Endovascular therapy for infected aortic aneurysms

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Objective: To determine the outcome of endovascular therapy for an infected aortic aneurysm in patients with or without aorto-aerodigestive/aortocaval fistulas.

Methods: From September 2005 to May 2010, 21 patients, 17 abdominal and four thoracic infected aortic aneurysms were treated with an endovascular stent graft at Songklanagarind Hospital, Thailand. Five patients presented with fistula complications, 1 aorto-sophageal, 1 aortobronchial, 1 aortocaval, and 2 aortoenteric fistulas. Lifelong antibiotics were planned for all patients. In-hospital mortality and follow-up outcomes were examined.

Results: The average age was 66 years (range, 42-84) and 18 patients were male. All five cases in the fistulous group presented with symptoms related to the organs involved, four massive bleedings and one congestive heart failure. Symptoms of patients in the non-fistulous group were abdominal, back, or chest pain in 94%, fever in 81%, and diarrhea in 19%. Blood culture was positive in 10 patients (48%): eight Salmonella spp and two Burkholderia pseudomallei. The overall in-hospital mortality was 19% (4/21); 60% (3/5) in the fistula group and only 6% (1/16) in the nonfistula group. One conversion to open repair was performed in the fistula group 2 weeks after the endovascular procedure. During the follow-up period, one of the two survivors in the fistula group died at 18 months from unrelated causes, while there were no deaths in the 15 patients of the nonfistula group with an average patient follow-up of 22 months (range, 1-54). Periaortic inflammation and aneurysms in the nonfistula group completely disappeared in 10 of the 15 patients (67%). The aneurysm significantly shrank in four patients (27%), and was stable at 1 month in one patient. There were no late conversions.

Conclusion: Endovascular therapy, as a definite treatment for infected aortic aneurysms, provided excellent short- and medium-term results in patients without fistula complications. However, a poorer outcome was evident in patients with fistula complications. (J Vasc Surg 2011;54:1259-65.)

An infected aortic aneurysm is rare and considered to be one of the most challenging problems faced by vascular surgeons. The standard treatment of performing an open repair with a resection of the infected aortic segment, extensive debridement of the surrounding tissue, and in situ or extra-anatomic bypass carries a significant morbidity and mortality rate. Operative mortality has been reported to be as high as 44%. 1-4

Endovascular aneurysm repair (EVAR), a less invasive option for patients with this serious condition, was first reported by Sembeta et al. 5 Over the past decade, there have been many reports of successful EVAR for infected aortic aneurysms, even though some patients experienced an unfavorable outcome. 5-14 Most of the reports had a small number of patients with a short-term follow-up. Controversy continues over the role of EVAR, whether it should be considered as a definite treatment or more of a “bridge-procedure” to improve a patient’s condition awaiting open repair.15

In the past several years in our hospital, EVAR has been our preferred choice of treatment in patients with infected aortic aneurysm since these patients are considered to be high risk for open repair. In this study, we review our experience of EVAR in infected aortic aneurysms with or without fistula complications and assess its efficacy and durability.

METHODS

From September 2005 to May 2010, 21 consecutive patients with infected thoracic or abdominal aortic aneurysms (TAA or AAA) were treated with an endovascular stent graft at our institution, Songklanagarind Hospital in southern Thailand (17 abdominal and 4 thoracic infected aortas). Infected aortic aneurysms were diagnosed and categorized into two groups based on the following criteria:

Group I – Fistulous group: Patients who presented with clinical evidence of fistulous complications of an aortic aneurysm, including aortoenteric, aortobronchial, aorto-sophageal, and aortocaval fistulas.

Group II – Non-fistulous group: Patients who presented with clinical evidence of bacterial aortitis or infected aortic aneurysm (fever, abdominal/back, or chest pain), with-
RESULTS

There were 18 males and three females with an average age of 66 years (range, 42-84 years) enrolled in the study. Two patients with HIV infection had their diseases at a younger age than the average, 42- and 48-years-old. Sixteen patients presented with clinical symptoms of microbial aortitis or infected preexisting aortic aneurysm without fistula, while five presented with fistula complications: one aorto-oesophageal, one aortobronchial, one aortocaval, and two aortoenteric fistulas.

