

Infected Thoracoabdominal Aortic Aneurysms Including the Major Abdominal Branches in 4 Cases

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We present four cases of infected thoracoabdominal aortic aneurysm (TAAA), including abdominal branches that underwent surgical repair. The mean age of patients at the time of operation was 61 ± 18 (range: 39–83) years. The extent of the aneurysm was Crawford type III in 1 case and type IV in the other 3. They all underwent an emergency or urgent operation, which consisted of a debridement of the infected tissue, in situ four-branched Dacron graft replacement, and iodine gauze packing for 48 h followed by omental wrapping of the graft. To prevent postoperative spinal ischemia, intercostal and lumbar arteries were reimplanted under motor-evoked potential (1.25 pairs per patient). There was one (25%) hospital death, but postoperative graft infection did not occur in these present cases during a mean follow-up period of 15 ± 43 (1–96) months. Antibiotics were administered intravenously for 8 weeks after the operation, then continued orally for a lifelong period. Postoperatively, paraplegia occurred in one (25%) patient. Our strategy for infected TAAA including major abdominal branches may prevent postoperative graft infection. (Ann Thorac Cardiovasc Surg 2008; 14: 196–199)

Key words: thoracoabdominal aortic aneurysm, infected aneurysm, in situ graft replacement

Introduction

Infected thoracoabdominal aortic aneurysms (TAAAs) are uncommon, but are associated with high mortality and morbidity. There is also a high risk of rupture compared with noninfected aneurysms.^{1,2)} It is challenging to do surgical repair for infected TAAAs, especially when the aneurysms include abdominal branches. In such cases, in situ graft replacement must be performed to ensure optimal flow to the abdominal branches. However, the possibility of postoperative graft infection and spinal cord is-

chemia are higher than that in reconstruction by an extra-anatomical bypass. We reported four cases of infected TAAAs, including the major abdominal branches, which were treated by our current strategy.

Patients and Our Strategy

Between January 1990 and April 2006, fifty-five patients with TAAAs underwent graft replacement in our hospital. Four (7.2%) of these had infected TAAAs, including abdominal branches. The extent of the aneurysm was characterized using the classification proposed by Crawford et al.,³⁾ in which type III was found in one and type IV in the other three. All four patients underwent an emergency or an urgent operation because the aneurysm had ruptured or was in a state of impending rupture. There were three males, and the mean age of the patients at the time of the operation was 61 ± 18 (39–83) years. The infected

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Fig. 1. Image obtained in a 39-year-old female with infected thoracoabdominal aortic aneurysm. Transverse contrast-enhanced computed tomography (CT) scan reveals a fusiform aneurysm with periaortic inflammation and fluid (arrow) measuring 74 × 81 mm in diameter.



Fig. 2. Image obtained in a 69-year-old male with infected thoracoabdominal aortic aneurysm. Transverse contrast-enhanced computed tomography (CT) shows a saccular aneurysm with periaortic abnormal fluid collection (arrow).

aneurysm was diagnosed after clinical findings of signs of infection and radiological findings, such as periaortic inflammation, and abnormal effusion surrounding the aneurysm (Figs. 1 and 2), aneurysm associated with a positive culture from blood or from an aneurismal wall, and pathological findings of the aneurismal wall. Preexisting infection was observed in 3 (75%) patients, in which a urinary tract infection was found in 2 and acute prostatitis in 1. A causative organism was demonstrated in 2 (50%) patients. One was *Klebsiella pneumoniae* from the blood culture of 1 patient, and the other was methicillin-sensitive *Staphylococcus aureus* (MSSA) from blood and tissue culture of the second patient. Another 2 patients were diagnosed as having infected TAAA mainly from pathological findings of the aneurismal wall that marked neutrophilic infiltration to the media and abscess formation around the aneurismal wall. Preoperatively, an Adamkiewicz artery (AKA) was not detected in any patients because an emergency or urgent operation was performed. Our current operative strategy for mycotic TAAAs, including major abdominal branches, consists of a distal perfusion with a normothermic partial bypass, wide debridement of the infected tissue, in situ graft replacement with a four-branched Dacron graft, segmental artery (segmental artery means intercostal and lumbar arteries), reimplantation under motor-evoked potentials (MEP), iodine soaked gauze packing after grafting for 48 h, and omental wrapping of the prosthetic graft at the time

of the wound's final closure. At the end of the first operation, only skin was closed. And at the time of the second operation, the omentum was harvested with the right gastroepiploic artery and completely covered all around the artificial graft. To prevent postoperative spinal cord ischemia, we used a distal perfusion of the aorta and segmental artery perfusion and reimplantation when the MEP decreased to less than 25% of its baseline.⁴⁾ The mean number of reimplanted segmental arteries was 1.25 (0-2) pairs per patient. Postoperatively, antibiotics were administered intravenously for 8 weeks, followed by oral administration for a lifelong period.

