A 32-year-old man was involved in a severe motor vehicle collision in India, 6 years before the current presentation. He suffered multiple fractures, including a closed fracture of his proximal femur that was treated with open reduction and internal fixation. Shortly after that operation, his femur became infected and was treated with irrigation and débridement. Nine months after the index procedure, his femoral fracture had healed and hardware was removed. He was left with a leg-length discrepancy, leg pain and a persistently draining sinus. He had no other significant medical history and did not report fever, chills or night sweats.

Physical examination revealed a short-leg gait on the right side with a 3-cm leg-length discrepancy and a healed lateral incision with a 1-cm draining sinus located anterolaterally. Quadriceps strength was 4+/5.

Anteroposterior (Fig. 1) and lateral (Fig. 2) radiographs of the femur showed bony bridging across the previous fracture site, with sequestrum formation. Technetium-99m bone scanning showed slightly increased uptake at the mid-femur on immediate, blood pool, and delayed images. Gallium scanning showed moderate increase in uptake at the same site. Magnetic resonance imaging confirmed bony destruction anterolaterally with a sequestrum and sinus tract visible on gadolinium-enhanced $T_2$-weighted images (Fig. 3).

A diagnosis of chronic osteomyelitis was made from the patient's

Submitted by Joel Lobo, MD, and Michael McKee, MD, Division of Orthopaedic Surgery, St. Michael’s Hospital, Toronto, Ont.

Correspondence to: Dr. Michael McKee, Division of Orthopaedic Surgery, Department of Surgery, St. Michael’s Hospital, 30 Bond St., Toronto ON M5B 1W8; fax 416 359-1601; mckee@the-wire.com

Musculoskeletal images. Chronic osteomyelitis
medical history, physical examination and imaging studies. He was treated with irrigation and radical débridement, followed by insertion of antibiotic-impregnated beads to eradicate the infection. Culture of tissue taken intraoperatively grew methicillin-resistant *Staphylococcus aureus*. For 6 weeks postoperatively he was treated intravenously with vancomycin through a peripherally inserted central catheter. Eighteen months postoperatively, he was pain-free and had a clean, dry, healed wound.

Chronic osteomyelitis is a supplicative infection of bone that follows a long-term course of intermittent symptoms. Although acute osteomyelitis occurs in the first 6 weeks after the initial infection, chronic osteomyelitis can flare years later, often following a waxing and waning course of purulent drainage, fistulas and long-term radiographic changes. The primary cause of persistent infection is the presence of dead bone to which systemic antibiotics cannot be effectively delivered. A fragment of dead bone in the centre of the infection is termed a sequestrum. New bone is formed (the involucrum) in an attempt to wall-off the infection, which may be contained in a chronic medullary abscess (Brodie’s abscess) or drain via a sinus tract to the skin.

Although patients may report an insidious onset with multiple exacerbations, they may be completely asymptomatic between episodes of pain, draining sinus formation or fever. Physical examination may reveal a draining sinus, bony tenderness and, in cases of juxta-articular infection, a reactive joint effusion. Especially in children with metaphyseal infection, a septic arthritis can occur and should be considered in the differential diagnosis of joint pain and effusion in the setting of osteomyelitis.

Plain radiographs often show the involucrum as intense sclerosis and cortical thickening often described as “onion-skinning.” The sequestrum may be visible on plain radiographs.

FIG. 2. Lateral (left) and lateral close-up (right) views of the right distal femur. Black arrows show the sequestrum.

FIG. 3. T1-weighted, gadolinium-enhanced axial magnetic resonance image of the right femur. The black arrow shows the sequestrum and the white arrow shows the sinus tract leading to a periosteal abscess, which is highlighted by gadolinium enhancement.
and represents the nidus of infection. If not present on plain films, adjunc- 
tive modalities include computed to-
mography, which may show the 
sequestrum and surrounding tissue 
edema. Technetium-99m scans often 
show increased uptake on acute and 
delayed images, but inflammation is 
cluded in the differential diagnosis 
for this finding alone. The addition of 
abnormal findings on the gallium scan 
increases the sensitivity for a diagnosis 
of chronic osteomyelitis. Magnetic 
resonance images show a darker $T_1$ 
and a brighter $T_2$ signal in the area of 
osteomyelitis owing to replacement of 
normal marrow by exudate and 
edema. With the small subset of pa-
tients in whom the diagnosis is still 
unclear, tissue biopsy and culture re-
main the standard diagnostic method. 
The mainstay of treatment is rad-
cial surgical débridement of all devital-
ized or infected tissue. Antibiotics are 
an important adjuvant treatment and 
should be started at the time of 
surgery. Antibiotic therapy should be 
based on results of intraoperative tis-
sue cultures, but if the organism has 
not been recognized, empiric intra-
venous antibiotics are started to treat 
the most common organisms, $S. au-
reus$, Pseudomonas, and anaerobic 
bacteria. The duration of antibiotic 
therapy is controversial, but most pa-
tients are treated for at least 6 weeks, 
which can include 2 weeks of par-
enteral and 4 weeks of oral therapy 
or, for virulent organisms or im-
munocompromised hosts, 6 weeks of 
intravenous antibiotic therapy. Dead 
space is managed by insertion of 
antibiotic-impregnated beads. Other 
adjuvant treatments to promote heal-
ing include proper nutrition, smoking 
cessation, control of medical condi-
tions such as diabetes and, in extreme 
situations, hyperbaric oxygen. 
Squamous cell carcinoma can de-
velop in long-standing sinus tracts, 
and can be identified by biopsy. In 
situations where infection is uncon-
trollable despite aggressive surgical 
chéridement followed by appropriate 
antibiotic therapy, amputation re-
mains the best alternative to restore a 
pain-free, stable, functional limb.■