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CLINICAL VIGNETTE

Late Presentation of a Prosthetic Joint Infection

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Case Presentation

A 72-year-old man presented with a 3-day history of progressively worsening right knee pain. The pain had not responded to acetaminophen he typically used to control his osteoarthritis.

His past history included post-traumatic stress disorder, morbid obesity, hypertension and osteoarthritis. He had bilateral total knee replacements 10 years prior for osteoarthritis. His initial surgery was complicated by infection of his left total knee replacement with methicillin-resistant *Staphylococcus aureus* (MRSA). He underwent resection arthroplasty, placement of a spacer and treatment with antibiotics with subsequent left knee fusion. His left knee continued to be painful but evaluation for infection was negative with normal bone scan and C-reactive protein (CRP). One year later, his right knee became painful. Infectious markers (ESR and CRP) were in the normal range and films suggested aseptic loosening which led to a revision right total knee arthroplasty.

Several years pass and he now presents with 3 days of right knee pain. He denied fever and chills but had a moderate right knee effusion with warmth and erythema over the anterior aspect of the right knee. His range of motion was limited to 45 degrees and he had lower extremity edema. Orthopedic surgery was consulted and deferred aspirating the joint in the emergency room due to overlying cellulitis. He was admitted and treated with vancomycin and ceftriaxone and discharged to complete a course of cephalexin and doxycycline with infectious disease follow up.

He was scheduled for a knee aspiration after his cellulitis resolved. Bone scan was positive with increased metabolic activity at the level of the femoral and tibial prosthesis concerning for prosthetic joint infection. C-reactive protein was 11 mg per liter. IR-guided aspiration showed a white cell count of 160,500 with 95% PMN. Cultures grew methicillin-sensitive *Staphylococcus aureus* (MSSA) and he was treated with cefazolin and rifampin. A two-stage knee replacement was recommended, but he elected to retain the prosthesis and be treated with long-term suppressive anti-biotics. His pain remains stable and his mobility has improved.

Discussion

Total knee arthroplasty is a common orthopedic procedure that can improve pain, joint function and mobility. However, pros-

thetic joint infection (PJI) is a rare complication of total knee arthroplasty (TKA). There are 1,000,000 total hip and knee replacements done annually.¹ The risk of infection after a total knee arthroplasty is .8-1.9%.² The average cost to treat each prosthetic joint infection is around \$30,000.³ Risk factors for PJI include tobacco use, obesity, immunosuppression and diabetes.² Surgery-specific risk factors include bilateral knee replacement, operative time >2.5 hours, urinary tract infection and *Staphylococcus aureus* bacteremia.²

Small numbers of bacteria can seed a prosthetic joint by forming a biofilm that is not susceptible to immune response. Common organisms causing PJI include coagulase-negative staphylococcus (30-43%), *Staphylococcus aureus* (12-23%), streptococci (10%), gram-negative rods (GNR) (3-6%) and anaerobes (2-4%).⁴ *Staphylococcus aureus* and gram-negative rods typically present less than 3 months after surgery while infection with coagulase-negative staphylococcus can present months to years later. Acute infection of the prosthetic joint typically presents with severe pain, redness, sinus tract or warmth over the joint. Chronic infection may present more insidiously with chronic pain and loosening of the prosthesis. Early infections typically occur at the time of implantation (from skin, respiratory, dental or urinary tract) while some late infections (>2 years) may be due to a hematogenous source.⁴

Diagnosis of a prosthetic joint infection can be challenging and is established with a combination of labs, imaging and arthrocentesis. The presence of a sinus tract is concerning for underlying PJI. ESR and CRP testing can be helpful. A normal CRP level makes infection unlikely. CRP has 73-91% sensitivity and 81-86% specificity for PJI of the knee when a CRP cut-off of >13.5 mg per liter is used.⁵ The CRP typically returns to normal within 2 months of surgery. Radiographs are recommended as part of the initial evaluation by IDSA guidelines. However, plain films have low sensitivity and specificity as radiolucency can be observed in infection or aseptic loosening. Other imaging modalities that have been used include CT, MRI and bone scan. CT and MRI may be limited by hardware artifacts. Per IDSA guidelines, CT, MRI, bone scans and positron emission tomography should not be routinely used to diagnose PJI.¹

The most helpful test for diagnosis is synovial fluid analysis. An aspiration of the joint synovial fluid should be sent for cell count, differential, and culture (aerobic and anaerobic).¹ A

synovial fluid leukocyte count of more than 1.7×10^3 per cubic millimeter or a differential with more than 65% neutrophils is consistent with PJI.¹ It is essential to know the pathogen to choose an appropriate antibiotic. Gram stain of synovial fluid is 97% specific but only 26% sensitive.³ Periprosthetic intra-operative samples (for aerobic and anaerobic culture) will also assist the orthopedic surgeon in diagnosis. IDSA guidelines recommend collection of five to six samples to aid in diagnosis.¹

Treatment of PJI is determined by collaboration between orthopedic surgery and infectious disease. Options for treatment of PJI include debridement and retention of a prosthesis, removal without replacement, one-stage replacement and two-stage replacement.³ Patients without a sinus tract and <30 days from the surgical date may be candidates for debridement without removal of the prosthetic joint. In a one-stage exchange, the infected prosthesis is removed and a new prosthesis is implanted in the same surgery. In a two-stage exchange, the infected prosthesis is removed with reimplantation occurring 6 weeks to 3 months later. A spacer treated with antimicrobial drugs is used in the interval when no prosthesis is present to maintain leg length and to treat infection.² Four to six weeks of targeted intravenous antibiotics are recommended to treat PJI in resection arthroplasty, one and two-stage exchange.¹ A two-stage exchange is more common in the US and has higher rates of cure than a one-stage replacement. The incidence of resolution of the infection is 87% with a two-stage exchange surgery.¹

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