Results

One patient died from paralytic ileus resulting from mesenteric ischemia 35 days after the operation (hospital mortality: 25%). This critical state continued and resulted in sepsis from bacterial translocation. Moreover, he also suffered from paraplegia. His aneurismal wall was too fragile to reimplant the segmental arteries between Th 10 and the L2 level. His autopsy revealed no abnormal effusion around the prosthetic graft and demonstrated no bacterial body by microscopic examination. The remaining 3 patients were discharged from our hospital with no graft infection or any other complications, such as wound infection, pneumonia and renal insufficiency. One of the discharged patients died from an acute myocardial inf-

Table 1. Summary of our patients with infected thoracoabdominal aortic aneurysm

Patient Age/gender	Crawford type	Preexisting infection	Causative organism	Complication	Outcome	Follow-up (month)
54/M	IV	Urinary tract Infection	<i>K. pneumoniae</i>	None	Outpatient	96
39/F	IV	Unknown	Unknown	None	LD (AMI)	16
83/M	III	Acute prostatitis	Unknown	Paraplegia	HD (DIC)	1
69/M	IV	Urinary tract infection	MSSA	None	Outpatient	15

M, male; F, female; *K. pneumoniae*, *Klebsiella pneumoniae*; MSSA, methicillin-sensitive *Staphylococcus aureus*; HD, hospital death; LD, late death; AMI, acute myocardial infarction; DIC, disseminated intravenous coagulation.

arction 16 months after the operation. During the mean follow-up period of 15 ± 43 (1–96) months, no postoperative graft infection appeared.

The serum concentration of iodine was measured in one patient during the postoperative period. Although normal serum concentration ranges from 4–8 $\mu\text{g/dL}$, his serum showed an elevated level at 3870 $\mu\text{g/dL}$ at 2 days after iodine packing. This level decreased to within the normal range at 37 days after the operation. No patients developed any other complications related to thyroid function.

Discussion

Infected aortic aneurysms are uncommon, since the first report by Osler in 1855.⁵ It has been reported that the incidence of infected aneurysms is 0.7%–1.3% of all aortic aneurysms.^{1,6} Moreover, they have a higher risk of rupture than noninfected aneurysms,^{1,2} so they require an emergency or urgent operation before the infection can be well controlled. In three of our four cases (75%), the aneurysm had already ruptured (included impending rupture) at the time of the operation. Further, the management of infected TAAAs, including the major abdominal branches, remains controversial and challenging.

Among patients with an infected aortic aneurysm, the frequency of positive blood or tissue cultures ranges from 60%–70%.⁶ *Salmonella* and *Staphylococcus* species were the most common blood or organ cultures. In the present study, only 2 of 4 patients (50%) had positive blood cultures, which were *K. pneumoniae* and MSSA. The remaining two patients whose blood and organ cultures were negative were considered to have an infected aneurysm by clinical and operative findings, including pathological findings of the aortic wall. They were distinct from

the inflammatory aneurysms, which present marked thickening of the aneurismal wall and periaortic fibrosis and inflammatory process involving adjacent organs.⁷ Treatment for infected aneurysm was established using preoperative antibiotics, an operation that consists of the debridement of the infected tissues and an in situ graft replacement, and the administration of postoperative antibiotics. Published reports document in-hospital mortality rates of 11%–40% in which patients underwent surgery.^{1,2,8,9} Optimal surgery for infected aneurysms remains controversial whether done by an in situ graft replacement or by an extra anatomical bypass. But if the infected aneurysm includes the abdominal branches, such as the celiac artery, supramesenteric artery, or renal arteries, it is questionable whether adequate blood flow can be obtained to such branches by an extra anatomical bypass. Moreover, a rupture of the aortic stump and graft occlusion may occur postoperatively. So we implemented an in situ graft replacement using the four-branched Dacron graft in the present cases. In terms of graft materials, the use of cryopreserved arterial allograft and rifampin-soaked gelatin-sealed polyester graft for in situ graft replacement for aortic infection was reported to be the most effective method under these conditions.^{10,11} Although the cryopreserved arterial allograft is thought to have a higher resistance to infections than synthetic grafts, they are difficult to obtain in our hospital.

To prevent postoperative spinal ischemia, we used a normothermic partial bypass with sequential multisegmental aortic clamping.¹² However, the aneurismal wall is too fragile to do a multisegmental clamp for mycotic aneurysms. Postoperatively, paraplegia occurred in 1 of the 4 (25%) present cases, as compared with a fiftieth (1.9%) of our noninfected TAAA patients. In our elective cases of TAAAs, AKA is used to be detected on

multislice computed tomography (CT) or magnetic resonance imaging (MRI). But in our cases AKA was not detected because of emergency or urgency operation.

Postoperative infection control is one of the most important issues for mycotic aneurysms, and methods for the prevention of a recurrence of infection remains controversial. Several methods such as Omental wrapping to prevent graft infection and iodine-soaked gauze packing for infected artificial grafts were reported as effective methods.^{13,14} We did an Omental wrapping to the artificial graft in all four patients.

Our strategy for infected TAAAs, especially those including abdominal branches, consists of preoperative antibiotics, an in situ graft replacement using four branched Dacron grafts, and an omental wrapping to the graft, as well as the intravenous administration of antibiotics for 8 weeks followed by an oral administration for a lifelong period. Careful long-term follow-up is important in these patients for recurrent infection. White cell count and C-reactive protein tests are helpful to detect the graft infection, and we perform these tests every 4 months. Moreover, we also perform a CT scan to detect the abnormal effusion around the graft every 6 months for 1 year, and then annually.

We experienced 4 cases of infected TAAAs, including major abdominal branches. Our strategy for these conditions may be useful for preventing graft infection following surgery in our cases. However, further follow-up study must be made in a large number of patients to conclude the efficacy of our strategy for these conditions.

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