

Variability of Synovial Fluid pH Limits Its Clinical Utility in the Diagnosis of Periprosthetic Joint Infection

Wenbo Mu¹ Zongke Zhou² Haobo Wu³ Jiangdong Ren⁴ Michael Kheir⁵ Fei Wang¹ Boyong Xu¹ Guoqing Li¹ Xiaogang Zhang¹ Javad Parvizi⁶ Li Cao^{1#}



1 The First Affiliated Hospital of Xinjiang Medical University, Urumqi, China

2 West China Hospital, Sichuan University, Chengdu, China

3 The Second Affiliated Hospital, Zhejiang University School of Medicine, Hangzhou, China

4 Union Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China

5 University of Michigan, Ann Arbor, Michigan, USA

6 Acibadem Mehmet Ali Aydınlar University, İstanbul, Türkiye

Corresponding author.

TAKE-HOME

Synovial pH was time-sensitive, overlapped substantially, and added little beyond ESR/CRP.

238

participants

4

tertiary centers

3

measurement times

0.48

AUC at 1 week

01 WHY TEST SYNOVIAL pH?

Need: a rapid adjunct when PJI diagnosis remains uncertain.

Concern: pH may change after aspiration and may overlap across clinical groups.

Aim: test diagnostic utility, temporal stability, and incremental value beyond ESR/CRP.

02 PROSPECTIVE COHORT

Four tertiary arthroplasty centers; October 2024–March 2025.

Adults undergoing hip/knee aspiration, primary arthroplasty, or revision.

2018 ICM classification: PJI 43 · aseptic failure 53 · OA control 142.

03 PREANALYTICAL TIMELINE

FRESH

Measured immediately

4 HOURS

Room temperature

1 WEEK

–80°C, then thawed

The same specimen was re-measured at each time point.

04 MEASUREMENT & ANALYSIS

Calibrated Thermo Scientific Elite pH Spear Pocket Tester.

Duplicate readings by two independent observers blinded to diagnosis; mean value analyzed.

ROC AUC and Youden cutoffs quantified diagnostic performance.

Paired DeLong tests with Benjamini–Hochberg correction compared models.

05 INTERPRET WITH CARE

PJI sample was modest (n=43); precision and subgroup analyses were limited.

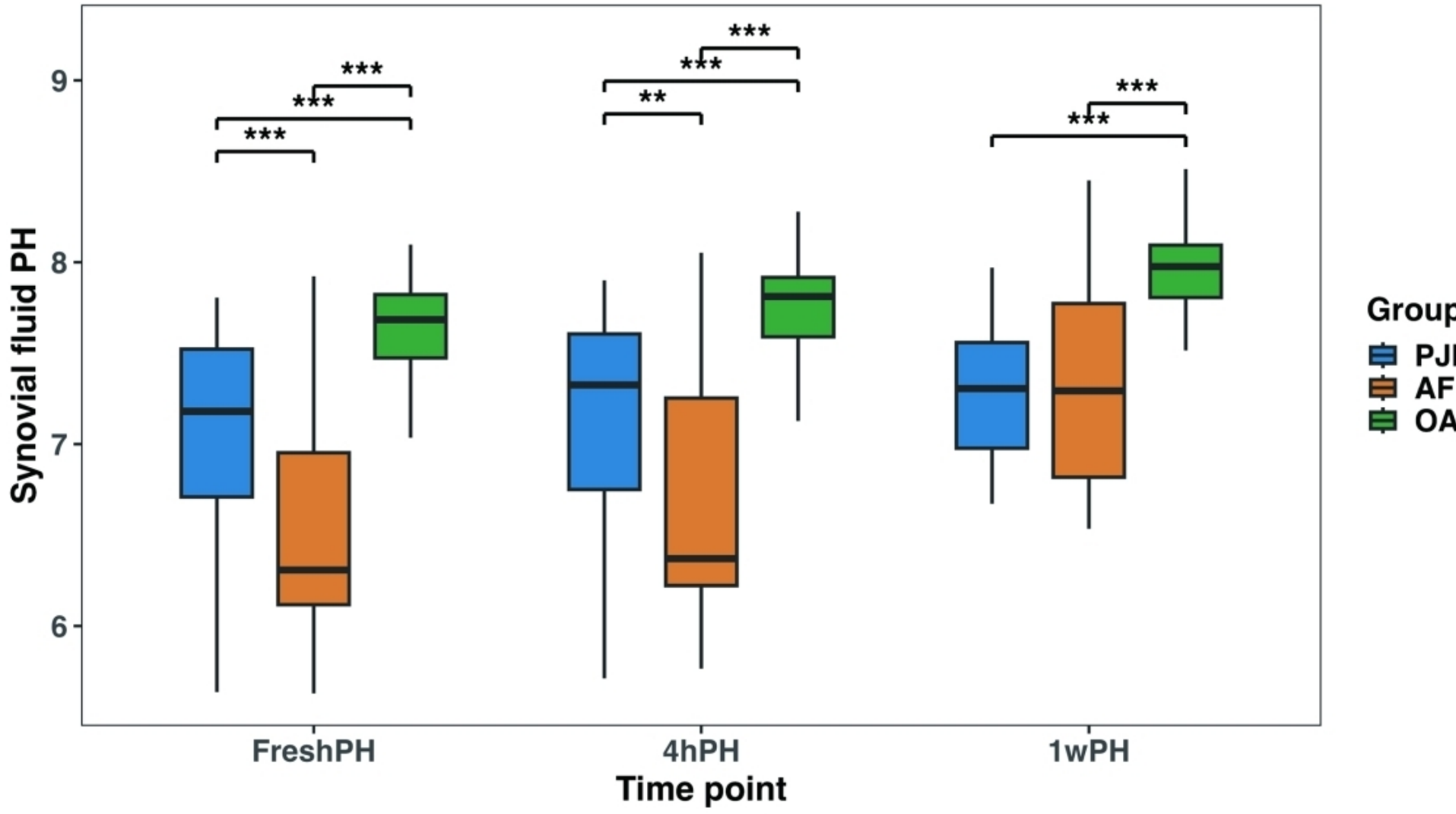
No stratification by organism, virulence, culture status, hip/knee, or acute/chronic infection.

