Refractory Pyogenic Spondylitis Subsequent to Vascular Graft Infection: A Case Report

Yuma Suga[1)], Hideki Shigematsu[1)], Jin Iida[2)], Nobuhisa Sato[3)], Masato Tanaka[1)], Sachiko Kawasaki[1)], Yusuke Yamamoto[1)] and Yasuhito Tanaka[1)]

1) Department of Orthopedics and Surgery, Nara Medical University, Nara, Japan
2) Department of Orthopedic Surgery, Matusaka Chuo General Hospital, Mie, Japan
3) Department of Orthopedic Surgery, Tukazaki Hospital, Hyougo, Japan

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A 78-year-old man who underwent aortic graft repair for an abdominal aortic aneurysm at the age of 60 years, presented to our institution with fever and low back pain. Laboratory investigations, computed tomography (CT), magnetic resonance imaging (MRI), and blood cultures confirmed a diagnosis of septic shock and pyogenic spondylitis. He began antibiotic therapy when his blood culture indicated *Staphylococcus aureus*. The patient was treated with intravenous cefazolin 3 g/day for three weeks, intravenous ceftriaxone 2 g/day for five weeks, oral levofloxacin 500 mg/day, and minocycline 200 mg/day thereafter. His symptoms improved, and he was discharged from the hospital three months later. He continued treatment with oral antibiotics and was followed up in the outpatient clinic.

After seven months, he presented again with high fever and low back pain. A recurrence of purulent spondylitis was suspected. We diagnosed septic shock, pyogenic spondylitis at L4/5, and an epidural abscess (Fig. 1). The patient underwent laminectomy and drainage with intravenous antibiotic therapy (cefazolin 3 g/day for 4 weeks and ceftriaxone 2 g/day for four weeks).

The patient's low back pain resolved, but he re-presented after nine months with a recurrence of high fever and septic shock. Blood culture revealed methicillin-resistant *S. aureus* and *Serratia* sp. Therefore, we changed the intravenous antibiotic therapy to vancomycin 2 g/day and meropenem 3 g/day for eight weeks. After confirming that the antibiotic treatment controlled the purulent spondylitis, we performed pedicle screw fixation using a percutaneous screw at ten months, and we changed the antibiotic regimen to trimethoprim/sulfamethoxazole 4 g/day and rifampicin 450 mg/day.

After that, the infection appeared to resolve. Laboratory tests, CT, MRI, and echocardiographic examinations were repeated but did not identify another source of infection.

At 12 months, the patient re-presented with a recurrence of high fever. A contrast-enhanced CT examination at that time showed perigraft air, which raised suspicion for an infected vascular graft (Fig. 2). We consulted the vascular surgeons who advised, that the likelihood of graft infection was low, so we continued antibiotic therapy.

At 14 months, he presented again with high fever, and a blood culture identified *Candida parapsilosis* and *Escherichia coli*. We changed the antibiotic regimen to intravenous ceftriaxone 2 g/day, fosfluconazole 200 mg/day for eight weeks, and oral fluconazole 100 mg/day. The purulent spondylitis responded to this treatment, and the patient was discharged at 16 months.

At 17 months, the patient was returned to our hospital with a further recurrence of high fever. A blood culture detected *Enterococcus faecalis* and methicillin-resistant *S. aureus*. We diagnosed recurrent pyogenic spondylitis and sepsis. The patient started appropriate antibiotic therapy (intravenous sulbactam/ampicillin 6 g/day for two weeks, imipenem/cilastatin 2 g/day for four weeks, and oral levofloxacin 500 mg/day for two weeks) and antifungal therapy (intravenous micafungin 150 mg/day for three weeks and fosfluconazole 200 mg/day for five weeks). We sus-

