Case report - Vascular thoracic
The treatment of infectious aneurysms in the thoracic aorta; our experience in treating five consecutive patients

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Received 26 June 2009; received in revised form 8 October 2009; accepted 8 October 2009

Abstract

The surgical strategy for infected thoracic aortic aneurysms (ITAA) remains controversial. Effective antibiotic therapy is mandatory and surgical intervention is indicated only to prevent an aneurysmal rupture. In-situ reconstruction through an aseptic route is ideal; however, urgent surgery is often required in the uncontrolled infectious phase. Five patients were recently treated surgically for ITAA. They were all males with a mean age of 61.2 (range: 58–66) years. Two patients were operated on urgently in the active infectious phase due to impending aneurysmal rupture. A total arch reconstruction with an extra-anatomical bypass between the ascending aorta and both femoral arteries in one and an extended aortic arch resection with an in-situ graft reconstruction were performed in the other. The other three patients underwent in-situ graft reconstructions in the controlled infectious phase. Four patients had multiple aneurysms, including nine saccular or nodular aneurysms. Short-interval computed tomography (CT) re-examinations revealed a rapid enlargement of the aneurysms and confirmed the diagnosis. All patients successfully survived and are doing well without any evidence of a recurrent aortic infection. The surgical strategy for ITAA should be determined on a case-by-case basis under a careful follow-up with short-interval CT re-examinations.

Keywords: Infected aneurysm; Thoracic aneurysm; Surgical reconstruction

1. Introduction

The major concerns regarding the surgical treatment for infected thoracic aortic aneurysms (ITAA) are the control of infection, the resection of the entire infected tissue, grafting via an aseptic route and the prevention of recrudescence infection. Therefore, effective antibiotic therapy is mandatory and surgical intervention is indicated only to prevent aneurysmal rupture. Five patients recently underwent successful surgery for ITAA. The surgical strategies should be determined on a case-by-case basis because they revealed various clinical courses.

2. Patients and methods

2.1. Patient demographics

Five patient were treated surgically for ITAA from 2005 to 2008. Patient demographics are listed in Table 1. The cases demonstrated obvious fever in four, low-grade fever in one and chest and/or abdominal pain in three cases. Multiple blood cultures were performed in each case but only one revealed positive blood cultures. ITAA was diagnosed based on the radiological findings for the screening of infectious foci in addition to their clinical infectious symptoms.

Four cases had multiple aneurysms and there were nine aneurysms. All aneurysms demonstrated either a saccular or nodular type (Fig. 1). Short-interval (week by week) computed tomography (CT) re-examinations are important to confirm the diagnosis of ITAA. The CT findings revealed a rapid enlargement of the aneurysms in all cases. The average maximum aneurysmal diameter at the time of surgery was 55.6 mm (range: 45–70 mm). The average enlargement ratio of the aneurysm diameter was 9.1 mm/week (range: 0–40 mm/week) (Table 1).

2.2. Treatment

Antibiotic therapy is listed in Table 1. Surgical intervention was basically performed in a controlled infectious state after sufficient antibiotic therapy; however, an urgent operation was applied for an impending aneurysmal rupture, when short-interval CT re-examinations revealed an abrupt aneurysmal expansion over 20 mm/week in diameter, even in the active infectious phase (Fig. 1). The surgical procedure should thus be determined on a case-by-case basis.

Surgery was performed in the controlled infection phase in three cases; however, the other two cases underwent urgent surgery in the active infectious phase. A total arch reconstruction and an extra-anatomical bypass between the ascending aorta and both femoral arteries were urgently performed without cardiopulmonary bypass via a median sternotomy, and the infected distal arch aneurysm was resected via left thoracotomy in one patient because of left pyothorax and septicemia. A complete excision of the infected abdominal aortic wall and in-situ grafting with the
Table 1
Patient demographics

