Treatment of Prosthetic Graft Infection after Thoracic Aorta Replacement

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Purpose: Prosthetic graft infection is a fatal complication after thoracic aorta replacement, and it is sometimes difficult to perform a prompt re-operation when the patient carries the infectious source of the graft. We evaluated the early and mid-term outcomes of aortic graft infection after thoracic aorta replacement, focusing on the timing of the surgery.

Methods: This study included eight consecutive patients with thoracic graft infection from 1997 to 2011 among 513 patients of graft replacement during this period. We performed re-graft replacement in six patients. Of these six patients, emergency surgery was performed in two and scheduled surgery was performed in two. An unscheduled emergency surgery was required in two patients during the medical treatment of the infection source. Solo medical treatment was performed in two patients.

Results: In-hospital mortality occurred in two of the eight patients (25%). Re-graft infection was not observed in the six patients who underwent re-graft replacement or the one patient who underwent medical treatment during the 1.5- to 14-year observation period.

Conclusions: Prompt re-replacement of the infected graft should be performed even when an orthotopic infection source led to the graft infection. Medical treatment might be applicable when neither an abscess nor pseudoaneurysm is observed.

Keywords: vascular graft, infection, thoracic aorta, re-operation, medical therapy

Introduction

Prosthetic graft infection is a fatal complication after thoracic aorta replacement, and its early mortality reaches as high as 25% to 42%. Removal of the infected graft and radical debridement have been considered mandatory. However, we sometimes encounter difficulties in performing prompt re-operation because of these high early mortalities when the patients' activities of daily living (ADL) are decreased because of neurological complications after the initial surgery. In addition, whether re-graft replacement of the infected graft should be initially performed while the patient carries the infectious source of the graft is controversial. Medical or surgical treatment for an orthotopic infection site might be given priority over surgical treatment of the infected graft because of the re-infection risk of a newly implanted graft in cases in which the persistent infection is the source of the graft infection. We evaluated patient characteristics and early and mid-term outcomes of aortic graft infection after thoracic aorta replacement, focusing on the timing of the surgery.

Materials and Methods

This study included eight consecutive patients in whom graft infection was observed from 1997 to 2011 among...
513 patients who underwent graft replacement of the thoracic aorta during this period in our institution. Written consent was obtained from the patients for publication of this study. The patients’ mean age was 66 ± 14 years, and one of the eight patients was female. The primary surgery was the Bentall operation in three patients, total arch replacement (TAR) in one, TAR with aortic valve replacement in one, TAR with the Bentall operation in one, TAR with mitral valve repair and coronary artery bypass graft in one, and ascending aorta replacement in one (Table 1). We used Teflon felt for enforcement of anastomosis in all patients. Seven of the eight patients presented with fever for 2 months to 6.5 years after the primary surgery, although one patient developed sudden hematemesis, 6 months after the primary surgery. Two patients carried a persistent orthotopic infection that led to the graft infection, and the other six patients had no obvious orthotopic infection source such as dental caries and respiratory infection or wound infection. The diagnosis of the graft infection was made by blood culture, echocardiography (UCG), computed tomography (CT), and gallium scintigraphy in addition to the presence of persistent fever. Blood culture was positive in seven of the eight patients, and we found methicillin-sensitive Staphylococcus aureus (MSSA) in three patients and methicillin-resistant Staphylococcus epidermidis in two patients. Alpha streptococcus and Enterococcus faecalis were found in one patient, and Streptococcus hominis was observed in one patient. Manifestations of the graft infection were abscessation around the primary graft in four patients, pseudoaneurysm of the proximal anastomosis in one, esophageal-aorta fistula in one, increased fat density around the graft on CT in one, and accumulation around the graft on positron emission CT in one (Table 1).

We performed re-graft replacement in six patients. Of these six patients, emergency surgery was performed in two patients and scheduled surgery was performed in two. An unscheduled emergency surgery was required for two patients during the medical treatment of pyogenic spondylitis and an infected pressure sore with purulent discharge. Solo medical treatment was performed in two patients.

Results

Emergency and urgent re-graft replacement

Four patients underwent an emergency or scheduled operation.

In Case 4, the patient who had undergone ascending aorta replacement for acute aortic dissection 2 months earlier developed a fever. UCG and CT revealed a pseudoaneurysm of the proximal anastomosis of the primary TAR with severe aortic regurgitation 1 month after the fever onset. An emergency Bentall operation was performed, preserving the distal site of the primary ascending graft because no sign of the infection was observed at the distal site. The patient died of low output syndrome on postoperative day 1.

We also performed an emergency partial graft
replacement in Case 5. The patient presented with chest pain and hematemesis 8 months after TAR with mitral valve repair and coronary artery bypass graft. CT revealed an esophageal-aorta fistula around the distal anastomotic end of the TAR, and the primary graft was partially replaced with a new graft. We could not perform an esophagectomy because the patient was hemodynamically unstable during the surgery. He died of sepsis 18 days after the re-graft replacement.