Aseptic failure was clinically heterogeneous.

Results reflect a portable handheld pH meter and may be platform-specific.

Strength: real-world, multicenter, repeated-measure design directly tested specimen handling effects.

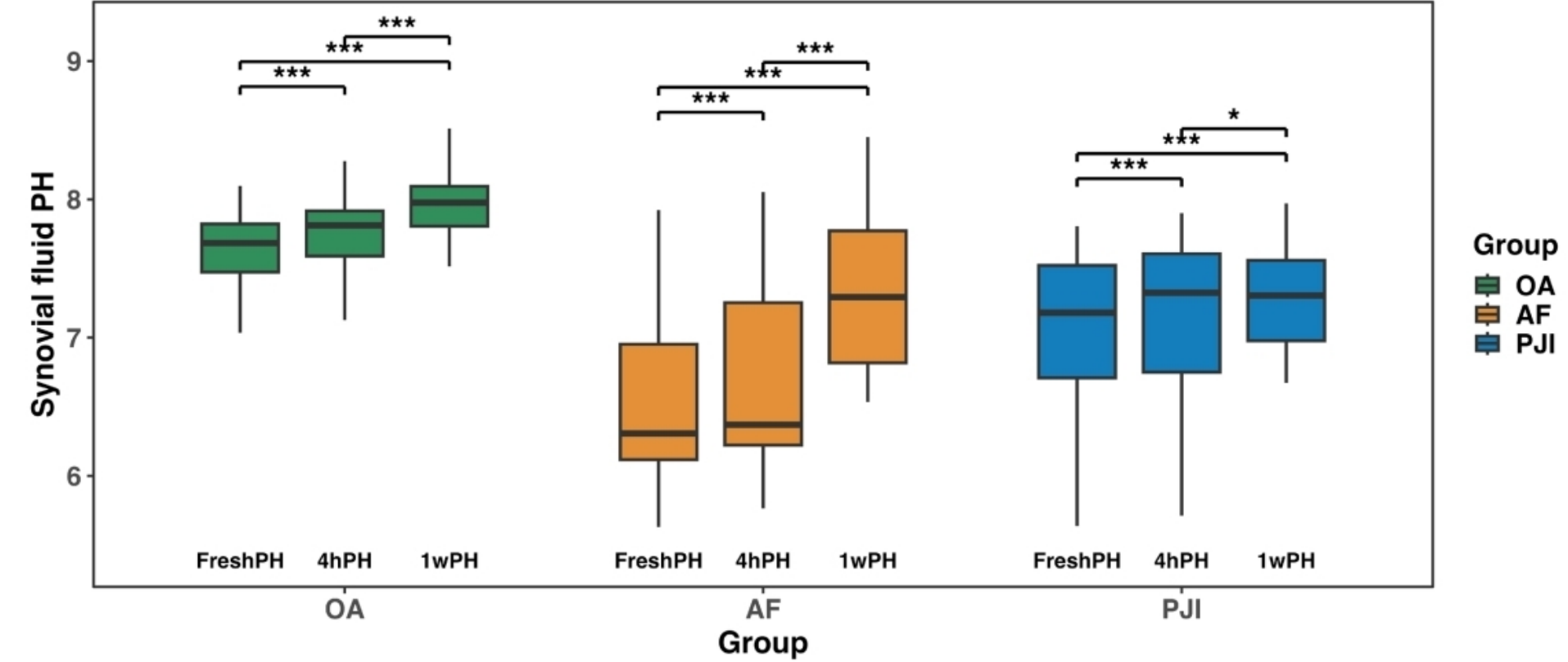
06 GROUP SEPARATION ERODED



Fresh and 4-hour values differed across groups; after 1 week, PJI and AF converged (p=.74).

PJI = periprosthetic joint infection · AF = aseptic failure · OA = osteoarthritis

07 pH SHIFTED WITH TIME



Values changed significantly within every group across measurement times (all p<.01).

