



Pneumococcal Osteomyelitis in Children: A Case Report

**Rihem Ben Marzouk¹, Hanen Smaoui^{1*}, Mehdi Trifa², Sami Bouchoucha³,
Wiem Douira⁴, Mohamed Nebil Nessib³ and Amel Kechrid¹**

¹Laboratory of Microbiology, Children's Hospital, Faculty of Medicine of Tunis, University Tunis El Manar, Tunisia.

²Department of Anaesthesia and Intensive Care, Children's Hospital, Faculty of Medicine of Tunis, University Tunis El Manar, Tunisia.

³Orthopaedics Department, Children's Hospital, Faculty of Medicine of Tunis, University Tunis El Manar, Tunisia.

⁴Department of Radiology, Children's Hospital, Faculty of Medicine of Tunis, University Tunis El Manar, Tunisia.

Authors' contributions

This work was carried out in collaboration between all authors. Authors HS and RBM wrote the draft of the Manuscript and managed the literature searches. Author WD designed the figures and performed radiological examinations. Authors SB and MT managed literature searches and contributed to the correction of the draft. Authors AK and MNN provided the case and supervised the work. All authors read and approved the final manuscript.

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Case Study

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ABSTRACT

We describe a case of osteomyelitis, in a 7-month-old boy, caused by *S. pneumoniae* involving the pelvic bone with a purulent collection in the adductor muscle. Osteomyelitis diagnosis was suspected using ultrasound and CT scan investigations. This showed a periosteal elevation in the

*Corresponding author: E-mail: hanen.smaoui@gmail.com;

pelvis and an abscess of the adductor muscle. Culture of the perioperative specimens isolated serotype 19A *S. pneumoniae* with reduced susceptibility to penicillin and macrolides. The patient was treated successfully with amoxicillin-clavulanate during five weeks, associated with gentamicin during the first week.

Keywords: Osteomyelitis; *Streptococcus pneumoniae*; children; serotype; antimicrobial therapy; North Africa.

1. INTRODUCTION

Streptococcus pneumoniae is frequently isolated from the nasopharyngeal tract of healthy children [1]. However, it may cause a variety of diseases such as sinusitis, otitis media, pneumonia, bacteremia, and meningitis, as well as arthritis and acute hematogenous osteomyelitis, which is a common bone infection occurring during childhood [1,2]. Osteomyelitis usually affects the long bones of the lower limbs and may be complicated with bone deformities and abnormal growth [3]. Bone and blood culture allow the etiologic diagnosis. The treatment includes immobilization, administration of antibiotics with high osseous penetration, and surgical drainage in the case of sub-periosteal abscess [4].

We describe a case of osteomyelitis caused by *S. pneumoniae* involving the pelvic bone with a purulent collection in the adductor muscle and a sub-periosteal abscess.

2. CASE REPORT

A 7-month-old boy, with no medical history was brought to the emergency room on September 3, 2012 for a left hip pain associated to fever. His clinical history began 48 hours before. The mother described a reduction of spontaneous movements of the lower limb and an increased volume of the member. There was no history of local trauma, intramuscular injection, skin abrasion or infection. The patient had all updated vaccinations apart from the pneumococcal conjugate vaccine. Physical examination on admission revealed normal vital signs except a body temperature of 38.7°C, local swelling of the left upper thigh, with mild local warmth and redness pain. Patient cried during palpation and mobilization of the left limb. The initial laboratory investigations found leukocytes (white blood count (WBC) = 44180 / μ l), elevated erythrocyte sedimentation rate (ESR, 85 mm/hour) and C-reactive protein (208 mg/l). Two blood cultures were performed and were placed in the automated blood culture apparatus Bact/Alert (bioMérieux, France). X-ray of both hips and

