

Preoperative ESR and CRP Demonstrate Differential Performance Across Organism Virulence Profiles in Periprosthetic Joint Infection

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Introduction

- Serum erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) are widely used screening markers for periprosthetic joint infection (PJI) [1-2].
- However, CRP may be less sensitive for low-virulence infections, with 35.8% of culture-positive PJIs reported to have normal CRP, 85.7% of which were caused by low-virulence organisms.

Aims:

- Determine whether (1) preoperative ESR and CRP levels differ by pathogen virulence and (2) can predict pathogen category.

Methods

- Retrospective cohort study of 1,160 patients
- Stratified based on microbiologic virulence:
 - Gram-negative (n=26)
 - High-virulence gram-positive (HV-GP) (n=87)
 - Low-virulence gram-positive (LV-GP) (n=67)
 - Culture-negative (n=972)
 - Rare/other organisms (n=8)
- ESR and CRP compared between groups
 - Post-hoc pairwise comparisons
- Multinomial logistic regression used to identify independent predictors of organism phenotype
- Receiver operating characteristic (ROC) analysis evaluated performance of ESR and CRP virulence prediction

References

[1] Akgün, et al., Bone Joint J, 2018.
[2] Kheir, et al., J Bone Joint Surg Am, 2018.

Results

- ESR and CRP values were highest among gram-negative and HV-GP infections and lowest among culture-negative cases (Figure 1).
- ESR independently predicted gram-negative, HV-GP, and LV-GP infections, while CRP predicted only gram-negative and HV-GP infection (Table 1).
- ESR and CRP showed strong discrimination for HV-GP and gram-negative infections (ESR AUC 0.838; CRP AUC 0.877) (Figure 2A).
- ESR and CRP poorly predicted low-virulence Gram-positive (LV-GP) infections (ESR AUC 0.556; CRP AUC 0.595) (Figure 2B).

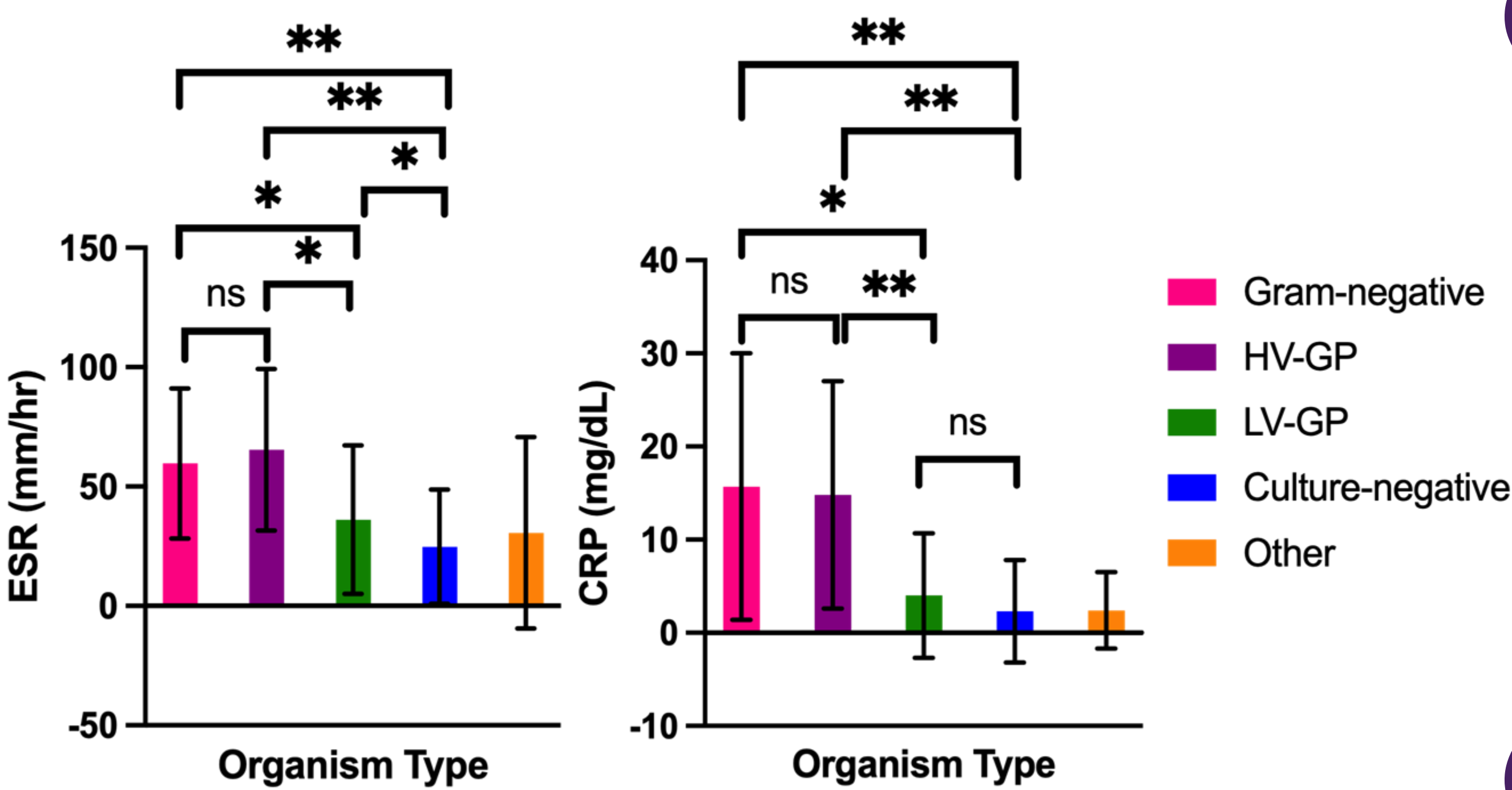


Figure 1. Preoperative ESR and CRP levels across organism virulence groups. Statistical significance is denoted by * $p < 0.05$, ** $p < 0.001$, and ns = $p > 0.05$.

