



Persistent Infection May Be Present Despite Minimal or Absent Clinical Findings Before Second-Stage Exchange Arthroplasty

Andrew B. Harris, MD¹; Nathan Cohen, PhD²; Veronica Marval, BS¹; Andrew L. Thomson, BS¹; Andy O. Miller, MD³; Alberto V. Carli, MD¹; Michael W. Henry, MD³

¹Hospital for Special Surgery, Department of Adult Reconstruction and Joint Replacement, New York, NY
²Hospital for Special Surgery, Center for Biostatistics, New York, NY
³Hospital for Special Surgery, Department of Infectious Disease, New York, NY

INTRODUCTION

- Two-stage revision is the standard for chronic periprosthetic joint infection (PJI) after Total Hip and Knee Arthroplasty (THA/TKA), but determining when patients are appropriate candidates for second-stage reimplantation remains a major challenge, and missed persistent infection leads to failure and morbidity.^{1,2}
- Serum markers (ESR, CRP) may potentially lose accuracy in the presence of an antibiotic spacer and do not reliably confirm infection eradication.^{3,4}
- Aspiration of antibiotic spacers is similarly limited as sampling is often inadequate and there is little agreement on thresholds used for guiding reimplantation.^{3,5}
- Thus, surgeons often rely on the preoperative physical examination, yet the independent value of specific findings (erythema, swelling, drainage) has not been quantified.⁶

PURPOSE

- To determine how often persistent infection is present despite a reassuring preoperative examination in patients undergoing second-stage surgery for chronic THA/TKA PJI. We assessed:
- Whether individual examination findings predict persistent infection
- The prevalence of patients with a normal examination who still had persistent infection identified at second-stage surgery
- Optimal synovial-marker thresholds for prediction of persistent infection

METHODS

- Design: Retrospective cohort from a single-institution registry, January 2017 – November 2024
- Population: 209 patients undergoing any second-stage surgery (reimplantation or spacer exchange) for chronic THA or TKA PJI.
- Inclusion required a ≥2-week antibiotic holiday, preoperative serum and synovial data within 120 days, and ≥3 intraoperative cultures with histopathology; two-stage courses exceeding four months were excluded.
- Outcome: Persistent infection, defined by ≥1 positive intraoperative culture and/or histopathology showing acute inflammation.
- A “normal” examination required absence of erythema, absence of swelling, resolved pain, a healed incision, and no wound drainage.
- Multivariable logistic regression (adjusted for age, sex, and CCI) evaluated examination findings and serum/synovial markers; ROC analysis identified optimal thresholds.

TABLE 2. Exam Findings as Predictors of Persistent Infection at Second-stage Surgery

Characteristic	OR	95% CI	p	q
Erythema				
Not documented	0.56	0.14–1.79	0.36	0.65
Yes	3.95	0.81–19.4	0.081	0.65
Persistent swelling				
Not documented	0.63	0.22–1.61	0.35	0.65
Yes	1.32	0.54–3.14	0.54	0.71
Resolution of pain				
Not documented	1.24	0.39–3.77	0.71	0.71
Yes	0.85	0.38–1.99	0.70	0.71
Incision healed				
Yes	0.69	0.13–5.31	0.68	0.71
Draining wound				
Not documented	2.69	0.45–14.4	0.25	0.65
Yes	3.50	0.36–42.3	0.29	0.65

RESULTS

- The final cohort included 209 procedures: 96 hips (46%) and 113 knees (54%); mean age 66 ± 10 years; 22 (11%) were spacer exchanges.
- Persistent infection was identified in 43 patients (21%).
- Positive examination signs were uncommon: erythema 4.8%, persistent swelling 22%, wound drainage 4.3%; pain had resolved in 55% and the incision was healed in 94%. Overall, 61 patients (29%) had a completely normal examination.
- Among the 43 with persistent infection, 10 (23%) had a normal preoperative examination.
- No individual examination finding was independently associated with persistent infection (Table 2).
- ROC thresholds: synovial WBC 1531.5 cells/μL (sens 0.40, spec 0.81, AUC 0.53) and PMN% 69.5% (sens 0.81, spec 0.33, AUC 0.52); ESR and CRP performed similarly (AUC 0.60 and 0.58)
- In the final adjusted model, only synovial WBC > 1531.5 cells/μL independently predicted persistent infection (OR 5.69, 95% CI 2.04–16.9; p = 0.001; q = 0.009); PMN%, ESR, and CRP did not (Table 3).

