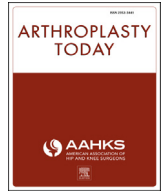




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Original research

Are patients being evaluated for periprosthetic joint infection prior to referral to a tertiary care center?

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ABSTRACT

Background: Patients with a painful or failed total joint arthroplasties should be evaluated for periprosthetic joint infection (PJI). The purpose of this study is to determine if patients referred to a tertiary care center had been evaluated for PJI according to the American Academy of Orthopaedic Surgeons (AAOS) clinical practice guidelines.

Methods: One hundred thirteen patients with painful hip (43) or knee (70) arthroplasties were referred to a single provider by orthopaedic surgeons outside our practice between 2012 and 2014. We retrospectively evaluated the workup by referring physicians, including measurement of serum erythrocyte sedimentation rate and C-reactive protein, performance of a joint aspiration if these values were abnormal, and obtainment of synovial fluid white blood cell count, differential, and cultures.

Results: Sixty-two of 113 patients (55%) did not have a workup that followed AAOS guidelines. Serum erythrocyte sedimentation rate and C-reactive protein were ordered for 64 of the 113 patients (57%). Of 25 patients with elevated inflammatory markers warranting aspiration, 15 (60%) had an aspiration attempted, with synovial fluid white blood cell, differential, and cultures obtained in 9 of 12 (75%) aspirations that yielded fluid. Of the 62 patients with an incomplete infection workup, 11 (18%) had a bone scan, 6 (10%) a computed tomography scan, and 3 (5%) a magnetic resonance imaging. Twelve of the 113 patients (11%) were ultimately diagnosed with PJI, with 5 undiagnosed prior to referral.

Conclusions: The AAOS guidelines to evaluate for PJI are frequently not being followed. Improving awareness of these guidelines may avoid unnecessary and costly evaluations and delay in the diagnosis of PJI.

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Introduction

Periprosthetic joint infection (PJI) is a devastating complication that accounted for 25% of revision total knee arthroplasties (TKAs) and 15% of revision total hip arthroplasties (THAs) in a recent study

of the National Inpatient Sample [1]. PJI places a substantial economic burden on the patient and healthcare system [2,3]. Given that treatment is fundamentally different, PJI must be excluded when a patient presents with a painful or failed total joint arthroplasty.

Determining the presence of PJI can be a challenge as there is no gold standard diagnostic tool. In 2010, a multidisciplinary team developed the American Academy of Orthopaedic Surgeons (AAOS) Clinical Practice Guideline on The Diagnosis of Periprosthetic Joint Infections of the Hip and Knee [4,5]. The guidelines were formulated using a rigorous standardized process, including a systematic review of the literature, with the goal of providing physicians with evidence-based recommendations for the workup of PJI.

The purpose of our study is to determine if patients referred to our tertiary center by other orthopaedic surgeons for painful or

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Table 1
Demographics of the 113 study patients.

Variable	Count (%) or mean (range)
Age (y)	62 (37–82)
Gender	
Female	70 (62%)
Male	43 (38%)
Prosthesis	
Total knee arthroplasty	66 (58%)
Total hip arthroplasty	39 (35%)
Unicondylar knee arthroplasty	3 (2.7%)
Bipolar hip hemiarthroplasty	3 (2.7%)
Hip resurfacing	1 (0.9%)
Bicompartmental knee arthroplasty	1 (0.9%)

failed THAs or TKAs had been evaluated for PJI according to AAOS guidelines. We asked the following questions: (1) Of patients referred to our center, what percentage had a serum erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) drawn followed by selective aspiration of the joint prior to referral? (2) Of the patients with an incomplete PJI workup, how many underwent advanced imaging studies—specifically bone scan, computed tomography (CT), or magnetic resonance imaging (MRI)—prior to referral? (3) What proportion of referred patients was ultimately determined to have a PJI and had this diagnosis been made prior to referral?

