A Preoperative Nutrition Screening Tool for Detecting Biochemical Malnutrition in Elective Spine Surgery: A Prospective Cohort Study

Pitcherita Anthenor[1], Phillip Alexeev[1], Molly Szpakowski[1], Damon Abaray[2], Ryan Snowden[1,3]
[1]Thomas F. Frist, Jr. College of Medicine, Belmont University, Nashville, TN, [2] Ascension Saint Thomas Midtown, Nashville, TN
[3]2Tennessee Orthopaedic Alliance, Nashville, TN

pitcherita.anthenor@bruins.belmont.edu

Disclosures: Pitcherita Anthenor (N), Phillip Alexeev (N), Molly Szpakowski (N), Damon Abaray (N), Ryan Snowden (Kuros; Medtronic; SI Bone; Pressio Spine**)**

INTRODUCTION:

Malnutrition increases the risk of complications after spine surgery, but routine biochemical assessment is not always feasible. Previous attempts at simple screening tools have shown mixed results. We evaluated how well the Nestle Mini Nutritional Assessment **(MNA®)** identified biochemical malnutrition (prealbumin < 20 mg/dL) in elective spine surgery patients and whether performance varied by patient health status or surgical complexity.

METHODS:

We performed a prospective cohort study of 674 adult patients undergoing elective spine surgery from 2024-2025. The MNA® was compared with biochemical malnutrition. Patient demographics and perioperative factors were analyzed. Logistic regression was used to assess associations with patient and surgical variables. Diagnostic accuracy was measured using sensitivity, specificity, and predictive values.

RESULTS SECTION:

The cohort included 674 patients, mean age 61.2 years (SD 13.2), mean BMI 31.0 kg/m2 (SD 6.9), and median total instrumented levels 3. The prevalence of malnutrition was 9.5 percent. Against the laboratory reference, the screen yielded 22 true positives, 148 false positives, 42 false negatives, and 462 true negatives, corresponding to sensitivity 0.344, specificity 0.757, PPV 0.129, and NPV 0.917. In multivariable models adjusted for age, BMI, total levels, preoperative hemoglobin, ASA class, diabetes, and smoking, the screen's pooled adjusted odds ratio was 1.37 (95 percent CI 0.74–2.52; P = 0.318). Lower preoperative hemoglobin was strongly associated with biochemical malnutrition (adjusted OR 0.63 per g/dL; 95 percent CI 0.52–0.75; P < 0.001). Other covariates, including age (OR 0.99; P = 0.983) and BMI (OR 0.99; P = 0.978) were not significant in pooled analyses, while higher ASA class showed an association with malnutrition (OR 2.10, P = 0.023). Interaction testing found no significant effect modification: the screen × ASA interaction had a pooled OR 2.59 (P = 0.168) and the screen × total levels interaction had a pooled OR 1.06 (P = 0.428).

DISCUSSION:

In a contemporary elective spine surgery cohort, a simple nutrition screen showed high NPV but modest sensitivity and PPV for biochemical malnutrition. After adjustment for common clinical covariates, the screen did not demonstrate a statistically significant independent association with low prealbumin, and its effect did not vary significantly by ASA class or surgical extent. These findings suggest the screen may be useful to rule out biochemical malnutrition when negative, but positive results should be interpreted cautiously and, when clinically consequential, confirmed with laboratory testing.

SIGNIFICANCE/CLINICAL RELEVANCE:

The nutrition screen provides a low-cost tool for those who may need further laboratory assessment. Combining the nutrition screening with targeted lab tests or brief objective measures may further improve identification of those at risk and lead to better perioperative outcomes.

IMAGES AND TABLES:

Table 1. Univariate and Multivariate Analysis of Patient Risk Factors for Malnutrition Defined by Pre-Albumin < 20g/L.