Corresponding author: Hideki Shigematsu, shideki@naramed-u.ac.jp
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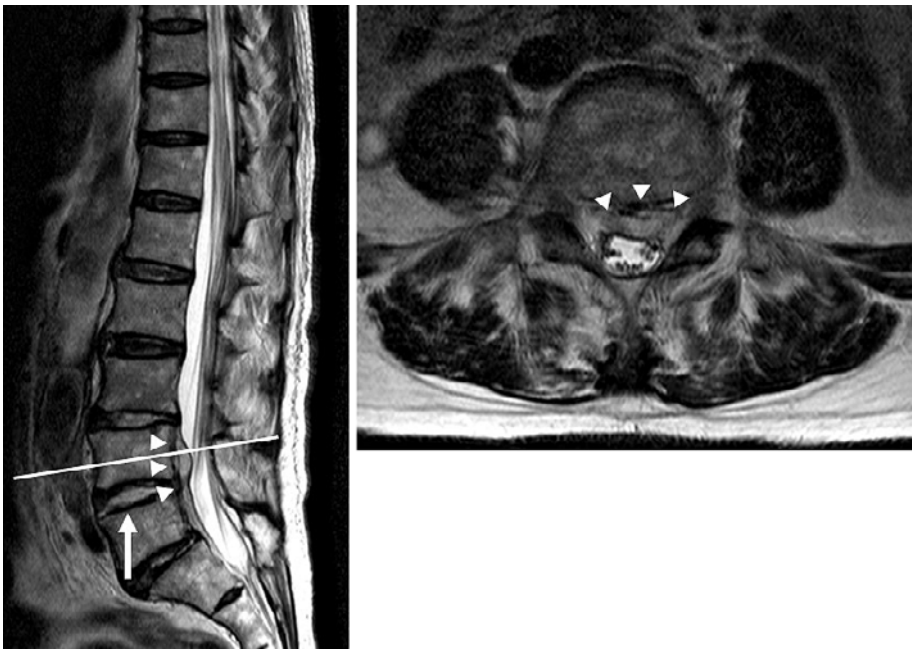

Figure 1. A T2-weighted image showing a high-intensity area at the L4/5 intervertebral disc (→) and an epidural abscess (△).

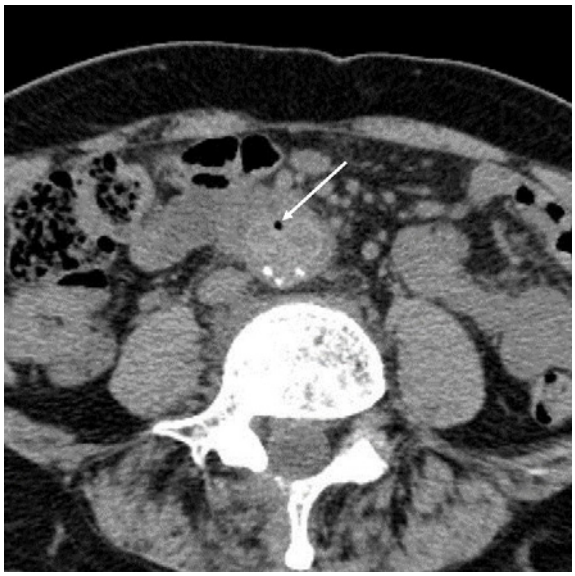

Figure 2. A contrast-enhanced computed tomography scan showing air around the vascular graft (→).

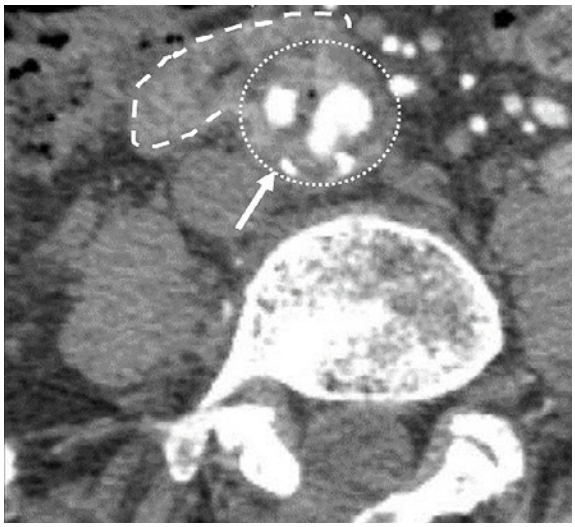

Figure 3. A contrast-enhanced computed tomography scan, showing a vascular graft (circle) that had migrated into the duodenum (→), raising suspicion of an aorto-enteric fistula and vascular graft infection.

pected another source of infection; however, repeat laboratory tests and CT, MRI, and echocardiographic examinations did not identify another source of infection.

