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Case Report

Salmonella Osteomyelitis of the Distal Tibia in a Healthy Woman

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Salmonella osteomyelitis is extremely rare; only a few cases have been reported in healthy adults. We describe a case of salmonella osteomyelitis in an otherwise healthy 20-year-old Japanese woman who presented with distal tibial pain. X-ray and magnetic resonance imaging showed a lesion suspected to be a bone cyst. Osteomyelitis was diagnosed when pus was observed during an open biopsy. The bacterial culture examination yielded salmonella. Surgical drainage and antibiotic treatment were performed, after which no recurrence was observed. To our best knowledge, this is the first report of salmonella osteomyelitis of the distal tibia in an otherwise healthy individual.

Key words: osteomyelitis, salmonella, tibia, healthy woman

Salmonella osteomyelitis is very rare, accounting for 0.8% of all cases of salmonella infection and only 0.45% of all cases of osteomyelitis [1]. It usually occurs in patients with sickle cell anemia [2] or other hemoglobinopathies [3, 4], immunosuppressive conditions such as diabetes mellitus [3-5], or the salmonella carrier state [2]. However, salmonella osteomyelitis has been reported in only a few healthy adults [6-15] and rarely involves the distal tibia. We describe here a case of salmonella osteomyelitis of the distal tibia in a young woman with no significant comorbidities.

Case Presentation

A 20-year-old otherwise healthy Japanese woman presented at our institution with a complaint of left distal tibial pain. She had experienced this pain during the preceding 2 months, but had not sought any prior treatment. She had no notable medical history. She was a student. She had no local symptoms such as swelling or redness of her lower leg. Radiographic examination showed an osteolytic lesion with marginal sclerosis in the left distal tibia (Fig. 1A, B). Magnetic resonance imaging (MRI) also showed areas with low intensity (T1-weighted) and hyperintensity (T2-weighted) with ring enhancement (Fig. 1C, D). The laboratory examination showed a mild C-reactive protein elevation (1.3 mg/dL, normal value <0.3 mg/dL) and a normal leukocyte count (neutrophils, 64.5%; lymphocytes, 27.1%; monocytes, 6.4%; eosinophils, 1.1%; basophils, 1.0%). Bone scintigraphy showed increased uptake in the distal tibia (Fig. 2A).

Based on all imaging findings, we initially suspected osteomyelitis. Since the MRI findings favored osteomyelitis, we did not perform a computed tomography (CT) scan. In addition, we did not perform a blood culture test since the patient did not have any systemic symptoms, such as fever or general fatigue, and demonstrated only mild inflammatory results on her general blood test. We considered other diseases such as a benign bone tumor (*e.g.*, simple bone cyst, aneurysm-like bone cyst, non-ossifying fibroma, or intraosseous lipoma) as a differential diagnosis, since we were able to rule out bacteremia infection.

After providing informed consent, the patient

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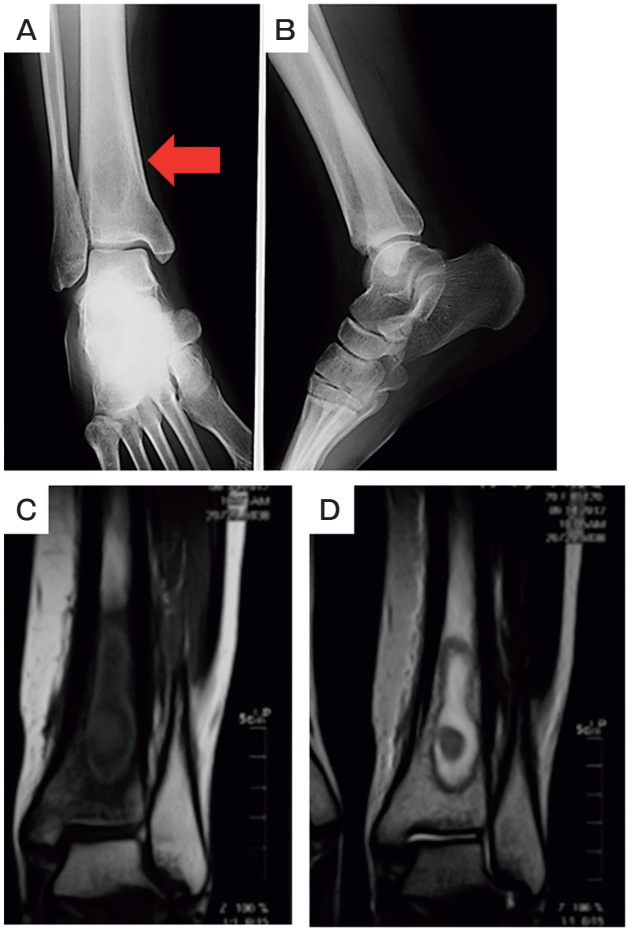