		Univariate Analysis				Multivariate Analysis		
	Variable	Healthy mean (SD), N (%)	Malnourished mean (SD), N(%)	P value	coef	P value	95%CI
Demographics							
	AGE	61.08 (13.14)	62.69 (13.84)	0.376	-0.003	0.86	(-0.0308, 0.0256)
	BMI	31.13 (6.84)	30.26 (7.77)	0.394	-0.003	0.88	(-0.0473, 0.0407)
Comorbidities							
	Diabetes			0.32	0.341	0.30	(-0.2985, 0.9804)
	Y	151 (24.8%)	20 (31.2%)				
	N	459 (75.2%)	44 (68.8%)				
	Smoking			0.34	0.039	0.92	(-0.6851, 0.7622)
	Y	117 (19.2%)	16 (25.0%)				
	N	493 (80.8%)	48 (75.0%)				
	History Prior Infection			0.34	0.039	0.92	(-0.6851, 0.7622)
	Y	23 (6.1%)	4 (6.2%)				
	N	588 (98.9%)	60 (98.8%)				
Clinical Assessment							
	Pre-Albumin	27.83 (9.32)	16.88 (2.77)	**<0.001**	∞	∞	∞
	Preop Hg*	13.62 (1.59)	12.42 (1.39)	**<0.001**	-0.476	0.00	(-0.6685, -0.2838)
	ASA			**<0.001**			
	1	7 (1.1%)	1 (1.6%)				
	2	176 (28.9%)	10 (15.6%)		1.781	0.13	(-0.5488, 4.1108)
	3	418 (68.5%)	47 (73.4%)		0.534	0.19	(-0.2655, 1.3339)
	4	9 (1.5%)	6 (9.4%)		1.993	**0.01**	(0.4376, 3.5683)
	Malnutrition Screen			**0.005**	1.759	**0.03**	(0.2177, 3.2408)
	WNL	455 (74.5%)	37 (57.8%)				
	At Risk/Malnourished	157 (25.7%)	27 (42.2%)				
Surgical Variables							
	SSI			0.78	-0.404	0.50	(-1.5741, 0.7667)
	Y	37 (6.1%)	5 (7.8%)				
	N	572 (93.9%)	59 (92.2%)				
	Spine Primary Diagnosis			0.67	-0.735	0.82	(-2.9843, 1.4844)
	DEGEN	480 (78.7%)	52 (81.2%)				
	DEFORMITY	116 (19.0%)	10 (15.6%)				
	TRAUMATIC	11 (1.8%)	1 (1.6%)				
	ONCOLOGY	3 (0.5%)	1 (1.6%)				
	Level # (Cervical)	0.84 (1.83)	1.33 (2.18)	0.063	∞	∞	∞
	Level # (Thoracic)	1.23 (2.11)	1.44 (2.73)	0.557	∞	∞	∞
	Level # (Lumbar)	2.77 (3.49)	2.81 (3.79)	0.91	∞	∞	∞
	Total # Levels	4.93 (5.44)	4.64 (5.79)	0.22	-0.001	0.57	(-0.0051, 0.0028)
	Approach			0.12	∞	∞	∞
	P	490 (85.4%)	35 (54.7%)				
	A	84 (14.6%)	28 (43.8%)				
	AP	160 (16.7%)	17 (26.6%)				
	Staged Procedure			0.43	0.020	0.97	(-0.9426, 0.9823)
	Y	78 (12.8%)	11 (17.2%)				
	N	532 (87.2%)	53 (82.8%)				
	Instrumentation			**0.021**	0.865	0.20	(-0.4442, 2.1747)
	Y	517 (84.8%)	61 (95.3%)				
	N	93 (15.2%)	3 (4.7%)				
	PSO or VCR			0.99	0.303	0.65	(-1.0028, 1.6079)
	Y	42 (6.9%)	5 (7.8%)				
	N	567 (93.0%)	59 (92.2%)				
	Durai Tuss or CSF Leak			0.39	∞	∞	∞
	Y	16 (2.6%)	0 (0.0%)				
	N	594 (97.4%)	64 (100.0%)				
	EBL >1000cc			0.36	-1.444	0.12	(-3.2741, 0.386)
	Y	36 (5.9%)	2 (3.1%)				
	N	574 (94.1%)	62 (96.9%)				
	Total OR Time	201.43 (108.82)	207.35 (81.7)	0.62	-0.001	0.57	(-0.0051, 0.0028)

Values are mean (SD) or median [IQR] for continuous variables and n (%) for categorical variables. P values from t-test, Wilcoxon, or Chi-square as appropriate. Malnutrition defined as prealbumin < 20.
* Preoperative Hemoglobin; ^ Welfare Nutrition Limits; ∞ p-value = 99

Table 2. Accuracy of Nestle Mini Nutritional Assessment ® for Identification of True Malnutrition Defined by Pre-Albumin < 20g/L.

Performance of Malnutrition Screening Tool					
Metric	**Estimate (%)**	**95% CI (lower %)**	**95% CI (upper %)**	**Event (n)**	**Population (n)**
Sensitivity	42.2	30.9	54.4	True Positive (27)	True Positives + False Negatives (64)
Specificity	74.4	70.8	77.7	True Negative (453)	True Negatives + False Positives (609)
PPV	14.8	10.3	20.6	True Positive (27)	True Positives + False Positives (183)
NPV	92.4	89.8	94.5	True Negative (453)	True Negatives + False Negatives (490)

Table 3. Logistic regression analysis of interaction effects between Mini Nutritional Assessment (MNA®) and clinical variables for malnutrition.

Logistic Regression Interaction Analysis				
Interaction	**OR**	**P value**	**CI Lower**	**CI Upper**
MNA® x AGE	1.01	0.5929	0.97	1.06
MNA® x BMI	1.02	0.6744	0.94	1.1
MNA® x Total_Levels	1.14	0.0802	0.98	1.32
MNA® x Preop_Hg	1.17	0.3943	0.81	1.69
MNA® x Diabetes	0.96	0.9413	0.28	3.23
MNA® x Smoking	2.05	0.3	0.53	7.98

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