

# Synovial Fluid Absolute Neutrophil Count and Neutrophil-to-Lymphocyte Ratio are Not Superior to Neutrophil Percentage in Detecting Prosthetic Joint Infection

Julian E. Dilley<sup>1</sup>, Abhijit Seetharam, R Michael Meneghini<sup>2</sup>, Michael Maher Kheir

<sup>1</sup>Indiana University Health, <sup>2</sup>Indiana Univ Hlth Phys

**INTRODUCTION:** Periprosthetic joint infection (PJI) is a devastating complication after total joint arthroplasty (TJA) with a high morbidity, mortality, and cost. Serum and synovial biomarkers are currently used in the diagnosis of PJI. Serum neutrophil-to-lymphocyte (NLR) ratio has shown promise as an inexpensive test in diagnosing infection, but there have been no known reports of synovial NLR or absolute neutrophil count (ANC) in the diagnosis of chronic PJI. The purpose of this study is to investigate the diagnostic potential of both markers.

**METHODS:** A retrospective review was performed for 730 patients that had a primary total joint arthroplasty and underwent aspiration for chronic PJI or aseptic reasons. Synovial white blood cell count (WBC), synovial polymorphonuclear percentage (PMN%), synovial NLR, synovial ANC, serum erythrocyte sedimentation rate (ESR), serum C-reactive protein (CRP), serum WBC, serum PMN%, serum NLR, and serum ANC had their utility in diagnosing PJI examined by area under the curve analysis (AUC). Pairwise comparisons of AUCs were performed for serum and synovial markers.

**RESULTS:** The AUCs for synovial WBC, PMN%, NLR, and ANC were 0.835, 0.841, 0.827, and 0.850, respectively (Figure 1). Synovial fluid ANC was a significantly better diagnostic marker than synovial NLR ( $p=0.027$ ) and synovial WBC ( $p=0.003$ ), but not PMN% ( $p=0.365$ ). Synovial NLR was also found to be inferior to PMN% ( $p=0.006$ ), but not different from synovial WBC ( $p=0.510$ ) (Table 1). The AUCs for serum ESR, CRP, WBC, PMN%, NLR, and ANC were 0.695, 0.787, 0.632, 0.724, 0.741, and 0.665, respectively (Figure 2). Serum CRP outperformed all other serum markers ( $p<0.05$ ) except for PMN%, and NLR ( $p=0.051$  and  $p=0.130$ , respectively). Serum PMN% and NLR were similar to serum ESR ( $p=0.471$  and  $p=0.237$ , respectively) (Table 2).

**DISCUSSION AND CONCLUSION:** Both synovial ANC and NLR were not superior to the traditional marker, synovial PMN%. However, synovial ANC had similar performance to PMN% in diagnosing chronic PJI, whereas synovial NLR was a poorer diagnostic marker comparatively. As for serum markers, CRP demonstrated the best performance for detecting PJI.

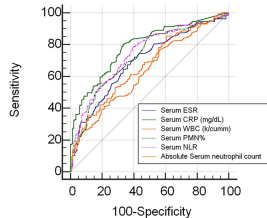
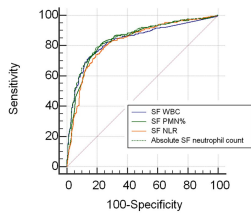


Table 2. Pairwise comparison of area under the curve (AUC) for serum markers

Markers	Difference between AUCs	Standard Error	95% Confidence Interval (CI)	P-value
ESR vs CRP	-0.092	0.0260	-0.144 - -0.040	0.004
ESR vs WBC	-0.067	0.041	-0.166 - -0.146	0.146
ESR vs PMN%	-0.036	0.041	-0.110 - -0.118	0.411
ESR vs NLR	-0.044	0.039	-0.106 - -0.124	0.214
ESR vs ANC	-0.071	0.047	-0.168 - -0.136	0.003
CRP vs WBC	0.156	0.034	0.087 - 0.225	<0.0001
CRP vs PMN%	0.052	0.023	-0.002 - 0.106	0.006
CRP vs NLR	0.040	0.036	-0.130 - 0.160	0.124
CRP vs ANC	0.120	0.048	0.018 - 0.190	0.005
WBC vs PMN%	0.024	0.034	-0.039 - 0.105	0.407
WBC vs NLR	-0.100	0.043	-0.187 - -0.103	0.001
WBC vs ANC	0.016	0.033	-0.111 - 0.113	0.810
PMN% vs NLR	-0.048	0.011	-0.069 - -0.028	0.001
PMN% vs ANC	0.037	0.023	0.002 - 0.108	0.020
NLR vs ANC	0.016	0.020	-0.017 - 0.108	0.801

Table 1. Pairwise comparison of area under the curve (AUC) for synovial fluid markers

Test	Difference between AUCs	Standard Error	95% Confidence Interval (CI)	P-value
WBC vs PMN%	0.0015	0.0117	-0.019 - 0.019	0.9617
WBC vs NLR	-0.0081	0.0119	-0.018 - 0.010	0.1101
WBC vs ANC	0.0147	0.0068	0.001 - 0.028	0.0208
PMN% vs NLR	-0.0140	0.0051	-0.024 - 0.006	0.0062
PMN% vs ANC	0.0060	0.0069	-0.018 - 0.040	0.365
NLR vs ANC	0.0230	0.0104	0.002 - 0.044	0.0274