Postoperative Inflammatory Markers and Surgical Wound Infection After Lumbar Spine Surgery: The Importance of Surgical Context.

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KEY MESSAGE | POD1 elevations largely reflected surgical stress and patient context. Higher POD3 WBC and NLR were exploratory signals; both weakened after adjustment for matching POD1 values.

BACKGROUND AND OBJECTIVE

• Early postoperative leukocytosis and neutrophil-to-lymphocyte ratio (NLR) elevation can reflect tissue trauma, obesity, medications, hemodilution, and operative duration—not infection-specific biology.

• Objective: determine whether POD1 and POD3 WBC/NLR, and their trajectories, were associated with 90-day surgical wound infection (SWI) after accounting for patient and operative context.

MATERIALS AND METHODS

• Retrospective cohort of adults undergoing elective 1- to 3-level lumbar fusion at one academic center, 2022–2024.

• WBC and NLR closest to 24 hours (POD1) and 72 hours (POD3).

• Complete-case analyses used timepoint-specific denominators.

• Mann–Whitney U and Fisher exact/χ^2 tests compared groups; logistic regression estimated ORs with 95% CIs.

• With 18 SWI events, adjusted models were intentionally limited to BMI and operative duration.

COHORT AND ENDPOINT

Outcome-eligible cohort: 380 patients; 18 SWI events (4.7%).

The pragmatic electronic-health-record endpoint was a wound-related infectious event within 90 days requiring antibiotics, wound intervention, or reoperation. It was not equivalent to a uniformly culture-confirmed deep, implant-associated, CDC/NHSN-, or ACS-NSQIP-defined surgical-site infection.

SWI phenotype: 9 return to operating room/washout; 7 nonoperative wound complications/interventions; 2 antibiotic-only or clinically treated events.

ANALYTIC DENOMINATORS

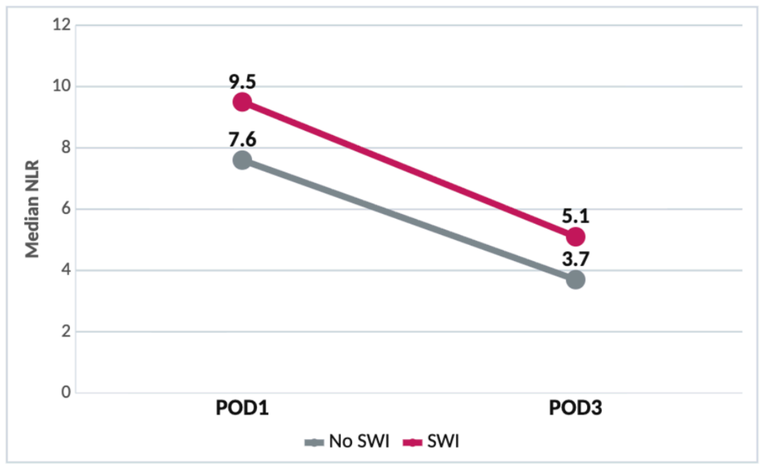
368	336
POD1 complete 18 SWI	POD3 complete 17 SWI
327	**18**
paired values 17 SWI	total SWI events

Ethics: Einstein IRB 2016-6896; consent waived. No competing interests declared.

RESULTS

380	18	4.7%
patients	90-day SWI	event rate

MEDIAN NLR DECLINED IN BOTH GROUPS



Paired cohort N=327 (17 SWI). POD3 NLR: 5.1 [4.3–8.9] vs 3.7 [2.7–5.3], p=0.007.

SURGICAL CONTEXT DIFFERED BY SWI STATUS

Characteristic	No SWI	SWI	p
BMI, kg/m²	31.0	35.3	<0.001
Morbid obesity	24.3%	50.0%	0.024
Operative time	263.5 min	368 min	<0.001

Medians [IQR] in manuscript; BMI 31.0 [27.3–34.8] vs 35.3 [33.1–39.9].

PARSIMONIOUS ADJUSTED MODELS

Marker	Adjusted OR (95% CI)	p
POD1 WBC	1.10 (0.96–1.26)	0.180
POD1 NLR	1.05 (0.98–1.12)	0.183
POD3 WBC	1.17 (1.00–1.37)	0.049
POD3 NLR	1.12 (1.01–1.23)	0.026

Adjusted for BMI and operative duration; OR per 1 $\times 10^9$/L WBC or per 1 NLR unit.

SENSITIVITY MODEL ADDING MATCHING POD1 VALUE

POD3 WBC: OR 1.15 (0.94–1.41), p=0.180 • POD3 NLR: OR 1.10 (0.99–1.22), p=0.089

POD3 associations weakened after accounting for POD1 values.

TRAJECTORIES AND EVENT PHENOTYPE

WBC −1.57 $\times 10^9$/L	NLR −4.54

Both declined from POD1 to POD3 (p<0.001); absolute and percentage changes did not differ significantly by SWI status. Adjusted ΔWBC p=0.790; ΔNLR p=0.490.

SWI events: 9 return to OR/washout • 7 nonoperative interventions • 2 antibiotic-only/clinical

INTERPRETATION

• POD1 WBC and NLR were not independently associated with SWI after adjustment for BMI and operative duration.

• POD3 WBC and NLR retained exploratory associations in parsimonious models, but the estimates weakened after adding the corresponding POD1 value.

• The inflammatory response declined substantially in both groups; change measures were not associated with SWI.

• Later marker elevation may warrant clinical attention, but operative and patient context is essential for interpretation.

• No diagnostic threshold, ROC analysis, calibration assessment, or decision analysis was performed.

LIMITATIONS

• Retrospective, single-center cohort with only 18 events.

• Heterogeneous pragmatic SWI endpoint.

• POD3 laboratory availability favored longer, more open cases with greater blood loss and longer length of stay.

• CRP, ESR, procalcitonin, and albumin were unavailable; residual confounding remains possible.

CONCLUSION

Routine POD1 CBC markers should not be interpreted in isolation after lumbar fusion. POD3 WBC and NLR may identify patients who merit closer clinical evaluation, but their associations were exploratory and attenuated after POD1 adjustment.

This study does not establish diagnostic cutoffs, clinical utility, or a validated prediction model.

Clinical examination and surgical context remain essential.

SELECTED REFERENCES

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Abbreviations: WBC, white blood cell count; NLR, neutrophil-to-lymphocyte ratio; POD, postoperative day; SWI, surgical wound infection.