Patient comorbidities are shown in the Table. There was no difference in comorbidities between the groups. The prevalence of diabetes mellitus was quite high, at 40% and 44% in the fistulous and nonfistulous groups, respectively.

As shown in the Table, the clinical presentations of the patients with fistulous complications were specific to the organ involved. The first case (F1) was a 79-year-old male with an 8-cm thoracic aortic aneurysm who presented with hemoptysis. The second case (F2) was a 50-year-old male who had developed congestive heart failure from an aortocaval fistula after he had been treated for salmonella septic arthritis for 8 weeks. Another three cases presented with massive gastrointestinal bleeding and hypotension (defined as systolic blood pressure <80 mm Hg). Preoperative hemoglobin readings of these three cases (F3-5) were 8.1 g%, 7.1 g%, and 8.5 g%.

For patients in the nonfistulous group, 81% (13/16) had fever, 94% (15/16) had abdominal, back, or chest pain, and 19% (3/16) had diarrhea. Leukocytosis (defined as white blood cell count >10 × 10^9/L) was found in 80% (4/5) and 75% (12/16) of the fistulous and nonfistulous

Table. Medical comorbidities, clinical presentations, and outcomes of the fistulous and nonfistulous infected aortic aneurysm patients

<table>
<thead>
<tr>
<th>Pt</th>
<th>Sex</th>
<th>age (range, 42-84 years)</th>
<th>Diagnosis</th>
<th>Associated disease</th>
<th>Clinical presentation</th>
<th>WBC (×10^9/L)</th>
<th>Pre-op images</th>
<th>Prior ABIs</th>
</tr>
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<tbody>
<tr>
<td>F1</td>
<td>M</td>
<td>79</td>
<td>Aortobronchial fistula</td>
<td>HTN</td>
<td>Hemoptysis</td>
<td>9.2</td>
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<tr>
<td>F2</td>
<td>M</td>
<td>50</td>
<td>Aortoenteric fistula</td>
<td>DM, CKD</td>
<td>Fever, CHF</td>
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<tr>
<td>F3</td>
<td>M</td>
<td>60</td>
<td>Aortoenteric fistula</td>
<td>DM</td>
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<td>18.8</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>F4</td>
<td>M</td>
<td>62</td>
<td>Aortoenteric fistula</td>
<td>COPD, CAD</td>
<td>Fever, GI bleeding</td>
<td>14.9</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>F5</td>
<td>F</td>
<td>84</td>
<td>Aorto-enteric fistula</td>
<td>DM, CKD, stroke</td>
<td>Fever</td>
<td>7.6</td>
<td>L</td>
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<tr>
<td>N1</td>
<td>F</td>
<td>65</td>
<td>Infected AAA</td>
<td>DM, CKD</td>
<td>Pan, fever</td>
<td>13.0</td>
<td>L</td>
<td>Yes</td>
</tr>
<tr>
<td>N2</td>
<td>M</td>
<td>79</td>
<td>Infected AAA</td>
<td>DM, HTN</td>
<td>Pan, fever</td>
<td>7.6</td>
<td>L</td>
<td>Yes</td>
</tr>
<tr>
<td>N3</td>
<td>M</td>
<td>79</td>
<td>Infected AAA</td>
<td>DM</td>
<td>Pain, fever</td>
<td>13.8</td>
<td>L</td>
<td>Yes</td>
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<tr>
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<td>F</td>
<td>42</td>
<td>Infected AAA</td>
<td>HIV</td>
<td>Pain, diarrhea</td>
<td>11.9</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>N5</td>
<td>M</td>
<td>59</td>
<td>Infected AAA</td>
<td>HTN</td>
<td>Pain, fever</td>
<td>13.0</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>N6</td>
<td>M</td>
<td>67</td>
<td>Infected AAA</td>
<td>HTN</td>
<td>Pain, fever</td>
<td>22.6</td>
<td>L</td>
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<tr>
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<td>48</td>
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<td>9.6</td>
<td>L</td>
<td></td>
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<td>HTN</td>
<td>Pain, fever</td>
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<td>M</td>
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<td>Infected AAA</td>
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<td>Pain, fever</td>
<td>13.4</td>
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<td>M</td>
<td>58</td>
<td>Infected AAA</td>
<td>DM, HTN</td>
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<td>11.2</td>
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<td>70</td>
<td>Infected AAA</td>
<td>CAD</td>
<td>Pain, fever</td>
<td>7.5</td>
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<td>N13</td>
<td>M</td>
<td>58</td>
<td>Infected AAA</td>
<td>DM, HTN, CKD</td>
<td>Pain, fever</td>
<td>11.9</td>
<td>L</td>
<td></td>
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<td>N14</td>
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<td>74</td>
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<tr>
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<td>63</td>
<td>Infected AAA</td>
<td>DM</td>
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<tr>
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<td>M</td>
<td>73</td>
<td>Infected AAA</td>
<td>DM</td>
<td>Pain, fever, diarrhea</td>
<td>11.1</td>
<td>L</td>
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</tr>
</tbody>
</table>

