Absolute Neutrophil Count in Synovial Fluid: A Promising Biomarker for Diagnosing Periprosthetic Joint Infections

Alisina Shahi[1], David Rodriguez-Quintana[2], Adam Michael Freedhand[3], Ali R Oliashirazi[4], Kenneth B Mathis
[1]University Of Texas Health Science Center At Houst, [2]University Of Texas - Houston, [3]UT Ortho, [4]Joan C Edwards School of Medicine

INTRODUCTION:

In the absence of a definitive gold standard for diagnosing periprosthetic joint infections (PJI), clinicians facing suspected cases typically rely on multiple tests. While the absolute neutrophil count (ANC) has proven valuable in diagnosing systemic infections, its utility in synovial fluid (SF) remains unexplored. This study evaluates the performance of ANC in SF (SFANC) and compares it with other markers such as synovial fluid polymorphonuclear percentage (SFPMN%) and synovial fluid white blood cell count (SFWBC).

METHODS:

This retrospective multicenter study reviewed clinical records from patients undergoing revision surgery between 2020 and 2022. Inclusion criteria were a complete data set of synovial fluid white blood cell count (SFWBC), synovial fluid polymorphonuclear percentage (SFPMN%), and synovial fluid absolute neutrophil count (SFANC). The cohort comprised 231 patients, categorized into aseptic revisions (N=136) and septic revisions (N=95). For each test, we calculated sensitivity, specificity, positive and negative likelihood ratios (LR), and diagnostic odds ratios (DOR). The optimal cutoff for SFANC, determined using Youden's Index, was set at greater than 1950 cells/μL.

RESULTS:

SFANC had a sensitivity of 88.4%, specificity of 85.2%, positive and negative likelihood ratio of 6.0 and 0.1, and a DOR of 44.2(95%CI: 20.1-97.3). SFWBC showed 84.2% sensitivity, 83.8 specificity, 5.2 +LR, 0.1 –LR, and 27.6 (95%CI: 13.5-56.5) DOR. Synovial PMN% had a sensitivity of 80.0%, a specificity of 80.8%, + and – LR of 4.1 and 0.2 respectively, and a DOR of 16.9(95%CI:8.7-32.7) (Figure 1.) SFANC with an area under the curve (AUC) of 0.93 was a significantly better predictor of PJI than both SF WBC (AUC=0.91, p=0.007) and SF PMN% (AUC=0.88, p=0.016). The AUC was comparable for SF WBC and SF PMN, p=0.16 (Figure 2.)

DISCUSSION AND CONCLUSION:

This pioneering study affirms SFANC's utility in diagnosing PJI, providing a reliable cutoff for clinical use. It appears that SFANC surpasses traditional synovial markers for diagnosing PJI. The establishment of a reliable cutoff value at greater than 1950 cells/μL enhances its clinical utility, providing clinicians with a potent tool in the differential diagnosis of PJI. Incorporating SFANC into the existing battery of tests for diagnosing PJI could significantly increase the diagnostic yield, ensuring a more comprehensive assessment and aiding in more accurate decision-making.

Figure 1. Laboratory values in the study cohort. The dashed lines indicate the thresholds for the tests.

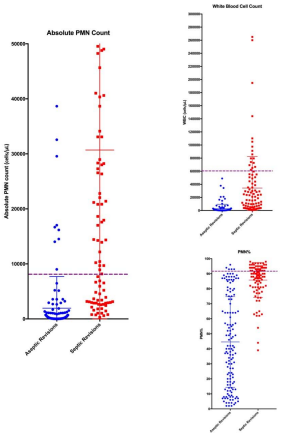

Figure 2. Receiver operating characteristic curves for synovial fluid WBC, PMN%, and absolute PMN count.