At 19 months, the patient presented again with a high fever. We changed his antibiotic therapy to intravenous vancomycin 2 g/day and levofloxacin 500 mg/day. Contrast-enhanced CT and blood cultures were repeated. The blood culture revealed streptococcus, and the contrast-enhanced CT findings were suspicious for aorto-enteric fistula and vascular graft infection (Fig. 3). Therefore, we consulted the vascular surgeons again and performed fluorodeoxyglucose positron emission tomography/computed tomography (FDG-PET/CT) to search for another source of infection. FDG-PET/CT showed an abnormal accumulation of FDG at L5 and around the vascular graft. We diagnosed pyogenic spondylitis, vascular graft infection, and an aortoenteric fistula (Fig. 4).

The patient underwent surgery to remove a pedicle screw and to replace the vascular graft with extra-anatomical bypass. He was then started on long-term antibiotic and antifungal therapy (oral trimethoprim/sulfamethoxazole 4 g/day and fluconazole 100 mg/day). He has had no low back pain or any evidence of recurrent infection in the 12 months since the operation. Fig. 5 shows the antibiotic and antifun-

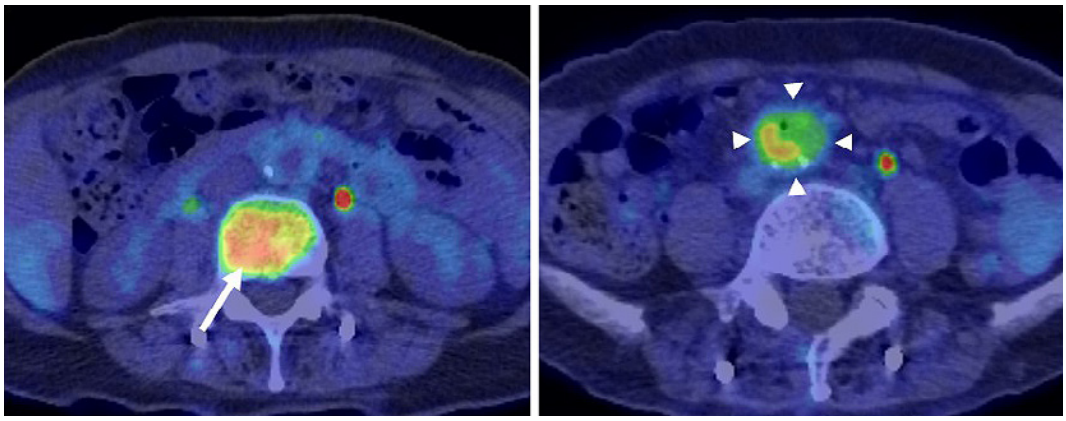

Figure 4. Abnormal uptake of fluorodeoxyglucose at L3 (→) and the vascular graft (△). The diagnosis was pyogenic spondylitis, vascular graft infection, and an aorto-enteric fistula.

