**Introduction**

In 1948, Dehlinger\(^1\) first reported a case of a fatal rupture of a *Salmonella* abdominal aortic aneurysm in a 69-year-old man with lumbar osteomyelitis\(^2\). Infectious aortitis is uncommon and typically affects immuno-compromised elderly men. *Salmonella* is the most common microorganism in infrarenal infected aneurysm\(^3\), which can be divided into five categories: gastroenteritis, enteric fever, bacteremia, localized infection, and chronic carrier state\(^4\). We describe a 73-year-old man with nonspecific low-back pain who was diagnosed with infectious aortitis. Even with early antibiotic treatment, it still progressed into a pseudoaneurysm. This may explain why the mortality rate is high with purely medical treatment. After the grafting operation and antibiotic therapy, he was discharged under stable conditions.

**Case Report**

On February 5, 2007, a 73-year-old man came to the emergency department for symptoms of progressive low-back pain for over 1 day. He had a history of diabetes but with no regular medication for a long time. Besides the back pain, he also had a mild sore throat, mild fever, rhinorrhea, and productive cough for several days, without dysuria or diarrhea.

Upon physical examination, his vital signs were: body temperature of 36.4°C, heart rate of 83/min, respiratory rate of 19/min, and blood pressure of 181/81 mmHg. This patient had clear consciousness, no neck lymphadenopathy, clear and symmetric breathing sounds, heart sound with no murmur, and regular heartbeat. His abdomen was soft with normal bowel activity and no focal tenderness or abnormal pulsation. He had no back wound, spinal knocking pain or flank knocking pain. His extremities were freely moving, with no wound or deformity.

The laboratory data showed his serum white blood cells to be 12,200/mL with 85% neutrophil and his hemoglobin to be 13.2 g/dL, and biochemical data were normal except for a serum glucose value of 688 mg/dL.
The patient had no ketone reaction or acidosis. His C-reactive protein was high (9.25 mg/dL), but D-dimer was in the normal range. His urine test revealed 43 white blood cells/µL.

Because his pain persisted even after an analgesic injection, we arranged for an abdominal computed tomography (CT) scan with and without intravenous contrast enhancement (Figure 1). The CT revealed some air collection at the left lateral and posterior aspects of his distal calcified abdominal aorta, just distal to his bilateral renal arteries. Infectious aortitis was then considered. Multiple calcified lymph nodes due to old inflammatory processes were identified in his mediastinum and bilateral hila. This patient was arranged for admission and received antibiotic medication with ceftriaxone and metronidazole. Meanwhile, his blood sugar was controlled with insulin. A blood culture revealed Salmonella group D.

After 5 weeks of medication, an abdominal CT was performed again, which revealed infectious aortitis and mycotic aneurysm with penetrating atherosclerotic ulcer as a pseudoaneurysm, just on the left of the abdominal aorta at the L3 level, measuring about 4 cm in length (Figure 2). Median laparoscopic surgery was performed 39 days after admission (on March 13) and involved debridement, irrigation and abdominal aortic grafting using an 18 mm Hemashield graft after clamping the abdominal aorta and bilateral iliac arteries. Pathology showed pieces of thickened atheromatous tunica intima with foci of calcification. The periaortic stromal tissue showed acute inflammation. After the operation, this patient received antibiotic medication and was discharged on March 26 (49 days after admission) under stable conditions.

Discussion

Spontaneously arising aortic infections were first recognized in the last half of the 19th century, although Ambrose Pare is noted to have recognized syphilitic aortic aneurismal disease in the 17th century. Osler is generally credited with recognizing the association between arterial infection and aneurismal disease. Hankins and Yeager, in 1956, reported the first case of successful treatment of a Salmonella mycotic aneurysm with the ligation and excision of an infected femoral arterial pseudoaneurysm. They noted the association of atherosclerosis in allowing seeding and subsequent arterial infection.

In Taiwan, 76% of patients presenting with infected aortic aneurysms are infected with Salmonella, and that ratio is nearly one-third in some other worldwide regions. The current epidemiology of infectious aortitis typically involves men aged 50–70 with atheromatous or aneurismal aortas infected with Staphylococcus or Salmonella. Preexisting aneurysms that become infected tend to be infrarenal, because this is the most common location of aortic aneurysms. The literature does not give a standard location of the suprarenal/infrarenal area.

