Septic Arthritis and Concern for Osteomyelitis in a Child with Rat Bite Fever

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CASE REPORT

A 22-month-old male presented during the summer of 2011 to the emergency department of the Alfred I. duPont Hospital for Children with 2 days of upper respiratory tract symptoms followed by 5 days of fever, malaise, and a gradually worsening rash on his upper and lower extremities, including his palms and soles. The rash began to blister, and the toddler became irritable, prompting evaluation. Given his prodrome and rash, the patient was initially thought to have a viral syndrome, such as coxsackievirus. He was admitted for intravenous hydration and pain control. Initial vital signs included mild hypertension, tachycardia, and a fever to 38.0°C.

Physical examination revealed a toddler in moderate distress with a tender, erythematous, pustular rash scattered on his feet (Fig. 1), ankles, and hands. No joint swelling or tenderness was initially noted; however, due to patient anxiety, examination was difficult. Initial laboratory results were unremarkable, including a white blood cell (WBC) count of 10,200/µl, a hemoglobin concentration of 10.9 g/dl, and a platelet count of 217,000/µl, with normal differential values, electrolytes, and urinalysis results.

After 6 liters of irrigation, a sterile Jamshidi needle was used to aspirate the proximal metaphysis of the right femur, and the bone sample was sent for culture. The Gram stain of the synovial fluid sample revealed Gram-negative rods, and the synovial fluid cell counts were concerning for acute infection. At this time, antimicrobial treatment was switched to intravenous penicillin at 250,000 units/kg of body weight/day divided every 4 h, based on our review of the literature regarding treatment for presumed complications of RBF.

A magnetic resonance imaging (MRI) study of the hips (Fig. 2) was performed to further characterize the infection 4 days after the surgical procedure, demonstrating bone marrow edema in the proximal femoral epiphysis. We remained concerned for osteomyelitis, although we acknowledged that the findings could have been due to initial ischemia of the femoral head related to septic arthritis, with reperfusion injury after the procedure. Postoperative changes were unlikely, given that the bone biopsy was performed in the metaphysis, not the epiphysis.

Eventually, the pustule, synovial fluid, and bone cultures grew Streptobacillus moniliformis, confirming our diagnosis of RBF with septic arthritis. Although the MRI findings were not specific for osteomyelitis and the bone culture may have been contaminated by infected synovial fluid, we still opted to treat for presumed osteomyelitis, given the scenario. In retrospect, his lack of weight bearing with persistent fevers may have represented an early septic hip, and infection of the bone may have occurred from direct seeding due to prolonged untreated infection.

Streptobacillus moniliformis, a Gram-negative bacillus, is a relatively uncommon cause of bacterial infections, except in known cases of rat exposures. S. moniliformis colonizes the nasopharynx of numerous rodents, especially rats, and can also be excreted in urine. It is described as a pleomorphic, non-acid-fast, nonmotile, facultative anaerobe with fastidious requirements for laboratory growth (1). For optimal laboratory growth conditions, standard medium needs to be supplemented with 20% sterile rabbit serum and incubated with 5 to 10% CO₂ at 35.0°C (1–3). Initial growth can still lag for up to 5 days, despite optimal conditions. Previous reports have highlighted that sodium polyanethol sulfonate (SPS) medium needs to be supplemented with 20% sterile rabbit serum and incubated with 5 to 10% CO₂ at 35.0°C (1–3). Initial growth can still lag for up to 5 days, despite optimal conditions. Previous reports have highlighted that sodium polyanethol sulfonate (SPS)
in concentrations of 0.0125% or greater, usually found as an anticoagulant in automated blood culture vials, can limit the growth of *S. moniliformis* (2). In our case, fluids from the septic joint, bone, and foot lesion were plated on standard sheep blood agar (SBA; Columbia CNA agar with 5% sheep blood, chocolate, and MacConkey agars), and Bactec blood cultures were submitted. Plates were incubated at 37°C at 5% CO₂. No growth was visible at 24 h. At 48 h, a film developed on the Columbia CNA agar containing 5% sheep blood with the synovial fluid, bone, and pustule fluid samples exclusively. Other plates revealed no growth. A Gram stain of the isolate showed a pleomorphic, filamentous Gram-negative bacillus with some bulbous ends. The isolate was oxidase, indole, and catalase negative. At 72 h, the thioglycolate enrichment broth began to demonstrate characteristic “puff ball” forms (2). The Bactec blood cultures were negative at 5 days. The isolate was sent to a reference lab for 16S RNA sequencing and DNA mapping. Based on these results, the identification of *S. moniliformis* was confirmed.

