

Sphingomonas paucimobilis osteomyelitis in an immunocompetent patient. A rare case report and literature review

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SUMMARY

Sphingomonas paucimobilis occurs widely both in natural and nosocomial environments, including hospital water systems, respiratory therapy equipment, and laboratory instruments. It is an opportunistic pathogen that rarely causes infections in humans. Among *S. paucimobilis* nosocomial infections, osteomyelitis is particularly rare. Almost all infections occur in patients with comorbidities such as malignancy, immunosuppressant therapy, diabetes mellitus and acquired immunodeficiency syndrome. We present the first case of *Sphingomonas paucimobilis* osteomyelitis in an immunocompetent patient and include updated literature concerning infections by this microorganism.

KEY WORDS: *Sphingomonas paucimobilis*, Osteomyelitis, Immunocompetent patient, Antibiotic treatment.

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INTRODUCTION

Sphingomonas paucimobilis is a yellow pigmented, strictly aerobic, non-spore forming, non-fermentative Gram-negative bacillus (Yabuuchi *et al.*, 1990). It is an opportunistic pathogen that rarely causes infections in humans (Charity *et al.*, 2005). Among *S. paucimobilis* nosocomial infections, osteomyelitis is particularly rare: only two cases of osteomyelitis are recorded in the literature, both in immunosuppressed patients (Charity *et al.*, 2005; Araújo *et al.*, 2000). We describe the first case of *Sphingomonas paucimobilis* osteomyelitis in a non-immunosuppressed patient.

CASE REPORT

A 26-year-old man presented to our infectious diseases outpatient clinic with a painful knee. He reported a history of fracture of the proximal end

of the right tibia. He had undergone successful surgery about three years before with resolution of the fracture. However, after surgery, there was a shortening of the limb. Therefore the patient underwent further surgery to obtain lengthening of the leg. This second surgery was done about two months before our examination.

At the time of the visit the patient had symptoms clearly indicating infection with the presence of two secreting fistulas at the surgical site (Figure 1). On examination, the knee was painful and swollen, making weight-bearing impossible; it was also moderately painful at rest. The patient's knee was also warm, erythematous and the symptoms extended to the whole leg, resulting in a decreased range of movement. The orifice of the first fistula on examination measured about 1.5 cm and secreted pus. The orifice of the second fistula was smaller (about 1 cm). Blood tests were thus performed together with arthrocentesis and a swab of the fistulas secreting pus.

While waiting for susceptibility testing and given that the patient had no risk factors for multi-drug resistant (MDR) infections, such as previous recent antibiotic treatment, altered immune status, previous infection by MDR germs, use of inva-

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FIGURE 1 - Secreting fistulas at the surgical site at the time of the first patient visit.



FIGURE 2 - Healed fistulas after a month of antibiotic therapy.

sive devices or long stays in nursing homes, we decided to start an empiric antibiotic therapy with amoxicillin (1 g every 8 hours) and rifampicin (900 mg/day). In addition, we planned to perform an X-ray of the limb and a bone scan with isotope leukocyte to assess the extent of infection and diagnose osteomyelitis.

After a few days the patient returned to our outpatient clinic with the results of examinations. Blood investigations were as follows: leukocyte count, 13,000 units/ml, with 87 % of neutrophils; hemoglobin level 10.3 g/dl; ESR 50 mm/h; C-reactive protein level 75 mg/L (normal range <5 mg/L). Biochemical serum analysis showed that all levels were within their normal limits.

Synovial fluid obtained by arthrocentesis was cultured together with swabs. The organism identified in both specimens by biochemical tests using the Vitek II method (bioMérieux, France) was *Sphingomonas paucimobilis*. The antibiotic susceptibility profile of the pathogen was obtained using the Vitek II ID system. The microorganism was susceptible to amoxicillin/clavulanic acid

(MIC:≤2), cefepime (MIC:2), trimethoprim/sulphamethoxazole (MIC:1), imipenem (MIC:≤1) and meropenem (MIC:1); resistant to amikacin (MIC:≥64), cefotaxime (MIC:8), ceftazidime (MIC:≥64), ciprofloxacin (MIC:≥4), levofloxacin (MIC:4), ertapenem (MIC:≥8) and gentamicin (MIC:≥16).

X-ray showed previous surgical marks in the proximal tibial condyle. The isotope leukocyte bone scan confirmed an inflammatory state, with a selective radioactivity build-up around the knee due to migration of labeled granulocytes in the infection site.

According to the culture results, the treatment was changed to amoxicillin/clavulanic acid (1 g every 8 h) and trimethoprim/sulphamethoxazole (160/800 mg every 12 h). After 15 days, smaller fistula size was greatly reduced, the largest fistula was less healed, but there was a cessation of purulent discharge of both. Even if limb function improved, inflammation laboratory parameters were still slightly elevated: the leukocyte count was 11,000 units/ml, with 75% of neutrophils; he-

moglobin level 11.3 g/dl; VES 35 mm/h; C-reactive protein level 45 (normal range <5).