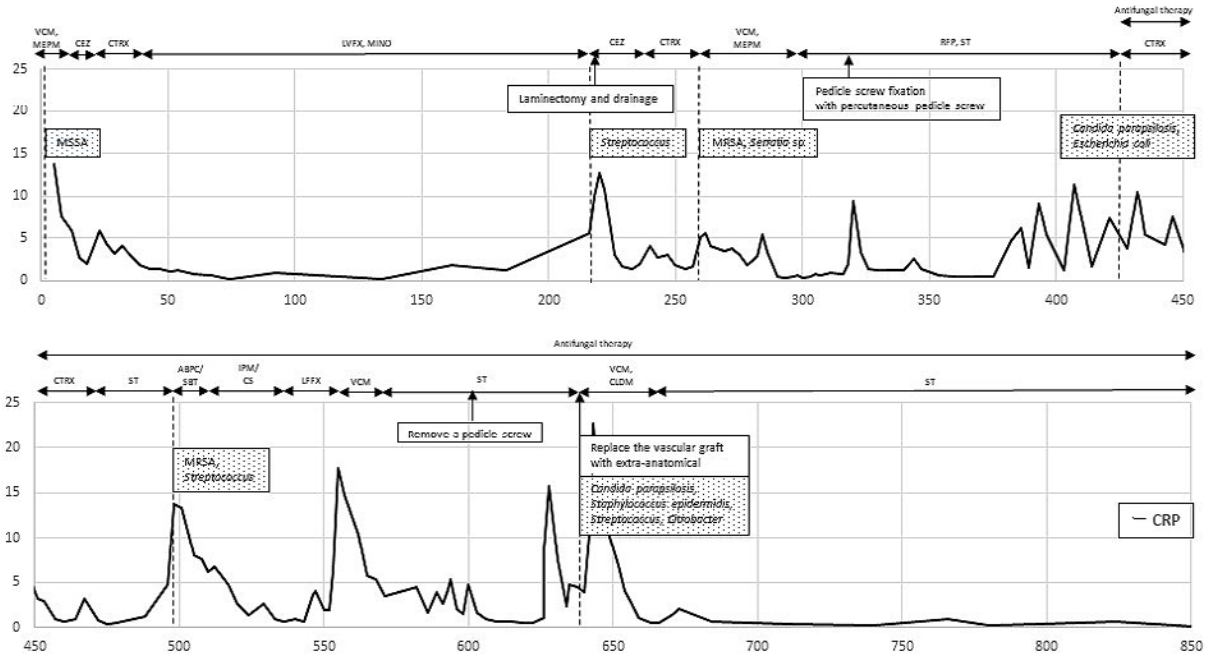

Figure 5. An outline of the antimicrobial and surgical treatment provided, the causative organism, and fluctuations in the C-reactive protein level over time.
ABPC/SBT: Ampicillin/Sulbactam, CEZ: Cefazolin, CLDM: Clindamycin, CTRX: Ceftriaxone, IPM/CS: Imipenem/Cilastatin, LVFX: Levofloxacin, MEPM: Meropenem, MINO: Minocycline, RFP: Rifampicin, ST: sulfamethoxazole-trimethoprim, VCM: Vancomycin, MRSA: Methicillin-resistant *Staphylococcus aureus*, MSSA: Methicillin-sensitive *Staphylococcus aureus*

gal agents used for this patient.

There are few descriptions of pyogenic spondylitis with vascular graft infection in the literature. To the best of our knowledge, there have only been 67 cases reported in the English literature to date[1-3]. Early diagnosis and treatment of pyogenic spondylitis with vascular graft infection are important, but challenging, if the symptoms are subtle and nonspecific. In our case, despite the early diagnosis of pyogenic spondylitis, the patient continued to have sepsis because of delayed recognition and treatment of his vascular graft infection.

A previous report suggested that plain CT helps assess structural changes secondary to infection[1]. Megaloikonomos et al[2] reported that the presence of perigraft air in the late perioperative period, i.e., four months after surgery, is suspicious for vascular graft infection. In our case, the graft surgery had been performed 18 years earlier, and perigraft air was detected on contrast-enhanced CT 12 months after the diagnosis of pyogenic spondylitis. However, the vascular surgeons had suggested that the likelihood of graft infection was low.

MRI is more useful for detecting epidural and spinal abscesses. However, given its disadvantage of pronounced artifacts (e.g., those caused by metal[2], motion artifact from the great vessels, and differentiation of gas from calcified plaque in the remnant native vessel[5]), it is unclear whether