08 PJI vs AF: MEDIAN pH

PJI

AF

7.18

Fresh
IQR 6.71–7.52

6.31

Fresh
IQR 6.12–6.95

7.32

4 hours
IQR 6.75–7.61

6.37

4 hours
IQR 6.22–7.25

7.30

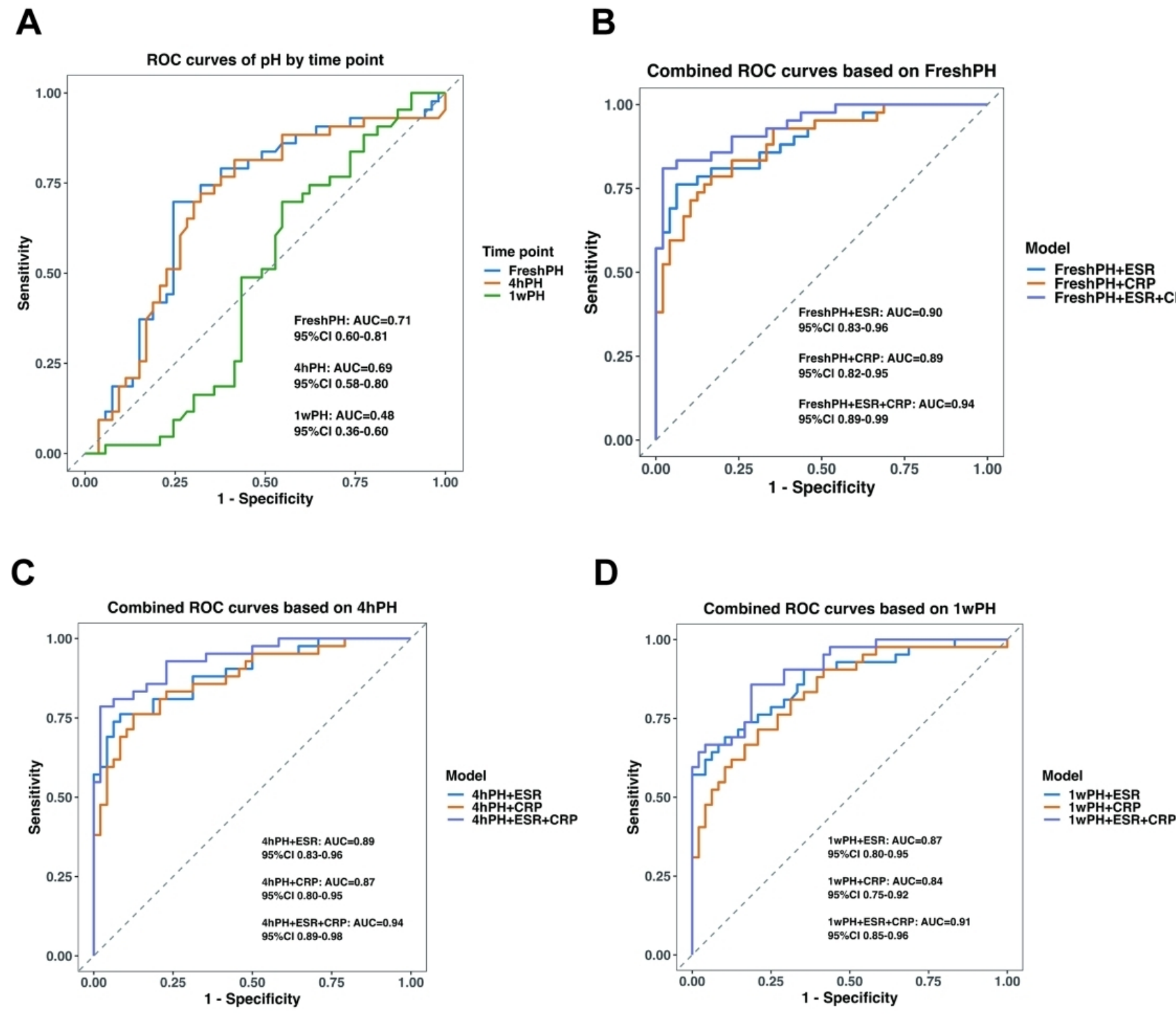
1 week
IQR 6.98–7.56

7.29

1 week
IQR 6.82–7.77

Group-level differences did not produce stable patient-level discrimination. At 1 week, the median values were nearly identical.

09 DIAGNOSTIC DISCRIMINATION



Fresh pH was modest; one-week pH alone was no better than chance.

pH ALONE: AUC (95% CI)

0.71

Fresh
0.60–0.81

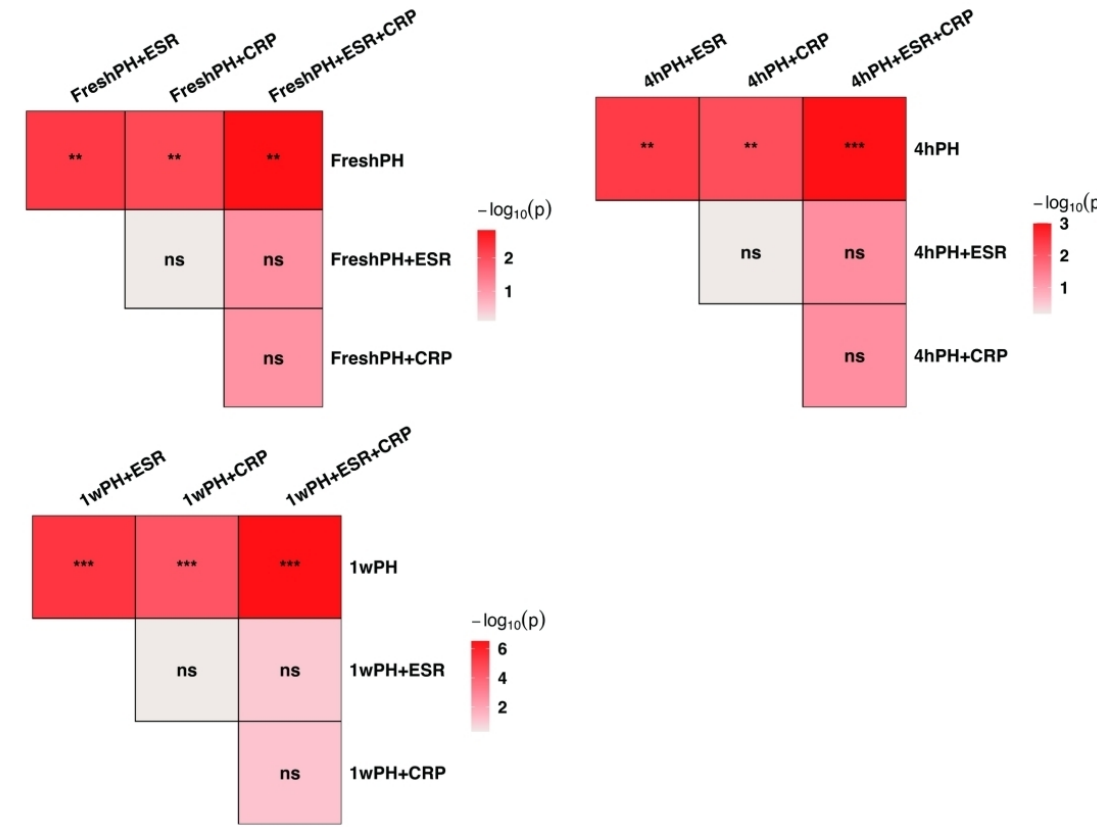
0.69

4 hours
0.58–0.80

0.48

1 week
0.36–0.60

10 DID pH ADD VALUE?



No statistically significant incremental gain beyond established ESR/CRP models after multiplicity correction.

CONCLUSION

Synovial fluid pH is not supported as a reliable standalone discriminator for PJI.

Measure promptly if pH is used at all.
Expect substantial overlap between PJI and AF.
Do not infer clinical benefit from small numeric AUC increases without significant model improvement.

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