Material and methods

After institutional review board approval, a retrospective chart review of all patients referred to a single adult reconstruction specialist at a tertiary orthopaedic care center for evaluation of a painful or failed hip or knee arthroplasty between 2012 and 2014 was performed. Our primary aim was to evaluate referring provider compliance with the AAOS Clinical Practice Guideline for ruling out PJI. A total of 180 patients were identified using the senior author's daily clinic schedule and personal case log as well as billing records. We queried the medical records and Internet to determine the specialty and fellowship training of referring providers. Sixty-seven patients were excluded, including patients referred by non-orthopaedic surgeons (31), referrals within our orthopaedic practice (30), and self-referred patients (2). This left 113 patients with painful or failed hip (43) or knee (70) arthroplasties for inclusion. Demographics of the study cohort are provided in Table 1.

We reviewed all referral records to specifically assess compliance with 3 of the AAOS recommendations deemed “strong” (Table 2), including obtaining an ESR and a CRP followed by

selective aspiration of the joint. The algorithm used to evaluate compliance is summarized in Figure 1.

Of the patients with an incomplete infection workup, we noted how many underwent other advanced imaging studies—specifically a whole body bone scan, CT or MRI of the replaced joint—prior to referral. While it was difficult to delineate which studies were done to evaluate for infection (study indications often vaguely cited “pain”), these represented tests that were ordered prior to ruling out PJI with the recommended tests.

Finally, we recorded the proportion of patients ultimately determined to have a PJI using Musculoskeletal Infection Society criteria [6] and whether this diagnosis was made prior to referral.

Infection workup compliance rates were compared for patients with hip vs knee arthroplasties and between orthopaedic surgeons with and without subspecialty training in adult reconstructive surgery using the Pearson's chi-squared test ($P < .05$).

Results

Of the 113 patients referred by orthopaedic providers outside our practice, 62 (55%) did not have a workup that was compliant with AAOS guidelines (Fig. 2a). A serum ESR and CRP were performed for 64 of the 113 patients (57%). Of the 25 patients with elevated inflammatory markers warranting aspiration based on the AAOS guidelines, 15 (60%) underwent attempted aspiration (including 3 aspirations that yielded no fluid). The synovial fluid was sent for a synovial fluid white blood cell (WBC) count, differential, and cultures for only 9 of the 12 patients (75%) with a successful aspiration; cultures alone were obtained in the other 3 cases.

There were 3 hip patients in whom 1 of 2 inflammatory markers was elevated; all 3 had a workup deemed compliant with the AAOS guideline. Two patients had an elevated ESR (but normal CRP), lower suspicion for infection, and questionable plans for revision surgery at the time of referral. Given the AAOS guidelines for selective aspiration of the hip laid out in Table 2, these were considered compliant workups even though the referring physician did not pursue an aspiration. There was 1 hip patient with an elevated CRP (and normal ESR) but high suspicion for infection; this patient underwent aspiration by the referring provider in accordance with the AAOS guideline.

With the sample size available, there was not a statistically significant difference in workup compliance rates for patients with hip vs knee arthroplasties (44% vs 46%, $P = .862$; Fig. 2b and c) or patients referred by adult reconstruction subspecialists vs by other orthopaedic surgeons (49% vs 42%, $P = .493$) (Table 3).

Of the 62 patients with an incomplete evaluation for PJI, approximately one-third (20 patients or 32%) had an advanced

Table 2
Clinical practice guideline recommendations assessed for applicable patients.

Recommendation	Strength of recommendation		
Obtain serum ESR and CRP testing for all patients assessed for periprosthetic joint infection	Strong		
Aspirate joint of patients being assessed for periprosthetic knee infection who have abnormally elevated ESR and/or CRP. Send aspirated fluid for microbiologic culture, synovial fluid white blood cell count, and differential	Strong		
Selective approach to aspiration of the hip based on patient's probability of periprosthetic joint infection and the results of ESR and CRP testing:	Strong		
Probability of Infection	ESR/CRP Elevation	Planned Reoperation Status	Recommended Test
Higher	Both or one	Planned or not planned	Aspiration
Lower	Both or one	Planned	Aspiration or frozen section
Lower	Both	Not planned	Aspiration
Lower	One	Not planned	Re-evaluation within 3 months ^a
Send aspirated fluid for microbiologic culture, synovial fluid white blood cell count, and differential			

^a Strength of recommendation for this component (re-evaluation within 3 months) is “consensus”.

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