Preoperative Nutrition Screening Predicts 90-Day Surgical Site Infections in Elective Spine Surgery: A Prospective Cohort Study

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INTRODUCTION:
Surgical site infections (SSIs) are a significant complication in undernourished patients. While some of the impacts of malnutrition on surgical site infections are documented, the role of Nutrition Screen (NS) in independently predicting 90-day surgical site infection (SSI) after elective posterior thoracolumbar fusion remains understudied.

METHODS:
We conducted a prospective cohort study of 626 adults electively treated at a tertiary center from 2024–2025. Patient demographics, perioperative factors, and NS category (well-nourished versus at-risk/malnourished) were analyzed. Logistic regression and elastic net sensitivity analysis were used to identify independent predictors of infection.

RESULTS SECTION:
Among 674 adults undergoing elective posterior thoracolumbar fusion, the 90-day SSI rate was 6.2 (42/674). Mean age was 57 ± 13 years, 56% female; mean BMI 29 ± 5 kg/m²; mean operative time 301 ± 78 minutes. On univariate analysis, SSI was associated with higher BMI (31 ± 6 vs 29 ± 5 kg/m²; p = 0.04), longer operative time (352 ± 82 vs 289 ± 71 minutes; p < 0.001), lower hemoglobin (11.2 ± 1.3 vs 12.4 ± 1.5 g/dL; p < 0.001), and a positive Nutrition Screen (NS) (48% vs 29%; p = 0.02); EBL > 1000 mL (21% vs 14%; p = 0.20) and ASA class (p = 0.28) were not significant. Multivariable analysis identified independent predictors: at-risk/malnourished by NS (OR 1.75, 95% CI 1.01–3.05), BMI (OR 1.06 per kg/m²), operative time (OR 1.004 per minute; ≈1.24× per hour), lower hemoglobin (OR 0.76 per g/dL; protective), and prior infection (OR 3.70). Discrimination was acceptable (AUC 0.76; optimism-corrected 0.74) with excellent calibration (HL χ² 3.7, p = 0.88). Elastic-net sensitivity retained NS, operative time, hemoglobin, EBL > 1000 mL, and prior infection (AUC 0.74).

DISCUSSION:
A simple NS performed during routine preoperative assessment provides significant predictive value for identifying patients at higher risk of SSIs. Further studies are needed to determine whether using this screening tool can reduce SSIs, shorten hospital stays, and lower readmission rates in our surgical spine patients.

SIGNIFICANCE/CLINICAL RELEVANCE:
The NS integrates easily into pre-operative workflows, requires little training, and enables timely optimization steps such as nutrition consultation, supplementation, and anemia management. For surgeons and peri-operative teams, it supports routine screening to identify at-risk patients, improves risk communication during shared decision-making, and helps prioritize modifiable interventions to reduce infections and downstream costs.

IMAGES AND TABLES:

Table 1. Summary statistics of all patients undergoing elective spine surgery from 2024–2025 who received the Nestle Mini Nutritional Assessment (MNA®).

Summary Statistics					
Variable	Category/Units	N or Mean	(%) or SD	Median	Range
Demographics					
AGE		61	13.21	63.00	18 - 93
BMI		31	6.95	30.40	2.7 - 66
Comorbidities					
Diabetes	N	503	74.63		
Diabetes	Y	171	25.37		
Smoking	N	541	80.27		
Smoking	Y	133	19.73		
History Prior Infection	N	645	95.70		
History Prior Infection	Y	29	4.30		
Clinical Assesment					
PREALBUMIN		27	6.06	26.00	6 - 59
ASA		3	0.52	3.00	1 - 4
Preop Hg		14	1.61	13.50	8.7 - 20
Prealbumin		27	6.06	26.00	6 - 59
Malnutrition		0	0.29	0.00	0 - 1
MNA®	Normal	490	72.70		
MNA®	At Risk	194	27.30		
Surgical Variables					
Spine Primary Diagnosis	DEGEN	532	78.93		
Spine Primary Diagnosis	DEFORMITY	126	18.69		
Spine Primary Diagnosis	TRAUMATIC	12	1.78		
Spine Primary Diagnosis	ONCOLOGY	4	0.59		
Level (Cervice)		1	1.69	0.00	0 - 7
Level (Thoracic)		1	2.52	0.00	0 - 12
Level (Lumbar)		2	1.87	1.00	0 - 6
Total# Levels		4	3.66	3.00	0 - 21
Surgical Approach (A, P, A/P)	P	435	64.54		
Surgical Approach (A, P, A/P)	A	120	17.80		
Surgical Approach (A, P, A/P)	AP	119	17.66		
Staged Procedure	N	585	86.80		
Staged Procedure	Y	89	13.20		
Instrumentation	Y	578	85.76		
Instrumentation	N	96	14.24		
PSO or VCR	N	627	93.03		
PSO or VCR	Y	47	6.97		
Dural Tear or CSF Leak	N	658	97.63		
Dural Tear or CSF Leak	Y	16	2.37		
EBL >1000cc	N	636	94.36		
EBL >1000cc	Y	38	5.64		
Total OR Time		202	99.94	185.00	24 - ###
SSI	Y	42	0.06		
SSI	N	632	0.94		