AAA, Abdominal aortic aneurysm; AE, aorto-enteric device; CAD, coronary artery disease; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; DM, diabetes mellitus; HIV, human immunodeficiency virus; HTN, hypertension; I, peri-aortic inflammation; L, aortic leakage.

out fistulous complications. In cases with negative blood culture, in addition to the clinical symptoms of fever and pain, the diagnosis required evidence of a typical imaging appearance of infected aneurysms, including peri-aortic inflammation, saccular aneurysm, and/or leakage.

Preoperative imaging studies, device selection, and operative procedures were conducted using the same principles as applied to our regular endovascular aortic therapy practice. All aortic stent graft procedures were performed in the operating room with thoracic cases under general anesthesia and abdominal cases under local anesthesia. The devices used were oversized by 15% to 20% of the native vessel diameter.

Antibiotics were prescribed according to the sensitivity obtained from the blood cultures. In cases with a negative blood culture, antibiotics were prescribed to cover salmonella, the most common pathogen causing bacterial aortitis in the region. Parenteral antibiotics were administered for at least 10 days, until the patient was afebrile for 72 hours.

Technical success was defined as successful at stopping the bleeding in the patients in group I, and successful exclusion of an aneurysm or leakage from circulation without endoleak in the patients in group II.

After the first 30-day visit, patients were followed up every 3 months during the first year and every 6 months thereafter. Follow-up imaging studies by computed tomography (CT) scan were performed at 1, 6, and 12 months, and yearly thereafter. Lifelong antibiotics were planned for all patients.

The demographic data, causative bacteriology, devices used, perioperative outcomes, and follow-up data were studied.
groups, respectively. Preoperative hypotension was found in only one patient (N1) in the non-fistulous group, the one who had severe sepsis. The postoperative course did not improve in this patient, and the family did not wish to have open surgery. This was the only patient who expired from the disease in group II.

Nine patients received antibiotics prior to their referral to our hospital. Two of the nine had been treated for established infections of other organs prior to the development of the infected aorta. Patient F2, a 50-year-old man, was treated for symptoms of congestive heart failure from aortocaval fistula. Patient N15, a 63-year-old man, developed an infection of the thoracic aorta 6 weeks after being treated for septic arthritis of his right knee. Blood culture revealed the same organism as the culture taken from the fluid from his knee. *Burkholderia pseudomallei*. The other seven patients had received antibiotics prior to their referral to our hospital.

