

[CASE REPORT]

Community-acquired *Pseudomonas aeruginosa* Osteomyelitis Caused by an Injury from a Dishwasher

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Abstract:

A 70-year-old healthy woman came to our hospital with right index finger pain and swelling after an injury incurred due to a commercial dishwasher. X-ray of the hand showed osteolysis around the distal interphalangeal joint. A further examination revealed *Pseudomonas aeruginosa* in the unexposed pus, so the patient was treated with a total of 10 weeks of cefepime, followed by levofloxacin and debridement twice. While this may have been a case of bacterial replacement, we should still consider *P. aeruginosa* infection in healthy adults when faced with an episode of waterborne injury.

Key words: osteomyelitis, *Pseudomonas aeruginosa*, community-acquired, skin and bone infection

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Introduction

Osteomyelitis by *Pseudomonas aeruginosa* is mostly reported as a complication of localized infections, such as mastoiditis, malignant otitis externa, and implant-associated or post-operative infections (1-4). Osteomyelitis caused by *P. aeruginosa* is common in nosocomial infection along with Enterobacteriaceae species and occurs more often in adults above 16 years old (5). We experienced a case of community-acquired osteomyelitis caused by *P. aeruginosa* in an otherwise healthy woman.

Case Report

A 72-year-old woman without any particular medical history presented to the orthopedic department of Showa General Hospital with complaining swelling and pain of her right index finger. Approximately two weeks before her admission, she injured the dorsal part of the distal interphalangeal (DIP) joint when her right index finger became caught in a commercial dishwashing machine at work (Fig. 1). She visited her local doctor and was prescribed cefdinir, but the treatment was switched to levofloxacin three days later due to poor efficacy. Anterior and lateral radio-

graphs of the hand taken five days before admission showed a slight osteolysis around the right DIP joint (Fig. 2). However, on the same day of admission to our hospital, osteolysis appeared on the palmar aspect of the base of the right distal phalanx and the head of the metaphysis (Fig. 3). The patient was thus referred to the Department of Orthopedic Surgery at our hospital and was admitted for a further examination and treatment.

At the time of the admission, her vital signs were normal. Her C-reactive protein (CRP) level was 0.11 mg/dL with a leukocyte count of 4,600 cells/ μ L. There were no HIV antigens or antibodies or rapid plasma reagin, Treponema Pallidum Hemagglutination test, hepatitis C virus-antibody, or HBs antigen (Table). We did not detect any serological abnormalities, but suspecting osteolysis of the index finger, we decided to perform urgent debridement.

The lesion was debrided, and cultures were obtained; Gram stain revealed elongated Gram-negative rods from unexposed pus (Fig. 4). During debridement, the subcutaneous soft tissue was removed, as it had become necrotic. In the DIP joint, small bone fragments caused by bone destruction were removed and gauze was placed. After the debridement, cefazoline was initiated, and *P. aeruginosa* was detected in the unexposed pus culture five days after the debridement. The isolate demonstrated resistance to minocycline [mini-

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Figure 1. The appearance of right index finger at the time of presentation.

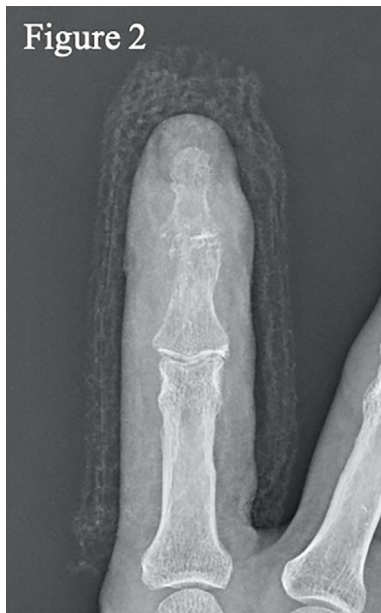


Figure 2. Anterior radiograph of the right index finger 5 days before the presentation.



Figure 3. Under the same condition of Fig. 2 at the time of the presentation.

imum inhibitory concentration (MIC) of 8 mg/L]. The isolate was susceptible to levofloxacin (MIC <1 mg/L), cefepime (MIC of 4 mg/L), and ceftazidime (MIC <4 mg/L). Based on the antimicrobial susceptibility testing, we escalated to cefepime.

Debridement was performed a second time nine days after admission, and the defective granulation caused by the infection was scraped off and the skin sutured. At this time, we found Gram-negative rods in the unexposed pus, but *P. aeruginosa* was no longer detected in the wound culture. Five weeks after admission, cefepime was terminated, and the patient was discharged with her medication switched to oral levofloxacin. Her vital signs and serological test results were normal throughout her hospitalization. The patient was treated with levofloxacin for 6 weeks, and the osteomyelitis improved after 10 weeks of antimicrobial therapy. Approxi-

mately two years since completing therapy, the patient has not presented with any recrudescent symptoms.

Discussion

The most common pathogens in osteomyelitis are *Staphylococcus aureus*, and the frequency of *P. aeruginosa* is relatively low, but its precise proportion is unclear (6). Osteomyelitis caused by *P. aeruginosa* was first described in 1940 by Albert J. Schein (7), and several cases were reported after the publication of his report. Most patients have a history of having been recently hospitalized or being immunocompromised by diabetes mellitus (3, 5). Otero et al described an 88-year-old woman with a history of obesity and type 2 diabetes mellitus who had acute osteomyelitis of the phalanx and metatarsal of the toe caused by *P. aeruginosa* soon after

Table. Laboratory Findings.