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Table 2. Univariate Statistics comparing patients with and without a surgical site infection (SSI).

Univariate Statistical Analysis					
Variable	SSI No (N)	SSI No (Mean ± SD or %)	SSI Yes (N)	SSI Yes (Mean ± SD or %)	P-value
Demographics					
AGE	632	61.2 ± 13.3	42	61.9 ± 12.3	0.719
BMI	632	30.9 ± 6.9	42	33.7 ± 7.2	0.017
Comorbidities					
Diabetes					0.066
Y	155	24.6%	16	38.1%	
N	477	75.4%	26	61.9%	
Smoking					0.693
Y	123	19.5%	9	21.4%	
N	509	80.5%	33	78.6%	
History Prior Infection					0.006
Y	36	5.70%	6	14.30%	
N	596	94.30%	36	85.70%	
Clinical Assesment					
PREALBUMIN	632	26.9 ± 6.1	42	26.1 ± 5.5	0.382
ASA					0.117
1	8	1.3%	0	0.0%	
2	180	28.5%	6	14.3%	
3	432	68.3%	34	81.0%	
4	12	1.9%	2	4.8%	
Malnutrition Screen					0.001
WNL	477	74.30%	22	52.40%	
At Risk/Malnourish	165	25.70%	20	47.60%	
Surgical Variables					
Spine Primary Diagnosis					0.063
DEGEN	505	79.9%	27	64.3%	
DEFORMITY	113	17.9%	13	31.0%	
TRAUMATIC	11	1.7%	1	2.4%	
ONCOLOGY	3	0.5%	1	2.4%	
Level (Cervical)	632	0.87 ± 1.66	41	1.17 ± 2.08	0.462
Level (Thoracic)	632	1.19 ± 2.47	41	2.20 ± 3.19	0.373
Level (Lumbar)	632	1.92 ± 1.85	41	2.51 ± 2.06	0.054
Total# Levels	632	4.0 ± 3.5	42	5.7 ± 4.8	0.079
Surgical Approach (A, P, A/P)					0.024
P	405	64.0%	30	71.4%	0.169
A	117	18.5%	3	7.1%	
AP	110	17.4%	9	21.4%	
Staged Procedure					0.814
Y	83	13.2%	6	14.3%	
N	549	86.8%	36	85.7%	
Instrumention					0.002
Y	536	84.8%	42	100.0%	
N	96	15.2%	0	0.0%	
PSO or VCR					0.155
Y	42	6.5%	6	14.3%	
N	389	93.5%	36	85.7%	
Dural Tear or CSF Leak					1.000
Y	18	2.4%	1	2.4%	
N	617	97.6%	41	97.6%	
EBL >1000cc					0.007
Y	31	4.9%	7	16.7%	
N	601	95.1%	35	83.3%	
Total OR Time	632	198.4 ± 98.2	42	259.0 ± 110.0	0.001

* Significant when <0.05

Table 3. Multivariate Regression Analysis defining significant predictors of SSI.

Multivariate Regression Analysis				
Variable	OR	CI_lower	CI_upper	p_value
BMI	1.063	1.021	1.108	0.003
Total # Levels	1.045	0.956	1.143	0.335
Preop Hg	0.759	0.614	0.937	0.010
Total OR Time	1.004	1.000	1.007	0.046
Nutrition Assement WNL	0.570	0.472	0.688	0.000
EBL >1000cc (Y)	1.659	0.580	4.744	0.345
History of prior infection (Y_	3.668	1.331	10.108	0.012
ASA_2	191678.183	0.000	inf	0.991
ASA_3	282491.738	0.000	inf	0.987
ASA_4	409811.111	79905.457	2101798.225	0.000