Almost every patient, 20 out of 21, had abnormal imaging studies. Leakage was evident in all five cases with fistulous complications. Periaortic inflammation, saccular aneurysm, or leakage was found in all but one case in the non-fistulous group. The exception was patient N8, a 68-year-old man with a 6.2-cm AAA who had been treated for diarrhea for 10 days before presenting with acute tenderness of the aneurysm, and blood culture was positive for salmonella. This was the only patient in this series that CT scan showed no periaortic inflammation or leakage.

Of all 21 patients, 10 (48%) had positive blood cultures. Salmonella was the most common pathogen found, in eight of the 10. *Burkholderia pseudomallei*, melioidosis, was found to be the causative organism in the other two patients.

**Perioperative outcomes.** A number of different types of devices were used in the 17 abdominal cases: 11 cases used bifurcated device, 4 cases used aortouniliac device, 1 case with a small aorta used an iliac limb device, and 1 case with a short diseased aortic segment used an aortic extension cuff. Of the four thoracic cases, hybrid procedure was performed in one case. A combined carotid-carotid and carotid-left subclavian bypass was performed in an 84-year-old man with a 9.4 cm TAA who presented with massive hematemesis from an aortoesophageal fistula. All endovascular stent grafts were deployed successfully. There were no perioperative complications related to the endovascular procedures.

Technical success was achieved in all 21 patients. Bleeding stopped immediately after the stent graft deployment in all five patients of the fistulous group. However, rebleeding occurred in two patients. Patient F3, a 60-year-old man who originally presented with massive bleeding from an aortoesophageal fistula had rebleeding the day following the procedure, while the aortoesophageal fistula patient, F5, who had the hybrid procedure suffered from rebleeding 2 weeks after the procedure.

Fever at presentation was found in only 40% (2/5) of the fistula patients (F2 and F4, Table). Patient F2, an aorto caval fistula, also continued to have fever despite the overall improvement of his congestive heart failure symptoms. Excavation of the stent graft and axillo-bifemoral bypass graft was performed at 4 weeks poststent graft. Another patient, F4, despite responding well to the EVAR, with controlled intra-abdominal sepsis and marked shrink-
However, presented with fever, and all but one case responded well to the treatment, with the fever disappearing within 5 days. The only nonimproved patient, N1, had severe sepsis and expired 9 days postimplantation.

The overall in-hospital mortality was 19% (4/21), only 6% (1/16) in the nonfistulous group, but 60% (3/5) in the fistulous group, \( P = .008 \) (\( \chi^2 \) test). Re-operation was performed in one case, patient F2 (an open repair 4 weeks after the initial endovascular procedure for the aortocaval fistula). Stent graft explantation and aortic exclusion with an iliofemoral bypass graft was performed. There were no secondary endovascular procedures needed in the other cases. The average hospital stay was 25 days (range, 10-70 days) among the surviving cases.

Follow-up outcome. The average follow-up period was 22 months (range, 1-54 months). One of the two patients who survived after the treatment in the fistulous group died at 18 months from nonaortic aneurysm-related causes. The only survivor from the fistulous group at the time of this report was the aortocaval fistula case who had received a subsequent open repair 4 weeks after the initial stent graft procedure. There were no deaths among the 15 survivors in the nonfistulous group.

No cases required conversion or a secondary procedure during the follow-up period. Fourteen out of 15 patients in the nonfistulous group had significantly decreased periaortic inflammation and aneurysm size at 6-month follow-up and beyond, as shown in the Table. Complete resolution of the periaortic inflammatory tissue and aortic aneurysm was seen in 10 patients; at 6 months in 4 cases, and at 12 months in the other 6 cases. A significant decrease in the aortic aneurysm diameter (\( \geq 5 \) mm) was seen in four of the remaining patients, while the last patient, who only had a 1-month follow-up, had no significant change in the aortic aneurysm morphology at that follow-up. The longest follow-up was 34 months in a 73-year-old man, whose infected aorta became normal 6 months after the EVAR (Fig 2) and was still normal at the final follow-up.

There were no cases of postoperative endoleak. Iliac limb thrombosis occurred in two cases. Buttock claudication symptoms in these patients improved without intervention.