In Case 2, persistent fever and hemiplegia were observed 14 years after the primary Bentall operation. CT revealed an abscess around the composite graft and a brain abscess with hemorrhage. We performed a Cabrol operation after 21 days of medical treatment with benzylpenicillin, cefazolin, and gentamicin because of the brain hemorrhage. The newly implanted graft was wrapped with omentum after 3 days of mediastinal irrigation with 0.1% povidone-iodine solution because we could not simultaneously perform re-graft replacement and omentum wrapping due to patient’s condition. He was discharged from the hospital without major neurological complications.

In Case 8, the patient had undergone a Bentall operation and ascending aorta replacement with a freestyle aortic valve and vascular graft 2 years earlier. He presented with a fever, and Staphylococcus hominis was recovered from a blood culture. UCG revealed vegetation on the freestyle aortic valve. We administered cefazolin and imipenem for 15 days during further examination and performed a re-Bentall operation and ascending aorta replacement with a composite graft and vascular graft after complete removal of the primary graft and freestyle valve. The newly implanted graft was wrapped by pleura, and the patient recovered without major complications.

Medical treatment → emergency surgery

Two patients initially underwent medical therapy because one had pyogenic spondylitis and the other had an infected pressure ulcer and paraplegia.

In Case 1, the patient suffered lumbago and fever 8 months after the initial Bentall operation, but only occasionally took oral minocycline. No further examinations or treatments were carried out. He complained of chest pain 3 months after the fever onset. CT revealed bone destruction with abscess formation in the L2 spine in addition to a pseudoaneurysm of the proximal anastomosis of the Bentall graft. Sequential administration of vancomycin, teicoplanin, and arbekacin was started to reduce the risk of re-infection of the newly implanted graft. However, his chest pain became exacerbated and dyspnea appeared 22 days after the medical treatment. UCG showed moderate aortic regurgitation, and we performed an emergency surgery. A composite graft was detached from the aortic annulus, although no vegetation or abscess was found. A re-Bentall operation was performed with graft wrapping by the omentum after radical removal of the infected composite graft.

In Case 3, the patient who had undergone TAR for acute aortic dissection 1 year and 7 months prior presented with fever, and CT revealed an abscess around the ascending aortic graft. We also initially performed medical treatment with ampicillin, gentamicin, and rifampicin combined with endoscopic mediastinal drainage because the patient had paraplegia after the initial surgery and pressure sore infection with purulent discharge. Massive hemorrhage from the drain was observed 20 days after the medical treatment was started. Emergency re-TAR was performed with graft wrapping with omentum after

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Table 2  Treatment and outcomes

<table>
<thead>
<tr>
<th>Case</th>
<th>Wound infection</th>
<th>Time from fever to re-operation</th>
<th>Treatment</th>
<th>Outcome</th>
<th>Re-graft infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>–</td>
<td>3 months and 22 days</td>
<td>Medical → AR → emergency Bentall + omentum wrapping</td>
<td>Alive</td>
<td>–</td>
</tr>
<tr>
<td>2</td>
<td>–</td>
<td>21 days</td>
<td>Urgent Cabrol → omentum wrapping</td>
<td>Alive</td>
<td>–</td>
</tr>
<tr>
<td>3</td>
<td>–</td>
<td>16 days</td>
<td>Medical → graft detachment → Emergency TAR + omentum wrapping</td>
<td>Alive</td>
<td>–</td>
</tr>
<tr>
<td>4</td>
<td>–</td>
<td>1 month</td>
<td>Emergency Bentall</td>
<td>Death</td>
<td>–</td>
</tr>
<tr>
<td>5</td>
<td>–</td>
<td>0 days</td>
<td>Emergency graft replacement</td>
<td>Death</td>
<td>–</td>
</tr>
<tr>
<td>6</td>
<td>–</td>
<td>–</td>
<td>Medical</td>
<td>Alive</td>
<td>+</td>
</tr>
<tr>
<td>7</td>
<td>–</td>
<td>–</td>
<td>Medical</td>
<td>Alive</td>
<td>–</td>
</tr>
<tr>
<td>8</td>
<td>–</td>
<td>15 days</td>
<td>Urgent Bentall + pleura wrapping</td>
<td>Alive</td>
<td>–</td>
</tr>
</tbody>
</table>

AR: aortic regurgitation; TAR: total arch replacement
infected graft removal and debridement. These two patients fully recovered without newly observed complications, and re-infection of the newly implanted graft was not observed for 21 to 29 months of observation after the re-operation.

**Solo medical treatment**

Medical treatment was chosen for the two patients because no abscess, vegetation, or pseudoaneurysm was found on transesophageal echocardiogram (TEE) or CT (Table 2).

