Pathological Fracture in Acute Osteomyelitis of Long Bones Secondary to Community-Acquired Methicillin-Resistant *Staphylococcus aureus*: Two Cases and Review of the Literature

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ABSTRACT: Pathologic fracture is a rare complication of acute bacterial osteomyelitis in adults. Community-acquired methicillin-resistant *Staphylococcus aureus* (CA-MRSA) has been increasingly reported in skin and soft tissue and systemic infections in children and adults, including many cases of osteomyelitis. We recently treated two adult patients with acute osteomyelitis of long bones secondary to CA-MRSA complicated by a pathologic fracture. In both patients, the primary source of dissemination to the bone was a skin and soft tissue infection. We speculate that virulence factors specific for CA-MRSA currently circulating in the United States may predispose to a complicated course of acute osteomyelitis. **KEY INDEXING TERMS:** Pathologic fracture; Methicillin-resistant *Staphylococcus aureus*; Osteomyelitis. **[Am J Med Sci 2006;332(6):357–360.]**

Pathologic fracture is a break in a diseased bone due to a weakening of the bone structure by a pathologic process (e.g., primary or metastatic tumor, infection, osteomalacia, Paget disease) without any identifiable trauma or following only a minor trauma.[1] Pathologic fracture is a rare complication of acute bacterial osteomyelitis of long bones in adults.[1] Few cases are reported in the modern literature. In the last few years, community-acquired methicillin-resistant *Staphylococcus aureus* (CA-MRSA) has been recognized as an important cause of skin and soft tissue infections and, less frequently, bone and joint infections, bacteremia and pneumonia.[2] CA-MRSA strains are distinguishable from the usual nosocomial strains of MRSA by belonging to a specific genetic group (SCCmec group IV), possessing a Panton-Valentine leukocidal toxin (PVL), and being susceptible to most antibiotics other than beta-lactams.[2] We recently cared for two patients who developed a pathologic fracture of a long bone as a complication of acute osteomyelitis due to CA-MRSA. We describe the clinical course of our patients and review the medical literature.

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Case Reports

Case 1

A 46-year-old woman was admitted to the hospital because of a pathologic fracture of the right humerus. Four months prior to the admission the patient noted a "boil" on the left lower leg with swelling, warmth, and purulent drainage. She was given a 7-day course of oral trimethoprim/sulfamethoxazole (one double-strength tablet twice daily) and the lesion resolved. The patient had no fever, chills, or sweats. There was no history of trauma or injections, but her daughter was reported to have had several furuncles.

Three months prior to the admission, the patient noted pain in the right upper arm. A radiograph of the right arm was unremarkable. The pain persisted despite treatment with oral analgesics.

Four weeks prior to the admission, the patient experienced worsening of the right arm pain after tossing a rubber ball to her grandchild. Radiograph of the right arm at that time revealed a pathologic fracture through a 10 cm permeative lesion of the shaft of the right humerus (Figure 1). The differential diagnosis was metastatic carcinoma, multiple myeloma, lymphoma, and osteomyelitis. The patient's past medical history was positive only for well-controlled hypertension. She was married and not employed. There was no history of a malignancy or weight loss. The patient had no history of hospitalization since the birth of her children more than 20 years earlier and her last office visit to her primary medical care provider was more than a year earlier. The patient did not drink alcohol or use tobacco or illicit drugs. Temperature was 37.1°C, pulse was 82/minute, respirations were 16/minute, and blood pressure was 126/84 mm Hg. Examination of the head, neck, breasts, chest, heart, and abdomen were normal. There was a firm, tender swelling over the right upper arm and a healed discolored area over the left lower leg.

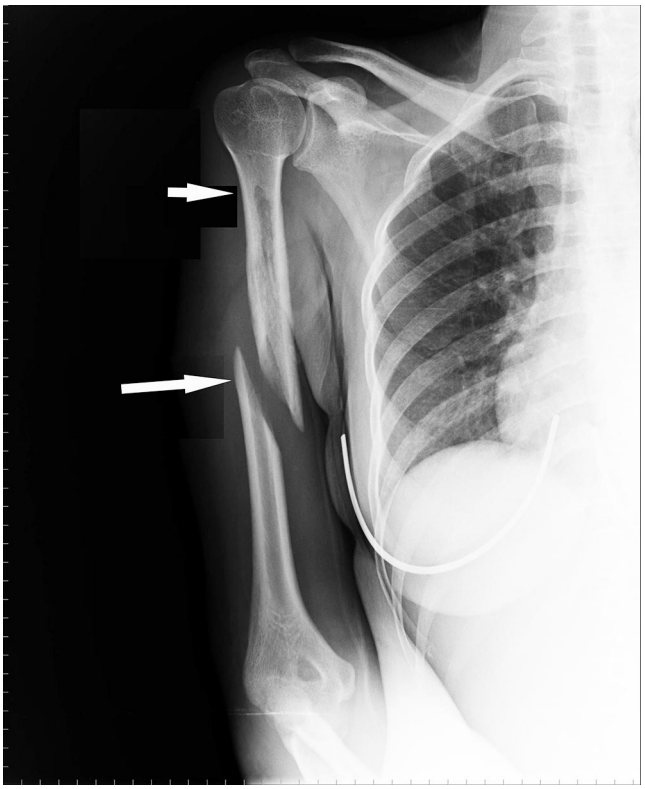

Figure 1. Radiograph demonstrating a permeative appearance of right humerus extending from proximal metaphysis (short arrow) to pathologic fracture of diaphysis (long arrow).