**DISCUSSION**

Infected aortic aneurysm is rare and its initial symptoms are subtle and nonspecific.\(^1\) However, the classical triad of features of fever, abdominal/back or chest pain, and leukocytosis are present in the majority of cases.\(^1,10\) Periaortic soft tissue inflammation and/or aortic leakage are typical findings in CT scans.\(^10\) In our series, almost all cases presented with typical features of infected aortic aneurysm and changes in imaging studies. Because of nonspecific symptoms in the early phase of the disease, almost half of our patients received antibiotic treatment prior to a definite diagnosis being made.

**Salmonella** and **Staphylococcus aureus** are the two most common causative organisms of infected aortic aneurysm reported in the medical literature,\(^3,11\) with **S. aureus** the main reported causative pathogen for an infected aortic aneurysm in western countries.\(^3,10,12\) and **Salmonella** the major reported causative agent in Asia.\(^11,14\) In our series, **Salmonella** was the predominant pathogen, together with, interestingly, melioidosis infection in two cases. Melioidosis, a disease caused by *Burkholderia pseudomallei*, is regarded as endemic to southeast Asia and northern Australia, with sporadic case reports from other regions such as central and southern America, the Caribbean, and Africa.\(^17,18\) Diabetics, thalassemia, renal disease, and occupational exposure to surface water such as rice farmers have been associated with an increased risk for melioidosis.\(^19\) The most common presentation of melioidosis is pneumonia, in approximately half of all cases, with other common presentations, including genitourinary infections, skin and soft tissue infections, splenic/liver and prostatic abscesses, and bone and joint infections.\(^18\) Infected aortic aneurysm due to melioidosis is rare, with high morbidity and mortality.\(^20\)

One of the most challenging issues for vascular surgeons is a serious presentation of infected aorta associated with a fistulous connection with an adjacent organ such as the gastrointestinal tract or lower respiratory tract causing massive bleeding. Fistulas can arise from the erosion of a large atherosclerotic aortic aneurysm, a rupture of a seen in 10 patients; at 6 months in 4 cases, and at 12 months in the other 6 cases. A significant decrease in the aortic aneurysm diameter (\( \geq 5 \) mm) was seen in four of the remaining patients, while the last patient, who only had a 1-month follow-up, had no significant change in the aortic aneurysm morphology at that follow-up. The longest follow-up was 34 months in a 73-year-old man, whose infected aorta became normal 6 months after the EVAR (Fig 2) and was still normal at the final follow-up.

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Aortic aneurysm complicating microbial aortitis or complications following open AAA repair. The clinical status of the fistula patients in our study was generally more debilitated than the nonfistula group because of the combined insults from sepsis and massive bleeding. Prognosis of our patients with an infected aortic aneurysm complicated with a fistula was poor. The causes of death were aneurysm-related in the early postoperative phase and from associated morbidities during later follow-up. The comparisons of mortality rates between the fistulous vs the nonfistulous groups were 60% (3/5) vs 6% (1/16) perioperatively, and 50% (1/2) vs 0% (0/15) during the follow-up. Our observations suggest that EVAR may not be able to control massive bleeding in all patients with aortocutaneous fistula.

Open repair is the established treatment for an infected aortic aneurysm, consisting of aneurysm resection, extensive local debriement, and revascularization. To avoid placing vascular graft in a contaminated area, an extraanatomical bypass has been advocated. However, significant complications can occur with such a bypass, most notably poor long-term patency of the axillofemoral bypass grafts or bleeding from the aortic stump. In situ graft repair has been reported to be a feasible technique in cases where there is an absence of grossly local infection or pus. Morbidity and mortality following open repair has been reported to be as high as 44%. Unfavorable outcomes generally result from performing major aortic surgery in patients already debilitated from sepsis and/or massive bleeding together with having significant comorbidities.

