Periprosthetic Joint Infection After Hip and Knee Arthroplasty: A Review for Emergency Care Providers

Tyler A. Luthringer, BA*; Yale A. Fillingham, MD; Kamil Okroj, BA; Edward J. Ward, MD, MPH; Craig Della Valle, MD

*Corresponding Author. E-mail: tyler.luthringer@gmail.com.

Periprosthetic joint infection is among the most common modes of failure of a total hip or knee arthroplasty and can be a common concern when patients present to the emergency department for care. The initial evaluation for periprosthetic joint infection includes a history and physical examination, followed by radiographs (to rule out other causes of pain or failure) and then serum erythrocyte sedimentation rate and C-reactive protein testing. If the erythrocyte sedimentation rate and C-reactive protein level are elevated or if the clinical suspicion for infection is high, the joint should be aspirated and the fluid sent for culture, as well as for a synovial WBC count and differential, with optimal threshold values of 3,000 WBC/μL and 80% polymorphonuclear cells, respectively. Recent work has shown that optimal cutoff values for patients presenting in the early postoperative period (within the first 6 weeks postoperatively) are different, with a C-reactive protein level greater than or near 100 mg/L (normal <10 mg/L), indicating the need for aspiration, with synovial fluid WBC thresholds of 10,000 WBC/μL and 90% polymorphonuclear cells. Antibiotics should not be administered before joint aspiration unless the patient has systemic signs of sepsis because even a single dose may cloud the interpretation of subsequent tests, including cultures taken from the joint. Furthermore, superficial cultures taken from wound drainage are discouraged because they can similarly cloud diagnosis and treatment. The rising prevalence of total joint arthroplasty makes proficiency in the assessment and early management of periprosthetic joint infection important for the emergency physician to optimize clinical outcomes. [Ann Emerg Med. 2016;68:324-334.]

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INTRODUCTION

Total joint arthroplasty is an effective means to improve quality of life and restore function in patients faced with end-stage arthritis of the knee and hip. As the demand for total joint arthroplasty continues to increase in an aging population, unfortunately so will the burden of the procedure's associated complications.[1] Periprosthetic joint infection is among the most feared modes of failure of hip and knee arthroplasty because it is difficult to diagnose and treat. Failure of a total joint arthroplasty may be defined as any complication that necessitates a return to the operating room. It is estimated that periprosthetic infection occurs in up to 2% of primary total knee arthroplasties[2] and total hip arthroplasties.[3] Infection is the leading cause of early revision after total knee arthroplasty, causing 25.4% of revisions within the first 2 years after the primary operation and 7.8% of revisions occurring more than 2 years postoperatively.[4] As the third leading cause of revision surgery after total hip arthroplasty, infection necessitates 14.8% of all revision total hip arthroplasty procedures.[5] The incidence of periprosthetic joint infection is even higher after revision arthroplasty, complicating up to 5.6% and 3.3% of revision procedures of the knee and hip, respectively, in one series.[6]

One of the most common misconceptions about periprosthetic joint infection among providers is the level of urgency posed by the diagnosis compared with that of a native joint infection. High bacterial and leukocyte burden within a native joint carries risk of cartilage deterioration, which necessitates emergency surgery to salvage the integrity of the supporting structures within the joint space.[7] After total joint arthroplasty, however, all native cartilage has been replaced by the prosthesis, thereby removing structures immediately susceptible to direct damage. Periprosthetic joint infection should be considered urgent, except for in the rare case in which the patient is showing signs of hemodynamic instability as a result of severe sepsis or septic shock, which should be considered an emergency. Such cases, although uncommonly encountered, should be treated with early antibiotics and resuscitation.[8] In the clinical experience of the senior authors, however, a (native or periprosthetic) joint infection is much more likely to occur as a result of inoculation in a bacteremic or septic patient than is

sepsis to arise from the source of an infected joint. To our knowledge, a search of the literature yields no articles that discuss the actual incidence of sepsis as a result of periprosthetic joint infection.

Generally, acute postoperative and acute hematogenous infections are considered urgent because rapid surgical treatment may improve the chances of being able to retain the prosthetic components, whereas most chronic infections can be managed on an elective basis because removal of the prosthetic components is almost always recommended for chronic infections. A familiarity with the basics of evaluating a patient for periprosthetic joint infection is useful to help guide prompt diagnosis and appropriate treatment. It is critical for emergency care providers to understand that the administration of antibiotics before an appropriate evaluation for periprosthetic joint infection can greatly hamper further efforts at an accurate diagnosis. Because emergency providers are trained to quickly identify and treat infection in accordance with Infectious Diseases Society of America recommendations[8] and National Quality Forum measures, it is important to recognize that the majority of periprosthetic joint infections are not life threatening, nor are they emergency issues like that of native joint infection, as previously described. Although the aim of such quality measures is to improve patient outcomes and safety in the face of severe sepsis and septic shock, it is crucial that emergency providers recognize and understand the benefit of withholding antibiotics early in the evaluation of medically stable patients with suspected periprosthetic joint infection. By interfering with organism isolation and culture growth, premature antibiotic administration can severely complicate the ability to correctly manage a periprosthetic joint infection.

CLASSIFICATION OF PERIPROSTHETIC JOINT INFECTION

Periprosthetic joint infections are classified according to timing of symptom development and the mechanism of infection as acute postoperative, acute hematogenous, or chronic.[9] Thus, when one evaluates a patient with suspected periprosthetic joint infection, it is important to consider the timeframe of the presentation relative to the date of arthroplasty to differentiate between possible causes of infection, as well as to determine appropriate treatment. Proper classification will also help with the interpretation of laboratory testing values because optimal thresholds change particularly for acute postoperative infections.

Acute postoperative infections occur within the first 6 weeks postoperatively and are commonly related to surgical site infections. Bacteria associated with acute periprosthetic joint infection are not dissimilar to that of native joint infections, with *Staphylococcus aureus* and *Streptococcus* being the most common causative organisms.[2,3,10] Chronic periprosthetic joint infection is defined as an infection that presents months to years postoperatively. These patients typically present with long-standing pain in the joint and rarely have any overt signs of infection such as fever or warmth of the skin overlying the joint, although some may develop a draining sinus (Figure 1). *Staphylococcus epidermidis* is among the most common infecting organisms, as is *S aureus*.[10] Acute hematogenous infections follow inoculation with bacteria from a distant site that spread hematogenously to the affected joint. Classically, patients have a recent event to account for seeding of the infection, such as a dental, urologic, or a gastrointestinal procedure or infection. The causative microbes in an acute hematogenous periprosthetic joint infection vary by source and therefore may include oral flora such as *Streptococcus mitis,* as well as commensal *Enterococcus* species.[10] Patients typically present with the acute onset of pain in a joint replacement that was previously functioning well. Presentation is oftentimes more like a native joint infection, with severe pain, swelling, and fever, along with the inability to bear weight on the affected joint. Chronic periprosthetic joint infection is most commonly observed (accounting for 56% of infections in one series), followed

Figure 1. Communicating sinus tract status post–total knee arthroplasty.