



# **NUTRITIONAL ASSESSMENT AND OPTIMIZATION**

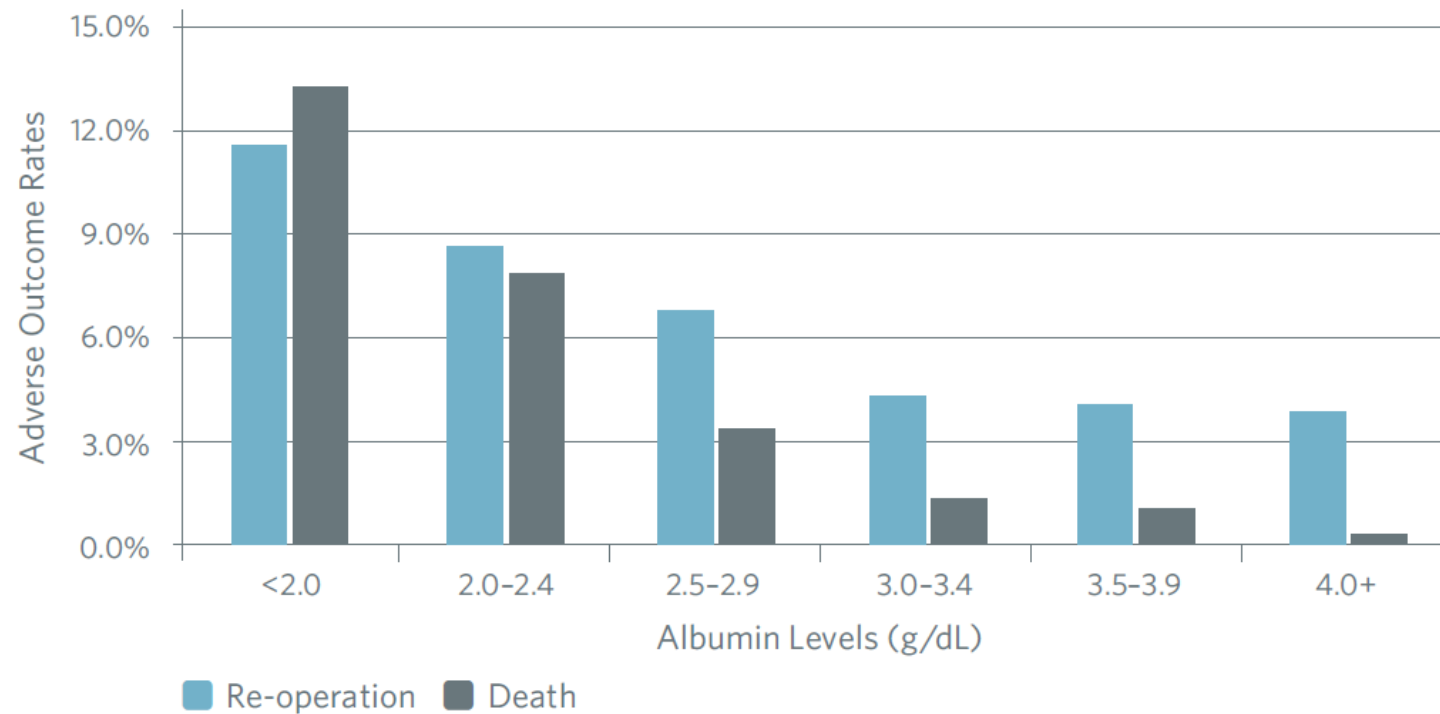
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**MICHIGAN SPINE SURGERY**  
IMPROVEMENT COLLABORATIVE



# Relationship of Albumin to SSI and Death

*SCOAP: Albumin and Complications  
Elective Colon/Rectal Procedures*





100+years

## AMERICAN COLLEGE OF SURGEONS

*Inspiring Quality: Highest Standards, Better Outcomes*

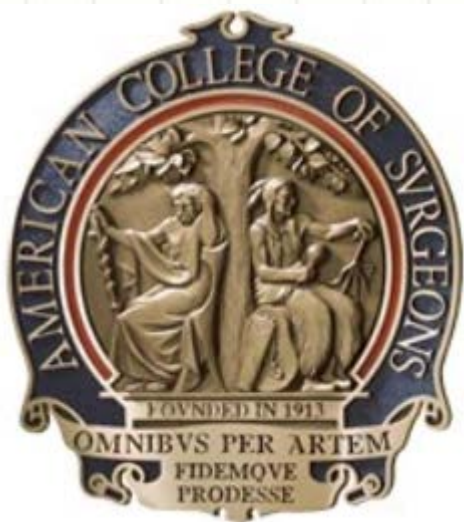
- The American College of Surgeons has made nutritional status one of the core measures in their “Strong for Surgery” ERAS protocol
- Important for both risk stratification and quality improvement

**STRONG**  
for SURGERY

A black stick figure icon with its arms raised in a celebratory gesture, positioned to the left of the text.

