Session 26: Revision TKA: The Preop Evaluation

Learning Objectives
Upon completion of this activity, participants should be able to:
1. Review the appropriate methods of evaluating the failed TKA.
2. Discuss the distinction between aseptic and septic failure based on the preoperative evaluation.

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Evaluation of the Problematic TKA: Cost-Effective Algorithm

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Total knee arthroplasty results are generally excellent. Most series report greater than 90% good or excellent results. Unfortunately there are a group of patients who are dissatisfied with their outcome.

In dealing with this type of patient, it is important to have a systematic diagnostic approach to make a proper evaluation. Initially low-grade infection and referred pain must be carefully ruled out before considering surgical intervention in any patient presenting with a painful total knee arthroplasty. Once these reasons for pain have been ruled out, a variety of diagnostic tools are available to the clinician. Available diagnostic tools are history and physical, radiographs, serology, aspiration, nuclear scans, and computerized tomography. Among these, a careful history and physical is the most important tool at the clinician’s disposal. Radiographs complement these clinical suspicions. Using these simple tools, the diagnosis can usually be made in a cost-effective manner.

While routine serology and aspiration are relatively inexpensive complimentary tests, nuclear scans and computerized tomography are rarely indicated when evaluating a painful total knee arthroplasty.
Making the Diagnosis of Infection: The Latest Tests

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Despite widespread use of several diagnostic tests, there are currently no preoperative tests that are 100% sensitive and specific. As a result, diagnosis relies heavily upon clinical judgment of the clinical presentation and sensible interpretation of subsequent investigations. A thorough history and physical with a strong index of suspicion are key to the diagnosis of infection. As acute postoperative and hematogenous infections are usually clinically apparent, late chronic infections are most difficult to diagnose and where testing and investigations are most useful.

Serum white blood cell (WBC) counts are rarely abnormal in late chronic infection and therefore not helpful. Erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) are potentially quite misleading when viewed individually, but when used in combination are the most useful screening investigations available. When assessing ESR and CRP, it is helpful to know the normative response of these tests following uncomplicated primary TKR. In 320 primary TKRs, mean CRP levels increased rapidly, peaking on day 2, decreasing to less than normal on day 42, and returning to baseline on day 90. Mean ESR levels peaked on day 5 and returned to preoperative levels on day 90. Wide variations occurred, and 43% of cases did not follow typical patterns. In the setting of revision knee replacement (TKR), reported results of these tests vary widely. In a series of 151 revision TKRs, the ESR (sensitivity, 0.93; specificity, 0.83; positive likelihood ratio, 5.81; accuracy, 0.86) and the CRP level (sensitivity, 0.91; specificity, 0.86; positive likelihood ratio, 6.89; accuracy, 0.88) had excellent diagnostic test performance. In contrast, in 295 revision TKRs, the ESR had a sensitivity of 0.63, a specificity of 0.55, a positive predictive value of 0.39, a negative predictive value of 0.77, and an accuracy of 0.57. The respective values for CRP were 0.6, 0.63, 0.45, 0.76, and 0.62.

Recently, the use of serum interleukin-6 (IL-6), procalcitonin, and tumor necrosis factor (TNF)-alpha have been evaluated as a marker of periprosthetic infection following TKR. In 78 knees, CRP (> 3.2 md/dL) and IL-6 (> 12 pg/mL) had the highest sensitivity (0.95), but IL-6 was less specific than CRP (0.87 vs 0.96). Combining CRP and IL-6 identified all patients with deep infection. Procalcitonin (> 0.3 ng/ml) and TNF-alpha (> 40 ng/ml) were very specific (0.98 vs 0.94) but had a low sensitivity (0.33 vs 0.43). The combination of CRP and IL-6 measurement provides the best screening tests. Plain radiographs provide limited value for diagnosis as loosening, osteolysis, and endosteal scalloping are nonspecific to both septic and aseptic failure. Simple Tc-99 radionuclide imaging is helpful only in equivocal cases when negative. Indium 111 labeled WBC scan usefulness remains controversial; however, when combined with a Tc-99m sulfur colloid study, sensitivity and specificity improve considerably. In reality, imaging is rarely required for definitive diagnosis.
Most authors favor a selective role for hip aspiration, but routine aspiration for failed knee replacements. Aspiration allows identification of organism(s) to direct appropriate antibiotics and allows for assessment of synovial leukocytes. It is critical to obtain an antibiotic history, specifically asking about recent or current antibiotic use prior to aspiration. All antibiotics should be discontinued at least 2 weeks (preferably longer), prior to proceeding with aspiration. Re-aspiration in equivocal cases improves overall accuracy. In 133 revision knees, the synovial fluid leukocyte count was significantly higher in patients with infection (median, 18.9 × 10³/microL; range, 0.3 to 178 × 10³/microL) compared with aseptic failure (median, 0.3 × 10³/microL; range, 0.1 to 16 × 10³/microL; \( P < .0001 \)). The neutrophil percentage was also higher in patients with infection (median [range], 92% [55% to 100%] vs 7% [0% to 79%], \( P < .0001 \)). A leukocyte count of > 1.7 × 10³/microL had a sensitivity of 94% and a specificity of 88% for diagnosing prosthetic joint infection. A differential of > 65% neutrophils had a sensitivity of 97% and a specificity of 98%.