We therefore decided to continue antibiotic therapy considering the success obtained with the healing of the smaller fistula. After 15 days, during control checks, the largest fistula was also healed (Figure 2). So the skin infection was clinically healed and the patient showed a significant reduction of pain with partial recovery of limb function. Inflammatory markers normalized and the fistula closed. It was decided to continue antibiotic therapy for a further seven days, and a bone scan to assess the state of bone tissue was programmed.

At the time of the scheduled visit there was complete clinical and laboratory recovery of the patient. The bone scan confirmed the well-being of the patient with the resolution of the infectious process of the bone. Antibiotic therapy was therefore interrupted and a monthly follow-up was scheduled for two months.

DISCUSSION

There are more than 30 species in the genus *Sphingomonas*. *Sphingomonas* spp. are aerobic Gram-negative, oxidase-positive, non-fermentative microorganisms. One of the best known species of the genus is *Sphingomonas paucimobilis*, thus named because it has a single polar flagellum with slow motility. It is the only representative of clinical importance (Roh *et al.*, 2009). This organism occurs widely in natural (water and soil) and nosocomial environments, including hospital water systems, respiratory therapy equipment, and laboratory instruments. It has also been isolated, albeit rarely, from a wide variety of clinical specimens including blood, urine, sputum and cerebrospinal fluid (Charity *et al.*, 2005; Carrega *et al.*, 2008). In our patients *Sphingomonas paucimobilis* was revealed through cultures performed on synovial fluid obtained by arthrocentesis and with swabs of secreting fistula on surgical site.

S. paucimobilis has thus been implicated in a variety of community-acquired and nosocomial infections such as bacteremia, catheter-related sepsis, meningitis, peritonitis, cutaneous infection, adenitis, septic arthritis, osteomyelitis, endophthalmitis, visceral abscesses and diarrheal disease

(Casadevall *et al.*, 1992; Souto *et al.*, 2012; Yabuuchi *et al.*, 1990; Charity *et al.*, 2005; Araújo *et al.*, 2000). In particular, it emerged in a recent work published by Lin *et al.* that 69.0% of patients with *S. paucimobilis* bacteremia developed the infection in the hospital setting secondary to the presence of indwelling intravascular devices (Lin *et al.*, 2010). Instead, another recent study by Toh *et al.* arrived at different data, reporting 52.7% of patients analyzed affected by *S. paucimobilis* community-acquired infections (Toh *et al.*, 2011). In our case it is not clear if the infection with *S. paucimobilis* occurred during surgery or subsequent surgical procedures (dressing or catheterization). The nosocomial origin of infection is, however, highly probable. That said, sporadic case reports in the literature indicate that the incidence of infection, whether nosocomial or community-acquired, has been increasing in recent years (Lin *et al.*, 2010).

Thus *S. paucimobilis* infection has been described as a nosocomial or community-acquired disease which is always associated with different comorbidities, such as malignancy, diabetes mellitus, alcoholism, liver cirrhosis, end-stage renal disease, chronic obstructive pulmonary disease, burn injury and acquired immunodeficiency syndrome (Lin *et al.*, 2010). In contrast with most other cases reported in the literature, the present case report described *Sphingomonas paucimobilis* osteomyelitis in a patient without comorbidities. A similar report was described only recently by Souto *et al.* who presented a case of *S. paucimobilis* arthritis in an immunocompetent patient (Souto *et al.*, 2012).

Although there are a great variety of infections described, none of them has proved lethal: even if *S. paucimobilis* is a gram-negative bacteria, this organism lacks the lipopolysaccharide components in the outer membrane of the cell wall usually found in this class of microorganisms and which are associated with endotoxin activity. Hence the absence of these components may explain the low virulence attributed to this organism (Kawasaki *et al.*, 1994; Bulla *et al.*, 2010). To date, no definitive guidelines exist for antimicrobial therapy for *S. paucimobilis* infections (Romano *et al.*, 2009). The strains of *S. paucimobilis* are usually resistant to penicillins and first-generation cephalosporins due to the production of chromosomally encoded beta-lactamase pro-

duction (Corkill *et al.*, 1991). However, susceptibility to third-generation cephalosporins and fluoroquinolones varies: in the study of Cheong *et al.*, the *S. paucimobilis* isolate exhibited antibiotic resistance to cefotaxime and to amikacin (Cheong *et al.*, 2008). By contrast, in the study of Ozdemir *et al.* the microorganism was found to be susceptible to aminoglycosides, quinolones, trimetoprim/sulfamethoxazole and cephalosporin apart from ceftazidime and ceftazidime (Özdemir *et al.*, 2011). These differing results indicate the need to treat these infections with individualized antibiotic therapy, guided by the *in vitro* susceptibility of each clinical isolate. In our case the *S. paucimobilis* isolated was unusually susceptible to amoxicillin/clavulanic acid, cefepime and carbapenems, and showed resistance to amikacin, ceftazidime and fluoroquinolones. In conclusion, *S. paucimobilis* can cause a variety of infections in healthy and immunocompromised patients, and has been increasingly detected recently. Thus, even if it is a microorganism of low clinical virulence, its importance cannot be neglected. Indeed, this case report highlights the need to consider *S. paucimobilis* an important pathogen both in nosocomial and community-acquired infections.

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