<table>
<thead>
<tr>
<th></th>
<th>Age/sex phase</th>
<th>Symptoms</th>
<th>Coexisting disease</th>
<th>Max WBC, max CRP</th>
<th>Blood culture</th>
<th>Location and size of aneurysm</th>
<th>Antibiotics</th>
<th>Surgical procedure</th>
<th>Outcome discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>63 M active</td>
<td>Fever, lumbago hoarseness</td>
<td>Peritonitis, HT</td>
<td>WBC 39,000, CRP 42.8</td>
<td>Streptococcus pyogenes</td>
<td>Distal arch; 50 → 90 mm/week AAA; 50 → 60 mm/week</td>
<td>ABPC, CLDM</td>
<td>Urgent staged operation 1) arch reconstruction + extra-anatomical bypass (Asc. AO-FA) via median sternotomy, infected graft resection via left thoracotomy 2) AAA resection, in-situ grafting with left renal artery reconstruction</td>
<td>Prolonged ventilation, 83rd POD</td>
</tr>
<tr>
<td>2</td>
<td>66 M active</td>
<td>Fever, cough</td>
<td>IHD, HT, af</td>
<td>WBC 11,800, CRP 17.5</td>
<td>Negative</td>
<td>Distal arch; 40 → 70 mm/10 days AAA; 30 → 40 mm/10 days</td>
<td>LVFX, IPM</td>
<td>Urgent staged operation 1) extended arch resection and in-situ graft reconstruction with Maze procedure 2) AAA resection and in-situ Y grafting</td>
<td>Chylothorax, 90th POD</td>
</tr>
<tr>
<td>3</td>
<td>58 M controlled</td>
<td>Fever, weight loss, abdominal pain</td>
<td>DM, HCV</td>
<td>WBC 17,800, CRP 7.2</td>
<td>Negative</td>
<td>DTAA; 45 → 60 mm/month, TAA; 45 → 45 mm/month</td>
<td>CTRX, GM</td>
<td>Elective single operation with CSF drainage TAA resection and in-situ reconstruction DTAA resection and in-situ reconstruction</td>
<td>Uneventful, 30th POD</td>
</tr>
<tr>
<td>4</td>
<td>59 M controlled</td>
<td>Subfever, abdominal pain</td>
<td>COPD</td>
<td>WBC 8500, CRP 7.5</td>
<td>Negative</td>
<td>TAA; 45 → 45 mm/month Infra-renal; 60 → 70 mm/month</td>
<td>CTRX</td>
<td>Elective single operation DAA untouched</td>
<td>Uneventful, 14th POD</td>
</tr>
<tr>
<td>5</td>
<td>60 M controlled</td>
<td>Fever</td>
<td>Chest TB, AP, af</td>
<td>WBC 16,700, CRP 17.3</td>
<td>Negative</td>
<td>DTAA; 35 → 60 mm/3 months</td>
<td>LVFX, IPM, GM</td>
<td>Elective single operation with CSF drainage DAA resection and in-situ resection</td>
<td>Uneventful, 17th POD</td>
</tr>
</tbody>
</table>

TAAA, thoracoabdominal aortic aneurysm; DTAA, descending thoracic aortic aneurysm; AAA, abdominal aortic aneurysm; AP, angina pectoris; DM, diabetes mellitus; HD, hemodialysis; af, atrial fibrillation; TB, tuberculosis; HT, hypertension, CSF; spinal cord fluid; M, male.
left renal artery was performed three days after the first operation. All of the infected tissue in the aortic arch and distal arch was resected and in-situ graft reconstruction was performed in another case in the active phase, by using deep hypothermic selective cerebral perfusion through an upper partial median sternotomy with a left anterior thoracotomy, and in-situ Y graft replacement was performed at three days after the first operation. The other three patients were operated electively in the controlled infectious phase as described in Table 1. Postoperative CT examinations were scheduled 1, 3, 6 months and one year after surgery and blood examinations were coincidentally performed thereafter.

3. Results

Two patients in the active infection phase received antibiotics for 4–6 weeks after surgery until their blood C reactive protein levels normalized. One was complicated with chylothorax after surgery, but both patients were discharged from the hospital within three months after surgery. Three patients in the controlled infection phase were placed on antibiotic therapy within a week and were discharged several weeks after surgery without any complications.