Our patient was treated for a total of 8 weeks with antibiotics, with 4 weeks of intravenous penicillin and 4 weeks of oral amoxicillin. At 1 month of follow-up after treatment, the patient remained afebrile, with normalized inflammatory markers, and a plain-film study of the hips and pelvis was normal. He was involved in physical therapy and had improved weight bearing. He is currently overdue for follow-up and has not been seen so far this year due to noncompliance.

RBF is a bacterial infection caused by either *Streptobacillus moniliformis* or *Spirillum minus*. The former is more common in North America, and the latter (causing a form of RBF also known as *sodoku*) is seen in Asia (2). The disease has previously been limited mostly to those with exposures to wild rats or laboratory rats. In recent years, however, the incidence of this disease has increased with the increasing popularity of pet rats. RBF classically presents as a systemic illness involving fever, malaise, rash, and migratory polyarthralgias and is associated with numerous complications. When left untreated, it carries a substantial risk of mortality. Due to the nonspecific nature of the presenting symptoms, the disease has a high potential for misdiagnosis, especially when exposure to the rodent is not obvious or known (2, 4). Our patient presented with two of the three classic signs and symptoms of RBF: fever and rash. Joint involvement, the third classic finding, was not apparent on initial evaluation but may have been caught earlier if RBF had been considered. Previous case reports and reviews of RBF involving both children and adults have reported various serious complications, including fulminant sepsis, meningitis,

FIG 1 A tender, erythematous, pustular rash was noted on the plantar surfaces of the patient’s feet.

FIG 2 MRI of the hip (with and without contrast) was performed after right-hip joint aspiration and metaphyseal bone biopsy. (A) A coronal, T2-weighted, fat-saturated image shows edema in the right femoral epiphysis, with edema in the surrounding muscles and fascial planes. Soft tissue changes may, in part, be postoperative. (B) A coronal, contrast-enhanced, T1-weighted, fat-saturated image shows asymmetric enhancement of the right femoral epiphysis and synovium.
hepatitis, nephritis, amnionitis, pneumonia, myocarditis, and pericarditis. Case reports have also described pericardial effusion, septic arthritis, suppurative polyarthritis, and systemic vasculitis. Streptobacillary endocarditis has often been described as a complication and carries a mortality rate of 53% (2, 3). In our patient, *Streptobacillus moniliformis* was eventually isolated from the right-hip synovial fluid, which is consistent with previous reports of septic arthritis (2, 3). His normal cerebrospinal fluid studies, echocardiogram, and electrocardiogram made central nervous system or cardiovascular involvement unlikely. Other lab work ruled out renal or hepatic involvement as well.

To our knowledge, osteomyelitis has not been previously reported as a sequela of RBF. In our case, the bone culture eventually grew the causative organism and the MRI was concerning for possible osteomyelitis. Although we decided to treat for presumed bone infection, we recognize that the culture may have been contaminated. In addition, the imaging was done postoperatively and is therefore difficult to interpret.

RBF is a potentially fatal infection with a mortality rate of 13% when left untreated. Although the differential diagnosis for a patient presenting with nonspecific symptoms is broad, social history and other factors must be kept in mind when reaching a working diagnosis. Physicians should keep RBF on their differential diagnosis when a patient presents with classic symptoms of fever, rash, and joint involvement, especially if there is a history of exposure to rats (2).

**REFERENCES**