EVAR for infected aortic aneurysm treatment was first reported over a decade ago. The main advantages of endovascular repair are the avoidance of a large incision, aortic cross clamping, interference with respiratory function, revascularization, and significant blood loss. Since its introduction there have been a number of small case series reports showing good results. A systemic review found 48 cases of infected aortic aneurysms treated by EVAR from 22 reports. The overall 30-day mortality rate from all of these studies due to massive bleeding or sepsis was 10.4%, and the study concluded that patients with an aneurysm rupture and fever at the time of the operation had a poor prognosis. However, in our study, fever and aneurysm leakage were found in almost every case of the “nonfistula” group, yet a good outcome was achieved in all but one case. The only nonresonptive case in this group continued to have a high fever postoperatively. A poor prognosis, according to our study, was primarily found in patients in the late stage of disease who presented with fistulous connections with adjacent organs or severe sepsis and who failed to improve after treatment with EVAR and parenteral antibiotics.

There have also been several reports of unfavorable outcomes from the use of an endovascular stent graft in infected aortic aneurysm repairs. Unsuccessful attempts to control bleeding by EVAR in aortocutaneous fistulas have also been experienced. We consider that our results to date with using EVAR in treating patients with fistulous complications are not satisfactory. EVAR can serve as a bridging procedure to temporarily stop the bleeding, but open repair is the definitive treatment to prevent recurrent bleeding, if the patient’s status allows.

Late failure due to reinfection has also been reported. Implantation of a foreign body, a stent graft, into an infected field is a concern with EVAR treatment in infected aortic aneurysms. However, in our cases, the inflammatory tissue around the aorta responded extremely well to a treatment of EVAR combined with antibiotics.
All 14 patients in the nontistula group had aneurysm shrinkage or complete disappearance by their 12-month follow-up, and they continued to do well during the longer follow-up without any recurrent infection. The longest follow-up was 54 months, the average 22 months. In this relatively “earlier” stage of the disease, nontistula, aggressive debridement of the infected tissue may not be needed. As noted by Patel et al, antibiotic therapy may be able to sterilize the native aorta, while the same results may not be achieved in cases with infected graft material.

Infected aortic aneurysms occurred at a younger age in our two HIV-infected patients in this series, but similar outcomes were achieved in both cases with the endovascular technique. All inflammatory tissues in both HIV-infected patients disappeared within 1 year. EVAR seems to be a suitable treatment modality for this group of patients because of the benefits of minimal blood loss, decreasing the chance for contamination, with a good outcome.

There was no second endovascular procedure required in any of our cases, although two iliac limb occlusions occurred. Both cases presented with leakage of the small aortas, and bifurcated devices were chosen due to aortouni unilateral (AUI) devices not being available at the time of the operations. Because of their health status, buttok claudication symptoms did not interfere with their daily activities. There were no other serious pelvic ischemic complications. The buttok claudication symptoms improved within 6 months in both cases.

Patient compliance with lifelong antibiotics is critical to achieving a good outcome. All of our patients complied with the treatment protocol, and no patients had been lost to follow-up as of this writing. Cessation of oral antibiotics may cause reinfection or stent graft infection, although the necessity of lifelong antibiotics in cases of this nature is still debated.

CONCLUSION

Our study shows that EVAR is an effective treatment for uncomplicated infected aorta without fistulous connection. Immediate improvement in abdominal or back pain followed by fever disappearance within 4 to 5 days indicates a good treatment result. CT scan reveals significant shrinkage of aneurysm and periaortic inflammatory tissue in as early as 2 weeks postoperatively. Our current plan for patients with this condition is lifelong antibiotics after EVAR. In patients with a fistulous connection, the results were not as good as with the uncomplicated group, but EVAR was still an effective option for the initial treatment to close the fistula. However, rebleeding did occur, thus close follow-up should be maintained in such cases, and open repair may be needed in cases in which EVAR is deemed to have failed. The presentation of fistulous connections with adjacent organs or severe sepsis which fails to improve after EVAR signifies a poor prognosis in patients with an infected aortic aneurysm.