Hematocrit was 28.1%, white blood cell count was 6800/mm^3 with a normal differential count, erythrocyte sedimentation rate was 77 mm/hour, and C-reactive protein level was 0.8 mg/L. A comprehensive multichemistry profile was normal. A serum protein electrophoresis showed no abnormalities. Radiograph of the left lower leg showed no bone abnormalities. Computed tomography scan of the chest, abdomen, and pelvis was normal. A technetium-labeled bone scan showed abnormal uptake at the fracture site only.

Because of suspicion of a malignant process, an incisional biopsy of the fracture site was performed. Purulent material was discovered at the fracture site. A frozen section revealed inflammation with no evidence of neoplasm. Subsequently debridement and irrigation was performed at the same surgical setting. The fracture was reduced and the wound was closed over a Hemovac drain. The reduction was initially maintained in a coaptation splint and later in a Sarmiento brace. Gram stain of the pus showed many gram-positive cocci in clusters. Culture of the pus showed a heavy growth of MRSA susceptible to vancomycin, erythromycin, clindamycin, rifampin, trimethoprim/sulfamethoxazole, tetracycline, levofloxacin, and gentamicin (microbroth automated susceptibility; Microscan, Renton, WA). Pathologic examination of the operative specimen showed granulation tissue and fibrinopurulent material but no evidence of neoplasm. Two sets of blood cultures were sterile.

The patient was given vancomycin 1 g intravenously twice daily for 8 weeks followed by an open reduction and internal fixation procedure. An additional course of intravenous vancomycin and oral rifampin was administered 8 weeks after the last surgery because of an operative culture showing a few colonies of MRSA with susceptibilities identical to the initial isolate. Two months after completion of antibiotic therapy, erythrocyte sedimentation rate has returned to normal and the patient had no clinical evidence of persistent infection.

Case 2

A 28-year-old woman with a history of subcutaneous heroin abuse ("skin popping") was admitted to the hospital with a right thigh swelling and pain of 3 days' duration. She reported daily subcutaneous injection of heroin into both upper thighs after becoming unable to gain venous access in either arm. Over the preceding several months, the patient had developed several small collections of pus in both arms and upper thighs and had treated them herself at home with needle drainage and application of warm soaks. She did seek medical attention for these infections and received no antibiotics. She smoked 1 pack of cigarettes daily, used alcohol to the point of intoxication frequently, and also occasionally smoked crack cocaine. She had been intermittently homeless but currently was residing with her grandparents. There was no history of chronic medical illnesses, surgical procedures, previous hospitalizations, or contact with healthcare facilities or personnel in the previous 3 years. She did have a history of a skin rash after taking trimethoprim/sulfamethoxazole for a urinary tract infection several years earlier.

Temperature was 36.8°C, pulse was 112 beats/minute, respirations were 22/minute, and blood pressure was 141/78 mm Hg. Oxygen saturation was 95% while breathing room air. The right thigh was diffusely swollen and tender on palpation with erythema of the skin but no fluctuance or crepitance. Head, neck, and chest examination was normal. Heart examination showed regular tachycardia with no murmur, gallop, or rub. Abdominal examination was normal. Multiple hyperpigmented needle track and injection marks were present on both arms and upper thighs. Pelvic and rectal examination was normal. There were no joint effusions or deformities or distal embolic lesions of endocarditis. Neurologic examination was unremarkable.

The white blood cell count was 15,600/mm^3 with 70% segmented neutrophils, 19% banded neutrophils, and 11% lymphocytes. Hematocrit was 35.9% and platelet count was 398,000/mm^3. Comprehensive metabolic panel showed albumin of 2.0 g/dL but was otherwise within normal limits. Erythrocyte sedimentation rate was 123 mm/hour and C-reactive protein level was 31 mg/L. Hepatitis C antibody was positive but serologies for syphilis and human immunodeficiency virus were negative. Two sets of blood cultures grew MRSA susceptible to vancomycin, erythromycin, clindamycin, rifampin, trimethoprim/sulfamethoxazole, tetracycline, levofloxacin, and gentamicin (microbroth automated susceptibility testing; Microscan, Renton, WA). The isolate was also susceptible to linezolid and daptomycin (Etest; AB Biodisk, Solna, Sweden). Transthoracic and transesophageal echocardiograms showed no valvular abnormalities suggestive of endocarditis.

A magnetic resonance imaging study of the right thigh showed osteomyelitis involving the middle portion of the right femur with a multiloculated abscess of the vastus intermedius and vastus medialis muscles. Vancomycin 1.5 g intravenously every 12 hours was administered. The patient refused surgical intervention or a radiographic drainage of the abscesses. After 2 weeks of vancomycin therapy, a diffuse maculopapular rash developed on the face, trunk, and extremities and vancomycin was changed to linezolid 600 mg orally twice daily. The rash resolved over the next few days. Blood cultures were repeated and showed no growth. During the second week of linezolid therapy, the patient stumbled and fell to the ground, twisting her right leg. A right leg radiograph showed a complete partially displaced fracture of the right femur. Magnetic resonance imaging examination of the right leg showed abnormal marrow signal consistent with osteomyelitis, as well as a midshaft femoral fracture with mild displacement of the distal fragment. Previously described abscess was unchanged (Figure 2).

A tibial pin was inserted and the right leg was placed in traction. Linezolid was changed to daptomycin 6 mg/kg intravenously every 24 hours to provide bactericidal activity, and the patient underwent open reduction, debridement, and internal fixation of the fracture with an intramedullary rod. Pathologic