Methicillin-Resistant *Staphylococcus aureus* as a Cause of a Quadriceps Tendon Tear

Shital N. Parikh, MD, and Danesh Bansal, BS

Abstract

Methicillin-resistant *Staphylococcus aureus* (MRSA) is an important causative agent in myositis and pyomyositis, but its involvement in quadriceps tendon tears has not been reported until now. In the case reported here, accurate diagnosis was delayed because of the unique presentation, and the infection was mismanaged with corticosteroids because of the presumptive diagnosis of an inflammatory pathology. Subsequently, aggressive surgical and antibiotic management produced a satisfactory outcome. Early detection and appropriate management of these infections are extremely important in preventing limb- and life-threatening consequences.

Methicillin-resistant *Staphylococcus aureus* (MRSA) has emerged as a major source of musculoskeletal infections in healthy people.[1] Although MRSA is an important causative agent in skin, soft-tissue, and necrotizing fasciitis infections,[2-4] to our knowledge, its involvement in quadriceps tendon tears has not been reported until now.

The patient provided written informed consent for print and electronic publication of this case report.

Case Report

A 19-year-old woman presented to our clinic with Klippel-Trénaunay syndrome in the right leg. This syndrome is characterized by capillary vascular malformation, varicose veins and/or venous malformations, and soft-tissue and/or bone hypertrophy, usually affecting one extremity. She reported a 3-week history of increasing pain over the left distal thigh and knee. She was afebrile and denied any history of trauma. Two days before symptom onset, she had been sitting for an extended time while painting baseboards. Physical examination revealed tenderness to palpation over the quadriceps tendon insertion site on the patella. There was swelling in this area with mild warmth but no erythema. Radiographs of the left knee were negative for lesions. Magnetic resonance imaging (MRI) was scheduled for the following week, and she was prescribed an anti-inflammatory medication, a knee immobilizer, and crutches for assistive ambulation. Two days later, she went to the emergency department because of continuing pain. There, she was started on oral prednisolone for presumptive quadriceps tendonitis.

After 6 days, the patient returned to the clinic. She was unable to bear weight on the left leg, and the pain and swelling in the distal thigh were increasing. She kept the left knee extended and was unable to perform a straight leg raise. Because of significant pain, she resisted attempts to flex the knee. Hematologic examination revealed erythrocyte sedimentation rate (ESR) was 50 mm/h (normal range, 0-20 mm/h); total white blood cell (WBC) count 8.2×10^9/L (normal range, $4.5\text{-}13\times10^9$/L) with 84% neutrophils (normal range, 40%-70%); and C-reactive protein (CRP) level 31.3 mg/dL (normal, <1.0 mg/dL). MRI without contrast showed disruption of the quadriceps tendon about 2 cm proximal to its patellar attachment, with fluid between the disrupted fibers. The quadriceps tendon insertion on the patella appeared intact; only a few tendon fibers were torn from the attachment. Edema was extensive, involving the soft tissues surrounding the patella and extending to the musculature and subcutaneous tissues (**Figures 1, 2**).

The patient was taken to the operating room for quadriceps tendon repair. General anesthesia was administered, and a midline 7-cm incision was made centered over the patellar insertion site of the quadriceps tendon. Clinically evident pus was evacuated and sent for gram staining, bacterial culture, fungal culture, mycobacterial culture, and WBC count. Most of the quadriceps tendon fibers, though attached to the patella, were disrupted longitudinally above the patellar insertion. After necrotic tissues and pus were debrided, a #2 FiberWire suture (Arthrex Inc, Naples, Florida) was looped around the quadriceps tendon fibers to approximate the strands of disrupted tendon. A single-layer wound closure was performed. The patient was placed in a knee immobilizer that was to be worn for 4 weeks.

The microbiological study confirmed the gram-positive cocci as MRSA. The isolate was clindamycin-sensitive and

Authors' Disclosure Statement: The authors report no actual or potential conflict of interest in relation to this article.

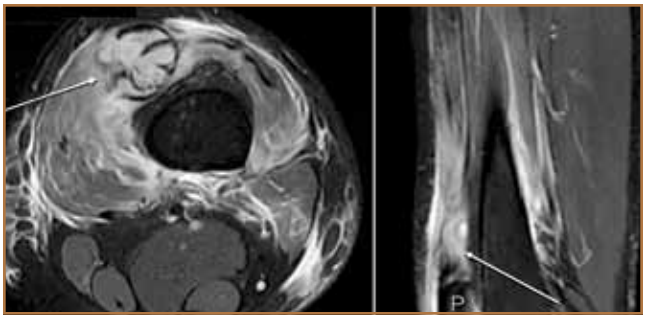

Figure 1. T_2-weighted magnetic resonance imaging shows disrupted quadriceps tendon (arrows) with fluid signal. Axial view shows increased signal in surrounding muscles. Sagittal view shows some quadriceps tendon fibers still attached to patella (P).