Associated risk factors, including atherosclerosis, lumbar vertebral osteomyelitis, age older than 50 years, history of intravenous drug use and recurrent bacteremia, may increase clinical suspicion of infected aortic aneurysm.

The etiopathogenesis of mycotic aneurysms includes six different mechanisms: (1) septic embolization lodged in the vasa vasorum or vessel lumen; (2) a contiguous inflammatory process outside the vessel wall that extends to a nearby artery; (3) inoculation of bacteria at
the time of accidental arterial trauma; (4) self-induced vascular manipulation; (5) iatrogenic causes; and (6) intimal defects, such as an atherosclerotic plaque that is seeded by concurrent bacteremia.

A triad of unexplained fever, back pain and pulsatile abdominal mass should suggest the presence of a mycotic abdominal aortic aneurysm. With this triad, Mundth et al. and Bennett and Cherry have proposed that persistent bacteremia should suggest the presence of a mycotic aneurysm.

However, only 50% of patients with aortitis have a palpable mass, only one-third has coexisting lumbar or thoracic osteomyelitis, and blood cultures are negative in 50% of patients. Positive blood cultures are found in 70% and a palpable abdominal mass in 53% of cases of infected aortic aneurysm.

Diagnosis of infectious aortitis before rupture is important but difficult. Only half of the 18 cases described by Hsu et al. had an intact aneurysm at the time of surgery, and rupture into neighboring structures is uncommon. In many cases, the diagnosis was made during autopsy. Only half of the patients had a pulsatile abdominal mass with fever. In Hsu et al.'s series, the average delay until surgery was 15 days (range, 4 to 30 days).

Although aortography is useful for planning operations, it does not reveal surrounding inflammation or loss of tissue planes and cannot determine the extent of a contained rupture. Ultrasonography demonstrating thickening of the abdominal aortal wall with gas echoes in the wall is a useful diagnostic tool. Technetium-99m-labeled leukocytes also may be useful in selected patients.

Diagnostic features on CT scan include a periaortic soft tissue density with rim enhancement, consistent with periaortic inflammation and hematoma (pseudoaneurysm). Adjacent vertebral osteomyelitis may suggest infectious aortitis.

Blood cultures are negative in up to 50% of diagnosed cases of abdominal aortic infection. Staphylococcus aureus accounts for the majority of Gram-positive infections; however, Gram-negative infections, including bacilli (e.g., Salmonella and Proteus species) and Escherichia coli, have been described. Less common causes include fungal agents, such as Candida and Aspergillus species.

The treatment of mycotic aneurysm includes three fundamental steps: prolonged antibiotic therapy, curettage of the infected region, and revascularization. Treatment of infectious aortitis is aortic replacement; no studies have reported long-term survival in patients treated otherwise. Three reports have described patients treated with antibiotics only, all of whom died.

Currently, it is suggested that antibiotic therapy be continued for a minimum of 6 weeks postoperatively. In some cases of direct arterial wall infection in which removal of all infected material is not possible, or in cases of reconstruction with prosthetic material in close proximity to the infection, lifelong suppressive antibiotic therapy has been recommended.

The overall survival rate after surgery is lower in patients infected with a Gram-negative organism than in patients whose infection is Gram-positive. Risk factors for death include shock at the time of surgery, other shock, spondylitis, and positive postoperative blood cultures.

Oz et al. reported that rapid dilatation of the aorta often preceded rupture. It is recognized that any virulent bacteria can cause aortic rupture without preceding dilatation. The mortality rate is significantly high if the patient is in shock.

To sum up, patients older than 60 years who have positive blood cultures for Salmonella, along with fever and back, abdominal or chest pain, should have an extensive workup for infectious aortitis, especially in diabetic or other immunocompromised people, including AIDS patients. Studies by Barlow et al. revealed that treatment with omeprazole reduces gastric activity and thereby increases the risk of Salmonella infection. We noted that the percentage of Salmonella infection was much higher in Taiwan than in America or Europe. Because antiacid medication is seldom used by old people in Taiwan, decreasing the use of antiacid drugs may need to be reconsidered.

References

Infectious Aortitis