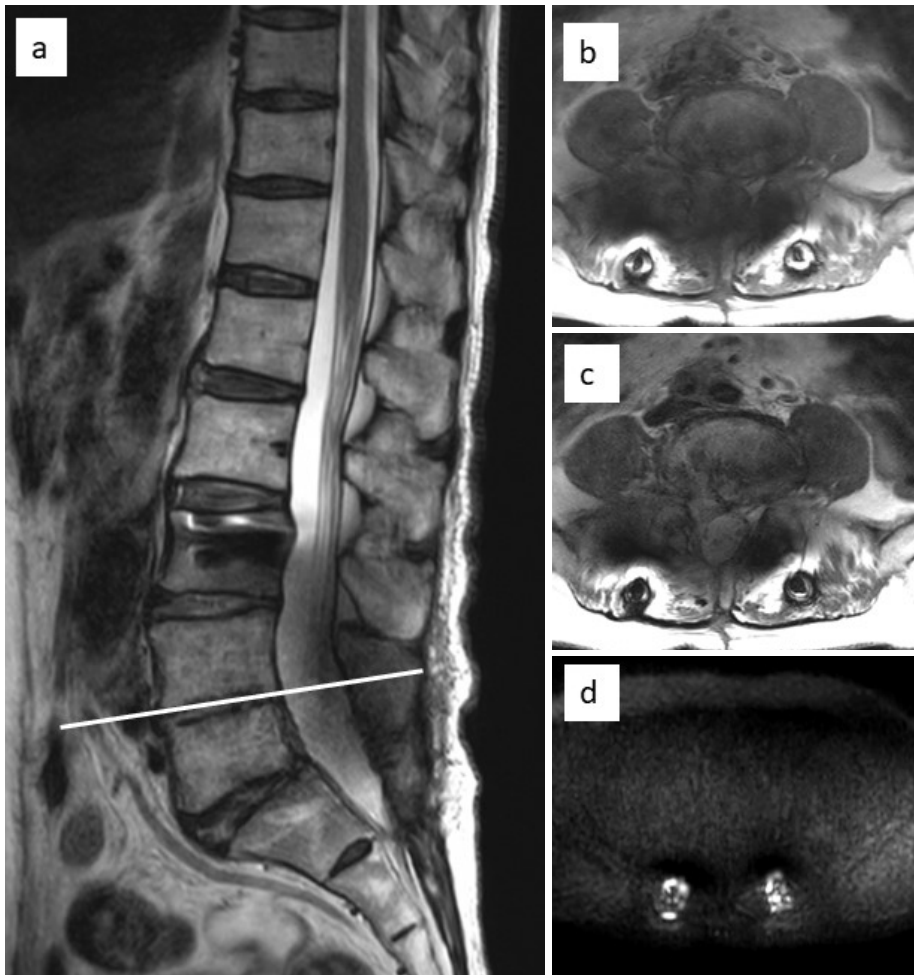

Figure 6. (a) Magnetic resonance imaging with T2 sagittal, (b) magnetic resonance imaging with T1 coronal, (c) magnetic resonance imaging with T2 coronal, (d) magnetic resonance imaging with a diffusion-weighted image (DWI). Magnetic resonance imaging showing no signal change in the area where FDG-PTE/CT accumulated FDG.

or not MRI can detect perigraft infection. In this case, we could not detect vascular graft infection on MRI because it did not show any signal change in the area where FDG accumulated on FDG-PET/CT scans (Fig. 4, 6).

In contrast, FDG-PET/CT has the advantages of no severe artifacts and being able to detect regional abscesses. FDG-PET/CT had a sensitivity of 82%-96% and a specificity of 81%-100%, for a diagnosis of pyogenic spondylitis[3,6-8] and a sensitivity and specificity of 93% and 91%, respectively, for a diagnosis of vascular graft infection[1].

However, FDG-PET/CT has several disadvantages[10]. First, it has a low international penetration rate. Second, it is a relatively expensive imaging modality. Third, it is not covered by insurance for pyogenic spondylitis in Japan. Therefore, it can only be used in the indications for which it is approved and may be difficult to perform. However, if the source of infection cannot be identified by CT and MRI, FDG-PET/CT may be needed to identify the source for surgical planning[5].

Although early diagnosis and treatment of pyogenic spondylitis with vascular graft infection is important, there are no standardized treatment guidelines. Standard conservative treatment is usually sufficient for pyogenic spondylitis. Therefore, surgical treatment is reserved for patients with a progressive neurological deficit, bone destruction, and deformity when conservative treatment fails. According to the literature[2,4], the mortality rate in patients with vascular graft infection is higher in those who are treated conservatively than in those who undergo surgery, but it is unclear because of few cases. In vascular graft infection, Setacci et al[11] reported 38% mortality after conservative treatment whereas 14.6% after extra-anatomical bypass and 7.4% after in situ reconstruction. If the patient's general condition allows, removal of the infected graft with debridement and revascularization, either via in situ or extra-anatomical aortic reconstruction, is recommended.

In conclusion, although pyogenic spondylitis with vascular graft infection is extremely rare[2], spine and cardiovascular surgeons should be aware of this condition. If vascular graft infection is suspected, perigraft air on CT and FDG-PET is likely to be a key finding and allow a definitive diagnosis.

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Informed Consent: The patient consented to the details of his case being submitted for publication.

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