upper legs were normal. Ultrasound of the pelvis and hip joints showed no collection of the left hip but there were multiple low-echo signals in the adductor muscles with a periosteal elevation in the pelvis bone. A CT-scan of the pelvis was performed twenty-four hours after the admission and revealed three abscesses of the adductor muscle ranging in size from 0.5 to 2 cm in diameter (Fig. 1). A sub-periosteal abscess was analyzed in this exam. A surgery was indicated immediately. It consisted on a surgical drainage of the abscesses; pus was evacuated by lavage and drainage of the cavity between the cortical bone and periosteum and inoculated into a blood culture bottle. Post-operatively, the patient was treated using a parenteral antibiotics association including cefotaxim 100 mg/kg/day and fosfomycin 100 mg/kg/day. This done according to the first-line antibiotic therapy protocols followed in our hospital for children under three years of age with acute osteomyelitis [5,6]. The blood cultures were negatives. Direct examination of pus showed multiple neutrophils leukocytes and the presence of Gram-positive diplococcus. Culturing on a blood agar plates, indicated the presence of Gram-positive diplococci colonies with alpha hemolysis. *S. pneumoniae* was confirmed by optochin susceptibility. Susceptibility tests were performed on Mueller Hinton Agar (Biorad, France) supplemented with 5% horse blood according to the "Comité de l'Antibiogramme de la société française de Microbiologie". Penicillin, cefotaxim and amoxicillin minimal inhibitory concentrations (MIC) were determined by the E test (bioMérieux) method. The *S. pneumoniae* isolated had a reduced susceptibility to penicillin (MIC: 0.25mg/l), but it was sensitive to cefotaxim (MIC: 0.25mg/l) and to amoxicillin (MIC: 0.25mg/l). The strain was susceptible to glycopeptides and fosfomycin. Moreover, it was resistant to erythromycin, lincomycin and tetracycline with low level of resistance to aminoglycosides (Table 1). *S. pneumoniae* serotype was detected by the latex agglutination method and Neufeld test using antisera from the Statens Serum Institute, Copenhagen. The *S. pneumoniae* isolated belonged to serotype 19A.

The initial antibiotics, used for treatment in our study, were replaced by amoxicillin-clavulanic-acid and gentamicin. Fever was resolved on the second postoperative day. Parenteral antibiotic therapy was maintained during the first postoperative week, and then converted to oral monotherapy by amoxicillin-clavulanic acid for another 4 weeks. Finally, there were a reduction of the local swelling and pain within 3 days and normalization of CRP in 7 days. The child was not discharged until the surgical wound healed and general health status recovered. Eight months after the surgery, there were no signs of chronic infection.

Table 1. Antimicrobial susceptibility test results (CA-SFM guidelines)

Antibiotic	Susceptibility result
Penicillin G	Intermediate : MIC = 0.25 mg/l
Amoxicillin	Susceptible : MIC = 0.25 mg/l
Cefotaxim	Susceptible : MIC = 0.25 mg/l
Gentamicin	Lowlevel of resistance
Erythromycin	Resistant
Pristinamycin	Susceptible
Vancomycin	Susceptible
Fosfomycin	Susceptible
Rifampin	Susceptible
Chloramphenicol	Susceptible
Trimethoprim-sulfamethoxazol	Susceptible

3. DISCUSSION

Acute osteomyelitis is defined as an infection of the bone diagnosed within 2 weeks of the onset of the disease [3,4,7]. It may affect any bone of the body, although most cases are found in the long bones of the lower limbs. A bacterium reaches a bone mainly through a hematogenous route from a primary infection site [4,8]. *Staphylococcus aureus* is the most common causative bacteria [4]. *Streptococci* are the second most frequent causative microorganisms, responsible for 10-15% cases, especially *Streptococcus pyogenes* [7]. Whereas *S. pneumoniae* is the most common cause of bacteremia in children, especially under the age of three years, it's an uncommon cause of bone and joints infections [1, 7].

S. pneumoniae colonizes the nasopharynx, and can be isolated in 20-40% of healthy children [9]. Invasive pneumococcal disease (IPD) may be

meningitis, pneumonia, bacteremia, osteomyelitis and septic arthritis. Pneumococcal arthritis is more common than pneumococcal arthritis in combination with osteomyelitis, whereas pneumococcal osteomyelitis without arthritis is even rare [1]. Pneumococcal osteomyelitis may have underlying conditions such as prematurity, central nervous system disease, respiratory tract disease, hemoglobinopathy, asplenia, malignancy, malnutrition, diabetic mellitus, HIV, renal disease or hypo-gammaglobulinemia. The incidence of systemic pneumococcal infection is substantially greater in children with underlying conditions than in previously healthy children [1,9]. In our case, we found no evidence of underlying diseases.

