Cell Count and Differential of Aspirated Fluid in the Diagnosis of Periprosthetic Joint Infection of Total Elbow Arthroplasty

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Background: Periprosthetic joint infection (PJI) is a common method of failure following total elbow arthroplasty (TEA). Diagnosis is often guided by synovial fluid leukocyte counts and neutrophil percentages. While cutoff values have been defined for hip and knee arthroplasty PJI, the elbow has a different microbiome and a higher rate of PJI. Currently, there are no data to guide determination of PJI following TEA. The purpose of this study was to identify cutoff values of synovial fluid leukocyte counts, neutrophil percentage, erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) to aid in detection of periprosthetic total elbow infection.

Methods: We identified 135 TEA undergoing revision surgery that had preoperative aspiration of the synovial fluid at a single institution. Receiver operating characteristic (ROC) curves were utilized to determine the optimal cutoff points for synovial fluid leukocyte count, the neutrophil differential, the ESR and the CRP. Sensitivity, specificity, negative predictive value and positive predictive value were determined. Patients were determined to be infected when they had a positive intraoperative culture or gross purulence at the time of reoperation.

Results: 35 elbows were found to be infected and 100 were determined to be aseptic. The infected elbow group had a higher mean fluid leukocyte count (8100 vs. 687 cells/mL, $p < 0.01$), higher neutrophil differential (63% vs. 18%, $p<0.01$), higher ESR (32 vs. 15mm/1h, $p<0.01$) and higher CRP (15 vs. 5mg/L, $p<0.01$) than the aseptic cohort. Based on the ROC curves the optimal cutoff values were a leukocyte count of 1300 cells/mL (sensitivity 88%, specificity 75%), neutrophil differential of 70% (sensitivity 71%, specificity 92%), ESR >13 (sensitivity 76%, specificity 67%) and CRP >7 (sensitivity 73%, specificity 83%). When both the leukocyte count and neutrophil differential were below the cutoff values, the negative predictive value was 96%. When both the neutrophil differential and ESR were above the cutoff values the positive predictive value was 95%.

Discussion: This study identifies optimal synovial fluid and inflammatory marker cutoff values to help clinicians determine the presence of a TEA PJI prior to revision surgery. The optimal cutoff values were a leukocyte count of 1300 cells/mL, neutrophil differential of 70%, ESR >13 and CRP >7.