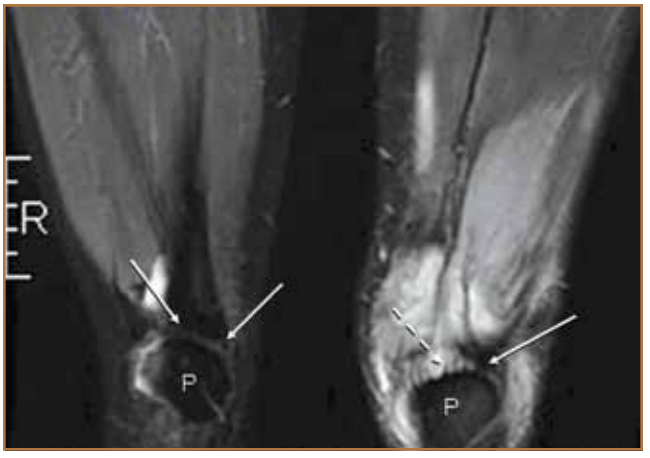

Figure 2. Coronal T_2-weighted magnetic resonance imaging shows partial tear of the tendon from its patellar insertion (dashed arrow) versus intact fibers and normal attachment of the quadriceps tendon to the patella (P) on the contralateral side (solid arrows).

erythromycin-resistant, with no inducible resistance to clindamycin, as confirmed by double disk diffusion (D)-test. The patient was treated with intravenous clindamycin for 2 weeks, then oral sulfamethoxazole/trimethoprim for 2 weeks. She, her family members, and boyfriend underwent a treatment regimen of intranasal mupirocin and weekly chlorhexidine showers.

The patient recovered well after surgery. Eight weeks postoperatively, her pain had decreased, full range of motion returned, and she was able to perform a straight leg raise. The inflammatory markers normalized: ESR was 6 mm/h (normal range, 0-20 mm/h); total WBC count was 6.2×10^9/L (normal range, 4.5-13$\times10^9$/L) with 54% neutrophils (normal range, 40%-70%); and CRP level was <0.5 mg/dL (normal, <1.0 mg/dL). One year after surgery, she had no symptoms, deficits in quadriceps strength or knee range of motion.

Discussion

Staphylococcus myositis and pyomyositis (bacterial infection of skeletal muscle with localized abscess formation) is endemic in tropical countries and less common in temperate areas, such as North America.[1-4] *S aureus* is an important causative agent in myositis and pyomyositis, but to our knowledge, its involvement in quadriceps tendon tears has not been reported until now. MRSA has moved beyond the hospital setting and emerged as a community-acquired pathogen in healthy patients.[5] Early detection and management of these infections are extremely important in preventing limb- and life-threatening consequences.[3]

Klippel-Trénaunay syndrome, a rare congenital disorder of the peripheral vascular system, is characterized by capillary vascular malformation, varicose veins and/or venous malformation, and soft-tissue and/or bone hypertrophy, usually affecting 1 extremity.[6,7] Our patient had cutaneous capillary malformations on the right leg but not the left leg, and no leg-length or -circumference differences. She had a history of menorrhagia but no limitations related to Klippel-Trénaunay syndrome, and she led an active life. The pathogenesis of infection in her case is unknown. It has been postulated that pyomyositis occurs when an injured muscle is seeded with an infective organism, usually from a breach, anywhere in the skin or mucosa, that leads to bacteremia and ultimately infection of the traumatized muscle.[2] Our patient did not have a history of trauma. It is possible that the quadriceps tendon was secondarily affected by pyomyositis involving the quadriceps muscle group. However, MRI and intraoperative findings did not reveal any substantial muscle necrosis or involvement. Another possible cause of tendon involvement is hematogenous spread through an arteriovenous malformation inside or around the tendon. Although such a malformation can develop as part of Klippel-Trénaunay syndrome, none was identified during surgery. The differential diagnosis on presentation included quadriceps tendonitis, calcific tendonitis, attritional rupture of tendon, and infection. Because of the unique presentation, the diagnosis was delayed, and the administration of corticosteroids may have exacerbated the infection.

The finding of pus during surgery and the subsequent isolation of MRSA were surprising. Although our patient's hematologic characteristics were similar to other infected patients, it was difficult to diagnose her condition, as its unusual presentation affected the relatively avascular quadriceps tendon, and the otherwise healthy woman had no fever or external injury. Plain radiographs were of limited value. MRI is the imaging modality of choice for musculoskeletal infections, as it can be used to delineate the extent of muscle or tendon involvement and to localize fluid collections.[8] In the case of our patient, MRI showed the quadriceps tendon tear and a fluid collection. The fluid could have been aspirated for diagnostic and therapeutic purposes, but the tear required surgical intervention. If infection is widespread, the surgeon can consider staged debridements before definitive closure. If possible, the surgeon should avoid inserting foreign materials, such as braided, nonabsorbable sutures, in the infection setting.

For all suspected cases, the widespread increase in community-acquired MRSA should be taken into account when selecting antimicrobial agents. The possibility of recurrent skin and

soft-tissue infections caused by MRSA has been reported to be as high as 21%,[9] so patients should be followed for a longer duration. Physicians must be aware of the virulent nature of *S aureus* and its increasingly varied presentation.

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Am J Orthop. 2013;42(5):227-229.

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