Hematology		Infection	
White blood cells	4,600 / μ L	RPR	<0.2 RU
Red blood cells	4.28 \times 10 ⁴ / μ L	TP antibody	<5.0 TU
Hemoglobin	13.6 g/dL	HCV antibody	0.1 C.O.I
Hematocrit	40.20 %	HBs antigen	0.1 C.O.I
Platelets	271 \times 10 ³ / μ g	HIV antigen/antibody	0.1 C.O.I
Blood chemistry		Coagulation	
Total protein	7.8 g/dL	PT-INR	0.96
Aspartate aminotransferase	21 U/L	APTT	30.6 s
Alanine aminotransferase	18 U/L	D-dimer	<0.50 μ g/mL
Sodium	141 mEq/L	Qualitative urine analysis	
Potassium	4.2 mEq/L	Specific gravity	1.02
Chloride	105 mEq/L	pH	5.5
Blood urea nitrogen	15.0 mg/dL	Protein	(-)
Creatinine	0.53 mg/dL	Suger	(-)
C-reactive protein	0.11 mg/dL	Ketone body	(-)
Total cholesterol	207 mg/dL	Occult blood	(1+)
Triglyceriides	144 mg/dL	Bilirubin	(-)
HbA1c (NGSP)	5.50 %	Urobilinogen	0.1 mg/dL
Blood suger	108 mg/dL		

PT-INR: international normalized ratio of prothrombin time, APTT: activated partial thromboplastin time

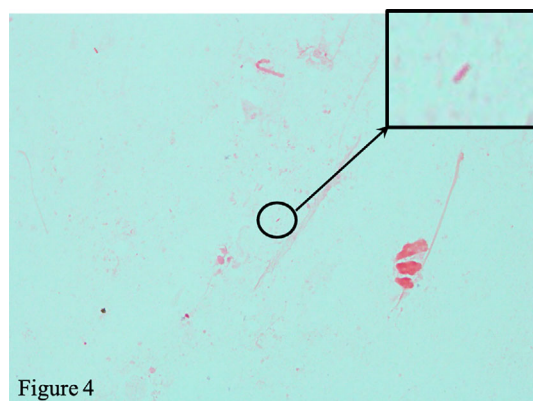


Figure 4

Figure 4. Gram stain obtained from non-open pus at first debridement and found an elongated Gram-negative rods (arrow) by 1,000 times magnification by microscope.

amputation of the fourth toe (2). As Otero et al noted, cases of osteomyelitis induced by *P. aeruginosa* in otherwise healthy adults are rare.

Dehority described an 18-year-old previously healthy boy with nosocomial chronic osteomyelitis of the tibia caused by *P. aeruginosa* following debridement of a non-pseudomonal chronic osteomyelitis in the same location 18 month earlier (6). While Dehority reported this case of nosocomial osteomyelitis in an adolescent without any particular medical history, we failed to find any community-acquired cases. According to Allou, 7 of 112 patients who sustained waterborne injury had osteomyelitis (8). Although the background of the patients is unclear, the most commonly isolated pathogens were *Aeromonas* spp., and none of them were in-

fectured with *P. aeruginosa*. Based on the above findings, it is rare for healthy adults to be infected by *P. aeruginosa*, but given the present case, we should consider *P. aeruginosa* infection in cases of waterborne infection in healthy adults.

P. aeruginosa easily forms biofilms and remains in a waterborne environment for a long time, and a large number of *P. aeruginosa* are thought to be present around dishwashers. Therefore, we suspected that *P. aeruginosa* might have caused osteomyelitis due to our patient's injury. In the present case, the involvement of bacterial replacement was considered, as the patient was prescribed cefdinir and levofloxacin for about two weeks before her admission to our hospital. In addition, given that we found Gram-negative rods in the unexposed pus at the second debridement procedure and the pre-administration period of antimicrobial agents was relatively short, we suspected that the possibility of bacterial replacement was relatively low. However, we could not deny the possibility of bacterial replacement and osteomyelitis due to methicillin-susceptible *Staphylococcus aureus* (MSSA) or streptococcus, so we decided to administer cefepime. Based on the above, we feel that this is the first case of community-acquired osteomyelitis caused by *P. aeruginosa* in an otherwise healthy adult.

Resistance to aminoglycosides, fluoroquinolones, and β -lactam is unusual in community-acquired *P. aeruginosa* and is more likely to be seen in hospital-acquired cases due to multiple different resistance mechanisms (9). In the present case, thanks to a detailed history taking, we found that her dishwashing company washed dishes from medical facilities, so the presence of drug-resistant *P. aeruginosa* in her workplace was considered possible. However, we were unable to

detect any particular resistance to antibiotics, so we switched to levofloxacin after cefepime administration. Taking a detailed history is very important for determining the causative organisms and selecting appropriate antimicrobial agents.

Conclusion

Osteomyelitis caused by *P. aeruginosa* in healthy adults is rare and most often occurs in patients with immunodeficiency factors. However, given the present case, we should consider the possibility of *P. aeruginosa* infection when faced with cases of waterborne infection.

The authors state that they have no Conflict of Interest (COI).

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