Fig. 1 Anterior-posterior (A) and lateral (B) radiographs of the right distal tibia. An intramedullary elliptical radiolucent area was observed in the distal tibia (*red arrow*). T1-weighted (C) and T2-weighted (D) MRI images. The T1-weighted MRI image shows a low-intensity area with an inner relatively high-intensity area surrounded by a high-intensity area (C). The T2-weighted MRI image shows a high-intensity area with a relatively low, inner-intensity area surrounded by a low-intensity area (D).

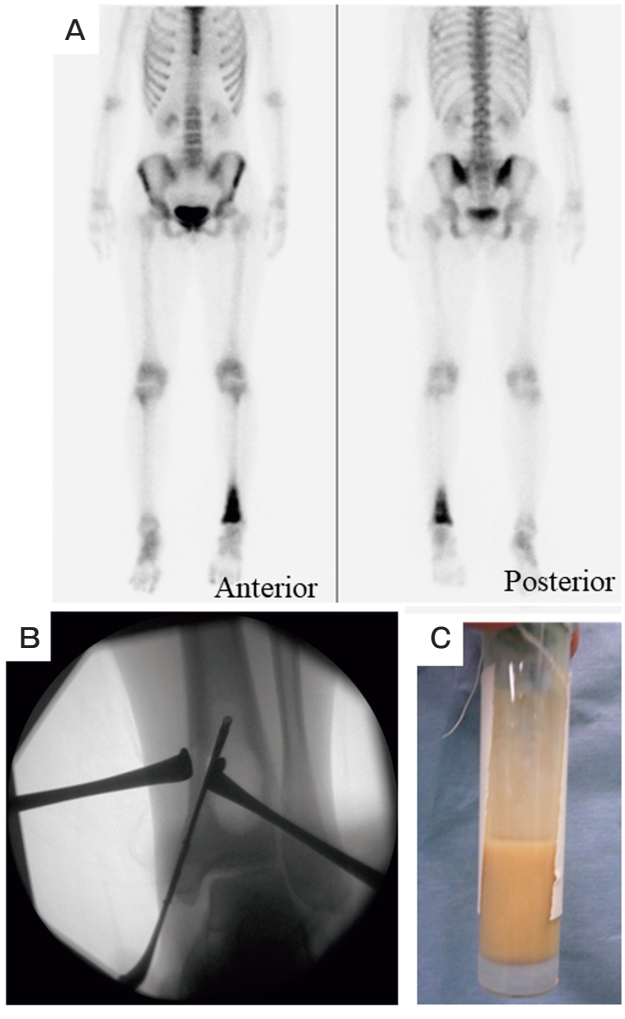

Fig. 2 A, Bone scintigraphy. Significant accumulation is observed in the distal tibia; B, Surgical drainage under X-ray guidance. We cut all surface layers of the bone wall under X-ray guidance; C, The collected turbid solution. The turbid solution is a yellow free-flowing liquid.

underwent surgical drainage under X-ray guidance (Fig. 2B). Upon incision of the lesion, a turbid fluid (Fig. 2C) was evacuated from the bone cavity. Surgical debridement was performed, the cavity was irrigated, and the bone wall was curetted. The microbiological examination of the fluid and tissue specimens showed *Salmonella enteritidis* infection. After surgery, intravenous meropenem was administered at 2 g daily for 2 weeks, followed by oral treatment with 200 mg of minocycline and 500 mg of levofloxacin for 6 weeks, based on the results of culture and sensitivity tests. This resulted in complete resolution of the inflammation. At the time of this report, 2 years after the completion of oral antibiotics, there has been no recurrence of inflammation.