All specimens of the aneurysm, even in controlled infection phase, revealed the presence of lymphocytes and neutrophils, while plasma cells invaded the aortic tissue with signs of an infected aneurysm.

All patients survived and were doing well without any evidence of a recurrent aortic infection or developing a de novo aneurysm with a mean follow-up period of 31 (range: 12–50) months.

4. Discussion

The diagnosis of ITAA is generally and comprehensively made based on the symptoms, laboratory data and CT findings. Therefore, ITAA is mostly suspected as a result of the CT findings and a short-interval CT re-examination is essential to confirm the correct diagnosis. CT scans commonly demonstrate a rapid enlargement of the aneurysmal lumen and soft tissue mass surrounding the aorta due to the progression of the aneurysmogenic processes. Mullar et al. reported CT scans in ITAA to reveal aortic nodularity, irregular configuration, and rupture of calcification or air in an aortic wall [1]. The multiple aneurysms demonstrating either a saccular or nodular type with a rapid expansion in the size are the most typical CT findings for ITAA.

Elective surgery is ideal in patients demonstrating a controlled infectious state. Therefore, sufficient antibiotic therapy is mandatory; however, urgent surgery is sometimes unavoidable due to a risk of aneurysmal rupture. It is therefore still difficult to determine the optimal timing for surgery. Short-interval CT re-examinations are also helpful to determine the optimal timing for surgical intervention in such cases. A case with an abrupt aneurysmal expansion of over 20 mm/week should be indicated for urgent surgery as an impending aneurysmal rupture.

The major concerns of surgical treatment against ITAA are a resection of all of the infected tissue and the reconstruction of the vessels via an aseptic route. The exclusion or debridement of an infected aneurysm and the surrounding tissues is essential. However, when such patients are easily complicated with pyothorax, then an in-situ reconstruction

![Fig. 1. (a) chest CT findings of case 2 at admission; (b) chest CT findings of case 2 at one week after (a); (c) chest CT findings of case 2 at ten days after (b). The distal arch aorta revealed an ulcer like protrusion with a low-density mass under a thickened and enhanced adventitia at first and an aneurysm expanded abruptly from 40 mm to 70 mm in a diameter within ten days.](https://academic.oup.com/icvts/article-abstract/10/2/334/645886)
should be avoided to prevent re-infection, while an extra-anatomical bypass is feasible [2, 3].

The use of a woven Dacron graft soaked with antibiotics has been reported to prevent graft infection even during in-situ replacement [2, 4, 5]. Prosthetic woven Dacron grafts soaked with Rifampicin were applied in three of the current patients. A homograft, although unusable at this institution, is known to better resist bacterial colonization and present better mechanical properties than prosthetic grafts.

The treatment of ITAA is principally based on the use of antibiotic therapy. Surgical intervention is indicated only for the prevention of an aneurysmal rupture. The surgical strategy for ITAA should be determined on a case-by-case basis with a careful follow-up including short-interval CT re-examinations.

References


eComment: Endovascular treatment of mycotic aneurysm as a definitive therapy or bridge to surgery in critically ill patients

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doi: 10.1510/icvts.2009.215046A

I read with interest the paper by Nakashima et al. on the surgical management of mycotic aneurysms of the aorta [1]. In spite of the advances in surgical techniques, postoperative care and antibiotics, the mortality and morbidity rates associated with conventional open surgical treatment of mycotic aneurysms are reported to be as high as 40% [2, 3]. Congratulations to the authors for their excellent surgical results in these really tough cases.

There are a few reports in the literature on successful endovascular management of infected aortic aneurysms [4, 5]. Also, we have a very limited experience on stent graft treatment of an infected post surgical pseudoaneurysm of the aorta presented with aortobronchial fistula. According to these reports, we believe that this type of minimally invasive treatment should be considered in very selected cases, especially for those patients who are critically ill and in sepsis condition. According to clinical response and results of imaging studies endografting can be considered the definitive treatment or a bridge to surgery as an interval to clinical stabilization of sepsis patients. More experience is needed to clarify the role of endovascular treatment in the management of mycotic aortic aneurysm.