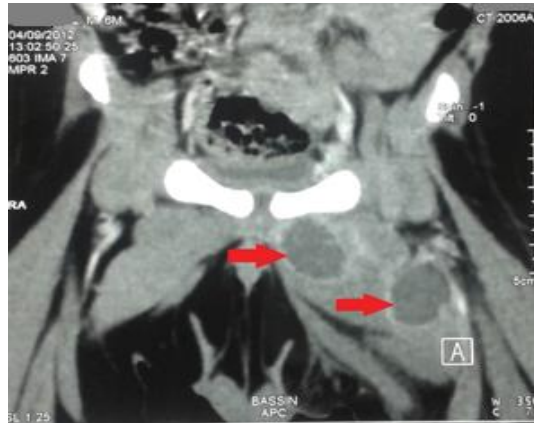


Fig. 1. Abscess of the adductor muscle in pneumococcal osteomyelitis

Classical acute osteomyelitis manifests as local pain in the affected limb. Local swelling, fever and redness are common especially in infants and young children [7]. Once the child's history and clinical symptoms and signs suggest acute osteomyelitis, serum CRP and ESR should be determined. At presentation, they almost always exceed 20 mg/l and 20 mm/h respectively [7]. Occasionally, the initial CRP value can be normal [10]. Sub-periosteal abscess may be complicate osteomyelitis; in this case a surgical drainage without delay is necessary [4]. In our case, the clinical, biological data (CRP, ESR, and WBC), ultrasound and CT scan suggested the diagnosis of acute osteomyelitis with a sub-periosteal abscess. This was confirmed by pus culture that isolated *S. pneumoniae*. For decades, penicillin was the major treatment of pneumococcal infections [2]. However, the increase of antibiotic resistance is recently a main problem. Tunisia belongs to countries having the highest levels of

penicillin resistance; this was reported in many studies from Tunisia showing that penicillin non-susceptibility rates exceed sometimes 50%, especially in children [11]. A direct causative effect of antimicrobial consumption on the increased rates of antibiotic resistance has been demonstrated [2]. Studies from Tunisia had also shown that the prevalence of resistance among other beta-lactams increased simultaneously with penicillin non-susceptibility [2]. The prevalence of macrolides resistance varies among countries but it has increased worldwide because of their widespread use [12]. In our case, *S. pneumoniae* was with reduced susceptibility to penicillin and resistant to erythromycin. The empiric antibiotherapy prescribed, based on cefotaxim and fosfomicin, was very broad-range. The choice was guided by the therapeutic protocols in our hospital [5,6]. This antibiotherapy was switched to amoxicillin-clavulanic acid to reduce the spectrum of activity.

S. pneumoniae presents with more than 90 serotypes, although a small number of them (e.g., serotypes 1, 4, 6B, 6A, 7F, 9V, 14, 18C, 19F and 23F) are implicated in more than 80% of invasive diseases and are also the prevalent carriers of antimicrobial resistance [2]. These ten serotypes, whether associated or not to three others (3, 5, 19A), are included in a pneumococcal conjugate vaccine (PCV). The inclusion of a pneumococcal conjugate vaccine in the immunization program of many countries has had a considerable positive impact on pneumococcal disease-associated morbidity and mortality. The PCV immunization program also reduces the antibiotic resistance of *S. pneumoniae*. In all conducted Tunisian studies, serogroups 14, 19 and 23 were the most frequent among clinical *S. pneumoniae* isolates [2,11]. In the present case, the isolate belonged to serotype 19A and manifested reduced susceptibility to penicillin. This serotype is part of the PCV13 conjugate vaccine. PCV is not yet included in our national immunization program, although it was introduced in the private sector since January 2008.

The gold standard for diagnosing osteomyelitis is the isolation of the responsible bacteria from local drainage of pus in a case of abscess. A blood culture is also very helpful for the diagnosis in association with other signs of bone infection. Cultures should be obtained before the initiation of antimicrobial treatment [4]. Most cases of osteomyelitis require a combination of adequate surgical drainage, lavage of sub-periosteal

abscess, and specific antimicrobial therapy for successful eradication of the infection [13]. Parameters such as resolution of clinical symptoms or the normalization of CRP value reflect a favorable evolution.

4. CONCLUSION

Osteomyelitis is a highly uncommon complication of pneumococcal bacteremia. Early diagnosis and treatment, which includes surgery and culture-directed antibiotic therapy, are essential for effective management of children with pneumococcal osteomyelitis. Long-term follow-up should be done to rule out a chronic infection. Because of the emergence of penicillin and multi-resistant strains, continual surveillance of antibiotic susceptibility, is recommended.

CONSENT

All authors declare that 'written informed consent was obtained from patient parent for publication of this case report and accompanying images.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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