Discussion

The clinical manifestations of salmonella infection can be divided into five syndromes: enterocolitis (food poisoning), enteric (typhoid) fever, bacteremia/septicemia, focal infection, and a chronic carrier state [6, 16]. Salmonella osteomyelitis occurs most frequently in patients with sickle-cell disease; other risk

factors include other hemoglobinopathies, immunocompromised status, and chronic salmonella carrier status [2,5,16]. In our patient's case, the point of entry for the infection is still unclear. While salmonella osteomyelitis is rare, it is typically an infection of the diaphysis of long bones, predominantly the humerus and femur [17]. Other bones commonly involved are the lumbar vertebrae, radius, ulna, and tibia [5,8,18].

Salmonella osteomyelitis in the tibia of an otherwise healthy person is very rare. The known cases are presented in Table 1 [3,6,19]. This is the fourth reported case of salmonella osteomyelitis in the tibia of a healthy person. Moreover, to the best of our knowledge, this is the first reported case of salmonella osteomyelitis of the distal tibia in an otherwise healthy woman. A study of salmonella osteomyelitis of the tibia in 23 patients showed a male-to-female ratio of 10:13, indicating that women may be more prone to developing this infection [20]. However, the series of individual case reports of salmonella osteomyelitis in the tibia of otherwise healthy adults is male dominant (3 prior case reports in males and the present report in a female) (Table 1). With respect to patient age, the average age was similar between the study enrolling 23 patients and the series of 4 individual case reports: 30 years old [20] versus 30.5 years old (Table 1), respectively. Finally, the duration of symptoms has been shown to vary from a few months to several years [11]. In our patient's case, the duration of symptoms was relatively short.

MRI is particularly helpful in diagnosing osteomyelitis [21]. Grey *et al.* reported the significance of the penumbra sign on T1-weighted images in subacute osteomyelitis [22], defining the penumbra sign as a transitional zone with relatively high signal intensity located between the abscess and sclerotic bone marrow on unenhanced T1-weighted images. Relative to muscle, the penumbra sign is isointense on T1-weighted images, enhances on contrast administration, and shows hypointensity on T2-weighted images [22,23]. In the above studies, the penumbra sign was reported in 75% of the cases of subacute osteomyelitis, and thus the penumbra sign is considered a characteristic MRI finding of subacute osteomyelitis. Since we identified the penumbra sign in the present case, we diagnosed our patient with a metaphyseal Brodie abscess, and initiated treatment.

The treatment of salmonella is difficult, and there are no randomized or case-control studies in the available literature. As a result, there are no standardized antibacterial therapy regimens or surgical procedures.

Table 1 Main features of salmonella osteomyelitis of the tibia in the reported and present immunocompetent patients

[ref]Author, Year	Age (years), Sex	Preceding systematic symptom(s)	Presentation	Operation	Antibiotics	Follow-up	Outcome
[6]Van Cappelle *et al*., 1995	22, male	6 years diarrhea	N/A	Surgical debridement	9 weeks of oral cortimoxazole 960 mg twice daily	6 years	No recurrence
[3]Salem, 2014	51, male	None	Refractory knee pain	Surgical debridement	Oral ciprofloxacin	2 months	No recurrence
[19]Durel *et al*., 2016	29, male	5-kg weight loss and night sweats for 2 months	Acute tibial pain	Surgical debridement	Ceftriaxone 2 g daily followed by oral ofloxacin 200 mg twice daily	2 years	No recurrence
Present case	20, female	None	2 months distal tibial pain	Surgical debridement	2 g of intravenous meropenem for 2 wks followed by oral minocycline 200 mg and levofloxacin 500 mg for 6 weeks	2 years	No recurrence

N/A: not available

However, treatment usually involves surgical drainage first, followed by antibiotic treatment [3,8,24]. The most commonly used antimicrobial agents are chloramphenicol, third-generation cephalosporins, and fluoroquinolones [4]. Ciprofloxacin has the ability to penetrate macrophages, which is imperative in killing intra cellular salmonellae, and oral ciprofloxacin demonstrates good efficacy in treating bone infections [7]. In our patient's case, we first performed surgical treatment for debridement and to confirm the diagnosis. We then initiated antibiotic treatment based on the results of culture and sensitivity tests.

In conclusion, we treated a case of salmonella osteomyelitis of the distal tibia in an otherwise healthy woman. Although salmonella osteomyelitis is very rare, it should be considered as one of th e differential diagnoses in immunocompetent patients with persistent pain in the distal tibia.

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