FIGURE 1. ROC Curves

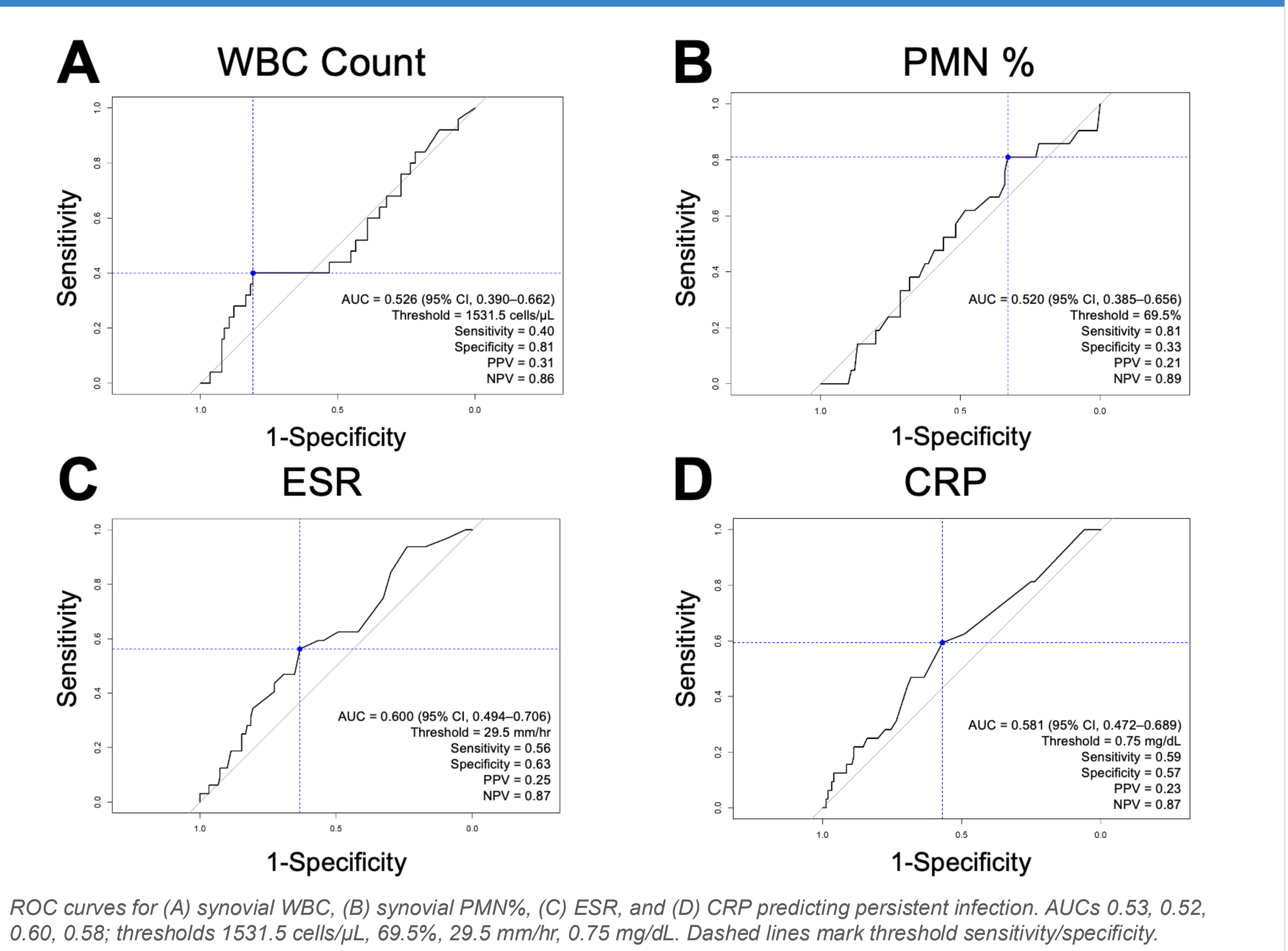


TABLE 3. Final Multivariable Model

Characteristic	OR	95% CI	p	q
Persistent swelling				
Not documented	0.97	0.26–3.32	0.96	0.96
Yes	1.21	0.34–4.05	0.77	0.87
Resolution of pain				
Not documented	0.55	0.10–2.48	0.46	0.86
Yes	0.78	0.27–2.27	0.64	0.86
Synovial & serologic markers				
Synovial WBC > 1531.5 cells/μL	5.69	2.04–16.9	0.001	0.009
Synovial PMN% > 69.5%	0.47	0.13–1.47	0.22	0.86
CRP, per 1 mg/dL	1.03	0.90–1.17	0.64	0.86
ESR, per 1 mm/h	1.01	0.98–1.03	0.50	0.86

OR reference group = "No"; all models adjusted for age, sex, and CCI. FDR-corrected q-values shown. CI, confidence interval.

CONCLUSIONS

- Preoperative physical-examination findings alone did not reliably exclude persistent infection before second-stage surgery for chronic THA/TKA PJI.
- Nearly one-quarter (23%) of patients with persistent infection at second-stage surgery had a completely normal examination (absence of erythema, absence of swelling, resolved pain, a healed incision, and no wound drainage)
- Synovial WBC > 1531.5 cells/μL was the only independent predictor of persistent infection, though its overall discriminative ability was modest (AUC 0.53).
- Surgeons should be cautious about proceeding to reimplantation on a reassuring examination alone; these findings support the value of pre-reimplantation synovial fluid aspiration.

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