Frozen section histological analysis is occasionally a useful study especially in equivocal cases. Unfortunately, the reliability of this technique is highly variable and very dependent on the pathologist’s interpretation and experience. Grams stain is not reliable and should not be used as a basis for determining treatment. Intraoperative synovial cultures have been the gold standard of diagnosis but are not 100% accurate as approximately 7% of infections are culture negative, often a result of prolonged antimicrobial treatment. Many investigators now are focusing on microbial prosthetic-joint infection present in a biofilm on the surface of the prosthesis. In a prospective trial comparing culture of samples obtained by sonication of explanted hip and knee prostheses to dislodge adherent bacteria from the prosthesis, sonication culture was more sensitive than conventional periprosthetic-tissue culture for the microbiologic diagnosis infection, especially in patients who had received antimicrobial therapy within 14 days before surgery.

It is hoped that combining one of the emerging rapid bacterial detection technologies with concentrated cultures from sonication will enable more accurate and effective diagnosis of infection in the near future.

References

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The Infected TKA: What Are My Options?

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Introduction: Deep sepsis complicating total knee arthroplasty (TKA) presents a challenging treatment algorithm that mandates consideration of the overall care of the patient in contrast to eradication of the infection as the principal goal of treatment.

Treatment Considerations in Prosthesis Management: Prosthesis retention or removal is the principal decision to be made; the absence of loosening is a prerequisite to consider preservation of the prosthetic knee. Ultimately, prosthesis removal and revision is the preferred treatment pathway. Retention of secure infected components may be considered in infirm patients who would not tolerate an operation and who have a sensitive organism, no other prosthetic joints at risk, and an effective oral antibiotic agent for protracted suppressive therapy. Systemic illness, such as diabetes mellitus and rheumatoid disease, diminishes the likelihood of an effective host response and successful eradication of infection in the face of component retention. Local factors, such as a virulent and resistant organism, deficiencies in the soft tissue envelope, an incompetent extensor mechanism, and inadequate bone stock all further diminish the likelihood of successful salvage of the infected TKA. Eradication of remote foci of infection is a prerequisite to definitive treatment of the infected joint arthroplasty.

Prosthesis Retention: Generally speaking, prosthesis retention results in component survival of less than 20% at 5 years. Acute infection managed less than 10 days from onset, a sensitive Gram-positive organism, and operative debridement with synovectomy, polyethylene exchange, and scrubbing of the components all increase the chances of successful TKA retention. Indefinite antibiotic suppression is nearly always required; availability of an effective oral agent is therefore essential. Combination therapy with a fluoroquinolone and rifampin has been successful with sensitive gram positive organisms.

Prosthesis Exchange: Single-stage exchange is only advised in a competent host with a favorable organism and antibiotic; success rates approach 90%. Two-stage exchange is the preferred treatment with complete debridement of all foreign material, placement of an antibiotic laden spacer, and systemic therapy for 6 to 12 weeks, followed by a drug holiday and then reimplantation with antibiotic laden cement. There is one good chance at successful revision; survival rates up to 97% have been reported.

References:


Assessing Polyethylene Wear and Osteolysis

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*Background:* Polyethylene wear around a total knee arthroplasty continues to be an emerging problem. Wear-generated osteolysis, whether due to polyethylene, metal, cement or all of the aforementioned can lead to significant defects in the femur, tibia, and patella. The magnitude of these defects can necessitate some of the most complex of revision knee arthroplasties.

*Methods and Clinical Results/Implications:* While there are fairly well-established reliable methods for estimating the degree of polyethylene wear in total hip arthroplasty, similar techniques have not fully validated for the knee. The aim of this session is to discuss:

1. Utility of plain radiographs in determining wear and lysis about a TKR
2. Role of computed tomography (CT) scan in evaluating wear and lysis and limitations of its use
3. Use of unique MR protocols to determine extent of lysis
4. Stratification of bone defects in anticipation of surgical intervention

*Clinical Relevance:* Wear and osteolysis is on the rise. Adult reconstructive surgeons will be faced with an ever increasing prevalence of this problem and a firm understanding of the assessment of lysis and wear is crucial.

References:


**Case Presentation & Discussion Panel**
Thomas K. Fehring, MD; Arlen D. Hanssen, MD; Vincent D. Pellegrini, Jr, MD; Douglas E. Padgett, MD; Harry E. Rubash, MD