AUTHOR CONTRIBUTIONS

Conception and design: BK, DP
Analysis and interpretation: BK, DP, JS, WT, SR, PJ
Data collection: BK, DP
Writing the article: BK, DP, WT, PJ
Critical revision of the article: BK, PJ
Final approval of the article: BK, DP, JS, WT, SR, PJ
Statistical analysis: BK

REFERENCES

DISCUSSION

Dr Ronald Fairman (Philadelphia, Pa). The obvious question for the nonfistula group is your management of antibiotics. Is it for life?

Dr Kritpracha. All of our patients received lifelong antibiotics.

Dr Fairman. We have also been taught in this country that salmonella can be one of the most virulent organisms to involve the arteries. You give a more optimistic view of that. Can you comment?

Dr Kritpracha. Most of the reported series in the literature are mixed cases, consisting of cases with and without fistulous connections together with different pathogens. It is difficult to conclude which group of infected aortic aneurysm patients will respond well to particular type of therapy. We believe that there are stages of the disease, not all infected aortic aneurysms are the same. Infected aneurysm with fistulous connection generally is a more advanced disease. When we look at the treatment results, we uniformly achieved good results when treated nonfistula infected aortic aneurysm cases with endovascular technique, while the treatment of cases with fistulous connections was still challenging. Even though most of bacteria found in our study were salmonella, with a few cases of melioidosis, they seem to respond well to EVAR in the condition of no fistulous connections.

Dr Linda Harris (Buffalo, NY). My question is about the fistula group. We have treated a number of these patients as a hybrid procedure where we have repaired the aorta with a stent graft, but then gone in and repaired the bowel separately. It seemed from your presentation that you are treating them only with a stent graft and not doing anything to repair the bowel. Can you clarify whether you repair the bowel or just treat with a stent graft?

Dr Kritpracha. In this series, we did not attempt to close the gastrointestinal defect after stent graft procedure. We had mixed results. There was a patient that I showed in the figure, had aortocostal fistula presenting with massive GI bleeding. Bleeding stopped immediately after deploying the stent graft. CT scan the following day showed a large connection between the aneurysm sac and small intestine. However, the status of the patient did not allow us to perform any major surgery. The follow-up CT scan in 2-week time showed significant shrinkage of the aneurysm. Unfortunately, this patient died from severe pneumonia. A lesson learned from this case was that a large defect could be resolved, but we cannot assume it will be true for every case. On the contrary, we lost two patients from recurrent bleeding, one aortocostal fistula and one aortoesophageal fistula. I believe that there is a certain role for closing GI defect if we are able to do so.

Dr William Tanski (Concord, NH). Which aortic endografts did you use? Different endografts may have different rates of residual or recurrent infection.

Dr Kritpracha. The question is the endograft that were being used in this study, right?

Dr Tanski. Yes.

Dr Kritpracha. All of the devices we used were stent grafts with Dacron fabric. We did not yet use stent grafts with PTFE fabric. Our study cannot provide the answer whether the Dacron fabric is superior or inferior to PTFE fabric when deployed in infected fields.

Dr Joseph Mills (Tucson, Ariz). Number one, could you talk a little bit more about what the organisms were, and did you correlate good or poor outcome with the type of organisms?

The second question is timing. If you have a patient that presents with aortic infection but their hemodynamics are stable and they are not ruptured, do you try to culture and treat the organism first for a period of time before you put the stent graft in?

Dr Kritpracha. For the first question, the majority of bacteria we found were salmonella. Only two cases were infected with Burkholderia pseudomallei and one with Klebsiella pneumoniae. I think we do not have enough subjects to compare which one is more virulent. But at least we know that in salmonella infection and melioidosis, treatment with EVAR is quite acceptable. For the timing of the procedure, we had some poor outcome of medical treatment for infected aortic aneurysm. In the past, we had a few cases that aneurysm grew significantly despite receiving parenteral antibiotics. It is our practice to offer EVAR once the diagnosis of infected aortic aneurysm has been made.
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