In Case 6, the patient who had undergone TAR and the Bentall operation for acute aortic dissection 12 months prior presented with a fever. Alpha streptococcus was detected in a blood culture, and positron emission CT showed accumulation on the ascending and arch grafts with 6.4 of the maximum standardized uptake (Fig. 1).

However, no abscess or pseudoaneurysm was found. Ampicillin and vancomycin were intravenously administered for 2 weeks. He was discharged from the hospital after the fever had disappeared and the complete blood cell count and C-reactive protein level had decreased to normal. However, he was re-admitted to the hospital and was given antibiotics thrice in the 3 years after the first medical treatment. He declined re-operation because he suffered paraplegia and decreased ADL after the initial surgery. Gallium scintigraphy and PET showed accumulation on the remaining ascending and arch grafts, but no abscess or pseudoaneurysm was found on the most recent CT.

The patient in Case 7 underwent medical treatment with cefazolin, gentamicin, and meropenem. We performed TAR and aortic valve replacement 6 years and 6 months prior, and the patient presented with a fever. CT showed...
increased density in the fat around the ascending graft (Fig. 2). MSSA was recovered from a blood culture. We started intravenous administration of cefazolin, gentamicin, and then meropenem according to the sensitivity of MSSA on blood culture. He recovered without complications after 28 days of antibiotic therapy and showed no signs of infection during 3 years of observation.

Overall, in-hospital mortality occurred in two of eight patients (25%) (Table 2). Re-graft infection was not observed in the six patients who underwent re-graft replacement and the one patient who underwent medical treatment during the 1.5- to 14-year observation period. The one patient who underwent medical treatment developed another fever and was again admitted to the hospital for antibiotic therapy.

**Discussion**

In the treatment of prosthetic graft infections, radical debridement and infected graft replacement have been considered ideal surgical procedures. However, the in-hospital mortality of graft replacement is very high at 25% to 42%. One option for surgical treatment is preservation instead of removal of the prosthetic graft because removal of the graft is technically difficult and requires a long period of cardiac arrest, which may increase morbidity and mortality. The early mortality with salvage of the prosthetic graft was recently reported as 9% to 25%. In one study, mediastinal debridement was performed without removing the infected graft when the patient presented with a sternal wound infection. We removed the infected graft in all of our cases with the exception of two patients who underwent solo medical treatment because no patients had wound infections. The in-hospital mortality was 25% and late mortality was 0% during the 1.5- to 14-year observation period, although we did not salvage the infected graft. The mortality rate among our patients is considered to be acceptable.

When an abscess or pseudoaneurysm is observed, early re-graft replacement should be performed even when the patient has an orthotopic infection source that might lead to graft infection. In this study, two of two patients required emergency surgery for graft detachment during medical treatment of orthotopic infection. We found no studies describing which treatment should be primarily performed between the infected aortic graft and the orthotopic infection source of the graft infection, although prompt removal of the infected graft and re-replacement is recommended when the patient does not have mediastinitis. Our two patients recovered without severe complications, and re-infection of the graft was not observed for more than 21 months, suggesting that early re-graft replacement should be initially performed even when the patient has an orthotopic source of graft infection.

Omentum wrapping is considered to be an effective treatment. In our series, three of six patients underwent omentum wrapping of the newly implanted graft and one patient underwent pleura wrapping, although two patients were in critical condition during the surgery and could not undergo wrapping of the new graft. All four patients who underwent omentum or pleura wrapping survived, and there were no signs of re-infection for 21 to 180 months of observation in these patients. In several papers, pedicled omentum was used to successfully treat mediastinitis and aortic graft infection after aortic arch replacement combined with vacuum-assisted closure. In addition, omentum wrapping of a cryopreserved homograft was reliable in the treatment of aortoesophageal fistula, although only one paper showed that a pleura patch was effective for aortoenteric fistula. Wrapping of the newly implanted graft by omentum is considered to be a favorable concomitant procedure for graft infection with graft re-replacement.

Medical treatment may be an alternative for prosthetic graft infections if the patient does not present with an abscess or pseudoaneurysm. Few papers have reported medical treatment of prosthetic graft infections after thoracic aorta replacement. In our study, two patients who underwent solo medical treatment are living normal
daily lives in spite of decreased ADL, and no vegetations or pseudoaneurysms have been found for more than 3 years. Medical treatment without surgery might be an option for patients with decreased ADL after the initial graft replacement, although a longer observational period and more case studies are warranted.

**Conclusions**

Prompt re-replacement of the infected graft should be performed even when the patient has an orthotopic infection source that led to the graft infection. Medical treatment might be applicable when an abscess and pseudoaneurysm are not observed on TEE and CT.

**Disclosure Statement**

None declared.

**References**