Table 1. Multinomial Logistic Regression Predicting Organism Virulence Phenotype

Predictor	Gram-negative OR (95% CI)	p-value	HV-GP OR (95% CI)	p-value	LV-GP OR (95% CI)	p-value
ESR	1.02 (1.00–1.03)	0.019	1.03 (1.02–1.03)	<0.001	1.02 (1.00–1.03)	0.007
CRP	1.11 (1.07–1.15)	<0.001	1.09 (1.06–1.12)	<0.001	1.10 (0.97–1.06)	0.654

Conclusions

- Preoperative ESR and CRP were associated with organism virulence phenotype in PJI, with greater inflammatory marker elevation observed in higher-virulence infections.
- Clinical Significance:** Normal or mildly elevated ESR and CRP should not exclude PJI when low-virulence organisms are suspected, as these infections may produce a muted inflammatory response.
- Limitations:** The retrospective, single-center design and small sample sizes within some organism groups.

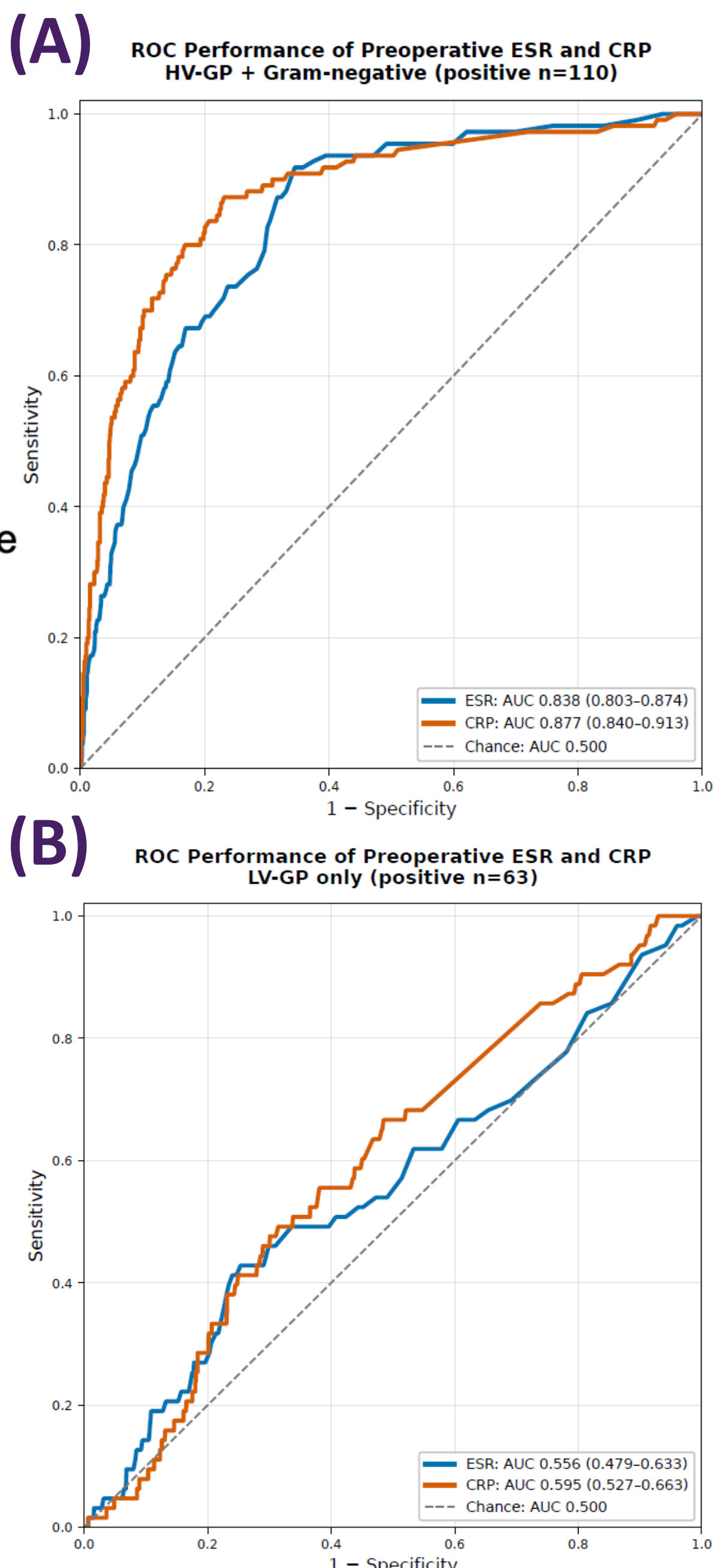


Figure 2. ROC analysis demonstrated strong discrimination for high-virulence infections (A), whereas discrimination for LV-GP infection was limited (B). CRP outperformed ESR in both analyses.