discussion

Conventional treatment of aortic graft infection consists of total graft excision and revascularisation, as graft excision alone is rarely feasible. This treatment option has become the “gold standard” in the management of aortic graft infection, but results remain far from ideal. Yet its critics emphasise the risk of aortic stump dehiscence, the risk of re-infection of the extra-anatomic bypass used for revascularisation, and its poor long-term patency. As alternative approaches to conventional management in certain well-defined circumstances, many recent reports recommend in situ replacement or conservative treatment. In situ reconstruction avoids the potential risk of aortic stump blow-out and results in a lower incidence of limb loss. Its main drawback is the risk of severe complications owing to recurrent infection.

Reports published in the 1960s and 1970s commonly described patients with aortic graft infections treated conservatively. Surgeons’ reluctance to remove infected prostheses in the absence of overwhelming indications reflected their concern that removing a functioning graft could result in severe distal ischaemia and even limb loss. At that time methods for extra-anatomic reconstruction around the infected sites had not been well developed. Because it resulted in unsatisfactory mortality and reinfection rates, conservative treatment eventually became reserved almost exclusively for patients considered at high risk for conventional surgery.

Nevertheless, a deeper analysis of such results – in cases with complications and in those without them – allows the identification of a group of patients who may benefit from conservative treatment. Support for the importance of secondary complications in surgical failure came from our review of published reports of patients with aortic grafts treated conservatively (Table 1). In patients with graft-enteric erosions, fistula, bleeding or pseudoaneurysms, in terms of operative mortality (76.6%) or persisting infections eventually necessitating radical surgery (6.4%), conservative treatment achieved wholly unacceptable results. During postoperative follow-up ranging from 2 to 24 months, only 17% of the 94 patients described could reasonably
Table 1. Conservative treatment of aortic graft infection: difference of results in presence of secondary complications. Literature review.

<table>
<thead>
<tr>
<th>Cases of aortic graft infection with complications</th>
<th>No patients</th>
<th>Recovery treat.</th>
<th>Excis.</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases of aortic graft infection without complications</td>
<td>94</td>
<td>17%</td>
<td>4%</td>
<td>76.6%</td>
</tr>
<tr>
<td>Cases of aortic graft infection without complications†</td>
<td>43</td>
<td>65.1%</td>
<td>23.3%</td>
<td>18.6%</td>
</tr>
</tbody>
</table>

*Sharf'59, Hagland'59, MGH'59, Boyd'59, Cordell'60, Thistlewaite'60, Pollock'61, Dowse'62, Long'62, Hummers'63, Ferris'65, Van De Water'65, Wiernan'66, Donovan'66, Shell'69, Scharmelle'71, Szilagyi'72, Tobias'73, Elliot'74, Brenner'74, Ray'76, Becker'76, Buchbinder'80, Perdue'80, Puglia'80, Puppala'80, O'Mara'81, O'Hara'86, Thomas'86, Higgins'90.
†Van De Water'65, Conn'70, Szaflagi'72, Bouhoutsos'74, Christiansen'77, Liekweg'77, Crawford'77, Yashar'78, Knight'83, Almgren'85, Edwards'88, Francois'91, Wakefield'94, Morris'94.

Patients without secondary complications fared better. Of the 43 patients considered, with follow-up ranging from 21 to 61 months, 65.1% recovered without complications and 23.3% had reinfections that responded to conventional treatment. Overall mortality, including patients in whom persisting infections necessitated further surgery, reached 18.6%. Patients with uncomplicated graft infections without general or local contraindications undoubtedly need conventional treatment, patients without secondary complications — not only those at high surgical risk — could undergo conservative procedures.

The contraindications to conservative management include anastomotic complications, systemic sepsis, septic peripheral embolisation (a sign of severe bacterial colonisation of the graft) and all immune system disorders. Patients with uncomplicated graft infections without general or local contraindications seem to respond well to an initial conservative approach using percutaneous CT-guided or ultrasound-guided drainage with concomitant high-dose local and systemic antibiotic therapy. More frequent use of conservative treatment might lead to earlier diagnosis of infections, before secondary complications develop.

CT-guided percutaneous drainage is a relatively simple procedure. It is done under local anaesthesia and is far less traumatic for the patient than surgical drainage. After an initial scan to assess the ideal puncture site and patient’s position, a 12-French dual-lumen catheter (Van Sonnenberg type) is inserted percutaneously. The cavity is drained and, as long as the catheter remains in place, samples of drainage fluid are repeatedly cultured to isolate organisms for antibiotic susceptibility testing. An antibiotic solution is instilled locally into the cavity through the catheter once or more a day. Drainage catheters are left in place until the drain yields sterile fluid and CT scans no longer show a retroperitoneal fluid collection. Systemic antibiotic therapy, selected from susceptibility testing, is administered intravenously for 4–6 weeks; after this period patients must continue long-term oral antibiotic therapy (from 3 months to life-long).

Although CT-guided drainage is relatively widely used in clinical practice, especially in diagnosis, few published reports have addressed its therapeutic uses. Tobin reported one patient in whom an aortofemoral bypass graft infection developed 1 month after surgery and responded to CT-guided percutaneous drainage. Matley et al. also described one patient who had a thoracoabdominal aortic graft infection with a good outcome after conservative management. Svensson noted the diagnostic and therapeutic usefulness of percutaneous catheter drainage in patients with aortic graft infections at high operative risk for redo surgery. Hollier also recommended this approach as a valid alternative to conventional treatment in selected patients.

As well as being indicated in high surgical risk patients, we believe that CT-guided percutaneous drainage can be used as a first step in treating aortic graft infection provided that infection is diagnosed early, before complications have developed. CT-guided drainage is indicated only for infections caused by less virulent organisms with high sensitivity to antibiotic therapy and is contraindicated in all patients with immune system impairment.

Conclusions

At present the preferred treatment of aortic graft infection is total prosthetic graft excision, with lower limb revascularisation achieved by an extra-anatomic bypass through uninjected tissue planes. Conservative treatment by surgical drainage is an alternative approach, but is a compromise solution that has few advantages. In high surgical risk patients without complications, CT-guided percutaneous drainage may be a safer alternative than routine aggressive excision. It also helps diagnosis by allowing detection of the graft infection in bacteriological cultures and antibiotic sensitivity testing. We suggest that it be used as the initial approach in all patients, who have an early diagnosis of aortic graft infections without complications. It offers a good chance of recovery or improvement by reducing bacterial concentrations before planning graft excision. Future experience will verify...
the real value of percutaneous catheter treatment as a first step for managing patients with non-complicated aortic graft infections.

References


27. Case records of the Massachusetts General Hospital (case 4528).


