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Aspiration as an Aid to the Diagnosis of Prosthetic Knee Instability

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Introduction

Knee instability following total knee arthroplasty is a common cause of early prosthetic knee failure. Clinical presentation can take many forms ranging from obvious dislocation (Figure 1) to vague complaints of diffuse anterior knee pain, giving way, or recurrent effusion. In cases of gross instability, the diagnosis is seldom in doubt. However, in patients who have subtle instability patterns (Figure 2) guarding in the exam room frequently precludes an accurate examination and subsequent diagnosis.

While synovial fluid analysis has been helpful in making the diagnosis of infection, the usefulness of synovial fluid analysis for other diagnoses has not been studied. The purpose of this study was to determine if synovial fluid analysis can be a useful diagnostic tool in making the diagnosis of prosthetic knee instability.

Methods

Between 1987 and 2006, 133 total knees were revised for instability at a single institution. Aspirations were performed when the preoperative serologies (C-reactive protein and sedimentation rate) were elevated or when the diagnosis of instability was in doubt (Figure 3). Forty-two of the 133 patients revised for instability had their knees aspirated prior to revision surgery. This group was compared to a control group of 117 patients revised during the same time period for reasons other than instability or infection.

Figure 1. Gross Instability

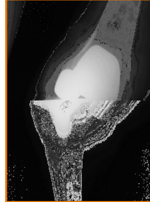


Figure 2. Subtle Instability

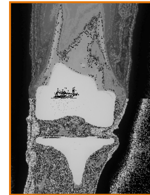
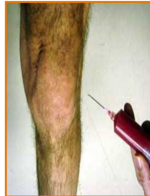


Figure 3. Bloody Knee Aspirate



Results

The average red blood cell count for those patients revised for a diagnosis of instability was 79,365 (SD 195,738; Range 300-960,000) red cells per cubic millimeter. The median red blood cell count was 9,175 red blood cells per cubic millimeter (IQR 37,750 – 2,337).

In those patients with diagnoses other than instability and infection who were revised and aspirated, the average red blood cell count in the synovial fluid was 60,965 (SD 230,074; Range 30-2,079,000) red cells per cubic millimeter. The median red blood cell count was 6,200 (IQR 27,525 – 2,512).

This difference between the average red blood cell count for the group of patients with instability and in those with diagnoses other than instability and infection was not statistically significant (p = 0.56), with the numbers available (Figures 4 and 5).

Figure 4. Median Red Blood Cell Count: Instability vs Control Group

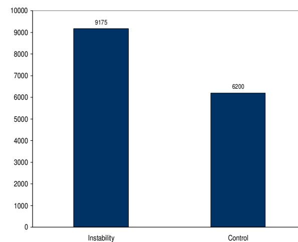
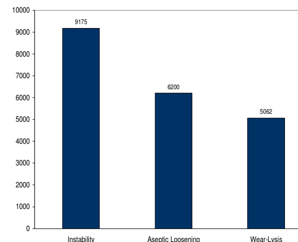


Figure 5. Median Red Blood Cell Count: Instability vs Aseptic Loosening and Wear/Lysis



Discussion

Knee instability is increasingly recognized as a mode of prosthetic knee failure. Such instability is frequently technique-related. Failure to adequately release and balance contracted ligaments, as well as, failure to equalize flexion and extension gaps are common errors leading to prosthetic knee instability.

Patients with prosthetic knee instability present in a variety of ways ranging from frank dislocation to vague non-specific complaints with normal radiographs. A careful history and physical examination and stress radiographs are the primary tools available to a clinician in making this diagnosis. In a patient with tibial femoral dislocation or a grossly incompetent medial collateral ligament, the diagnosis is rarely in doubt. However, in a patient with normal-appearing radiographs and excellent range of motion, the diagnosis of instability can be difficult. Other than stress radiographs, objective diagnostic testing to assist the clinician in making the diagnosis of prosthetic knee instability is lacking.

We originally theorized that a predominance of red blood cells on aspirates was related to microtrauma of the synovial lining and was specific for the diagnosis of instability. Unfortunately, we were unable to make such a distinction here regarding the presence of hemarthrosis and a specific diagnosis of instability. While we have shown that unstable total knees do, in fact, have preoperative bloody effusions with a median red blood cell count of 9,175, patients revised for other diagnoses frequently present with similar results when aspirated (median red blood cell count 6,200).

Conclusion

We conclude that while hemarthrosis is frequently present in an unstable knee, it is not pathognomonic of prosthetic knee instability. Other diagnoses such as aseptic loosening and wear related problems should also be considered when a predominance of red cells are encountered on aspirate. Therefore, a careful history and physical examination as well as stress radiographs remain the key determinants of prosthetic knee instability. A bloody aspirate can help confirm the diagnosis of instability suspected on history and physical examination.