# Albumin may be insufficient

- Relationship of calorie and protein intake to albumin levels is inconsistent
- American Society for Parenteral and Enteral Nutrition's (ASPEN's) Clinical Guidelines from January 2011 recommend that albumin and prealbumin not be used in isolation to assess nutrition status, because they are fundamentally markers of inflammatory metabolism
- Serum levels of some proteins change during the acute phase response; those that decrease are called negative acute phase proteins (e.g., albumin and pre albumin) and those that increased are called positive acute phase proteins (e.g., C-reactive protein [CRP])
- Therefore, some practitioners now measure CRP along with albumin and prealbumin to assess for the presence of inflammation



# Nutrition Screening Tool



# NUTRITION Screening Checklist

## SCREENING FOR MALNUTRITION

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Is BMI less than 19?  Yes  No

Has the patient had unintentional weight loss of over eight pounds in the last three months?  Yes  No

Has the patient had a poor appetite—eating less than half of meals or fewer than two meals per day?  Yes  No

Is the patient unable to take food orally (e.g., dysphagia, vomiting)?  Yes  No

**If YES to any of the questions:**

Referral to registered dietitian for evaluation unless currently receiving nutrition therapy

## LAB TESTS FOR RISK STRATIFICATION

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Is the patient having inpatient surgery?  Yes  No

**If YES:**

Check albumin level to assess complication risk after surgery

# Arginine supplementation

- Surgery patients suffer from immune suppression, which increases infection rates.
- A meta-analysis looking at 3,104 patients across 28 randomized control trials on elective surgeries demonstrated that use of “arginine-supplemented diets” was associated with a 41% reduction in risk of infectious complications. Seven studies of preoperative use showed a 43% reduction in risk.
- However, studies considered were all GI, head and neck and cardiac. Most were for cancer.





**HOW RELEVANT IS THIS TO  
SPINE SURGERY?**

# Medicare analysis of 1 and 2 level lumbar fusions

- 148K patients from 2005-2012 dichotomized by whether they had a dx of malnutrition within 3 months of surgery
- Multivariate logistic regression performed
- Diagnosis of malnutrition led to bad outcomes:
  - Infection (adjusted OR: 2.27, 95% CI: 1.70–3.04,  $P < 0.001$ )
  - Wound dehiscence (adjusted OR: 2.52, 95% CI: 1.64–3.88,  $P < 0.001$ )
  - 90-day major medical complications (25% vs. 6%, adjusted odds ratio, OR: 4.24, 95% CI: 3.64–4.94,  $P < 0.001$ )
  - 1-year mortality (1.7% vs. 0.2%, adjusted OR: 6.16, 95% CI: 3.70–10.25,  $P < 0.001$ )





# Duke series

- Limited by small numbers and lack of logistic regression
- Malnourished patients had more levels fused

Adogwa et al. *Spine*  
2014

**TABLE 1. Preoperative Baseline Variables for Patients With Degenerative and Deformity Causes**

Variable	Total (N = 74)	Nourished (n = 60)	Malnourished (n = 14)	P
Diabetes	12 (16.2)	10 (16.7)	2 (14.3)	0.83
Insulin	1 (1.4)	1 (1.7)	0 (0)	0.63
Smoker	12 (16.2)	11 (18.3)	1 (7.1)	0.31
Prior fusion (same operative area)	7 (9.5)	5 (8.3)	2 (14.3)	0.49
Chronic steroid use	6 (8.1)	4 (6.7)	2 (14.3)	0.35
COPD	0 (0)	0 (0)	0 (0)	—
CAD	3 (4.1)	3 (5)	0 (0)	0.39
PVD	3 (4.1)	3 (5)	0 (0)	0.39
Male	36 (48.6)	30 (50.0)	6 (42.9)	0.63
Age at surgery, mean (SD)	57.1 (14.8)	57.6 (14.2)	55.1 (17.7)	0.71
BMI, mean (SD)	30.3 (6.7)	30.9 (6.9)	27.7 (5.4)	0.19
Baseline creatinine, mean (SD)	0.92 (0.29)	0.93 (0.29)	0.86 (0.33)	0.69
Baseline albumin, mean (SD)	3.77 (0.64)	4.03 (0.34)	2.65 (0.35)	<0.01*
<b>Operative variables</b>				
Minimally invasive	21 (28.4)	18 (30.0)	3 (21.4)	0.52
Drain	48 (64.9)	38 (63.3)	10 (71.4)	0.57
Intraoperative steroid use	21 (28.4)	15 (25)	6 (42.9)	0.18
PRBC transfusion	16 (21.6)	8 (13.3)	8 (57.1)	<0.01*
Operative time, mean (SD), min	256.9 (81.7)	240.5 (71.0)	327.4 (89.3)	<0.01*
EBL, mean (SD)	579.6 (943.3)	476.3 (730.9)	1022.5 (1520.6)	0.11
UOP, mean (SD)	667.9 (483.5)	683.0 (489.4)	609.8 (473.0)	0.52
Fusion levels, mean (SD)	2.4 (1.6)	2.1 (1.0)	3.9 (2.5)	<0.01*
Laminectomy levels, mean (SD)	1.6 (1.4)	1.5 (1.1)	1.8 (2.3)	0.53
<b>Postoperative variables</b>				
UTI	3 (4.1)	2 (3.3)	1 (7.1)	0.52
Pneumonia	4 (5.4)	2 (3.3)	2 (14.3)	0.10
Deep surgical site infection	2 (2.7)	1 (1.7)	1 (7.1)	0.26
Superficial surgical site infection	1 (1.4)	0 (0)	1 (7.1)	0.04*
Nonspecific infection	9 (12.2)	5 (8.3)	4 (28.6)	0.04*
Sepsis	2 (2.7)	0 (0)	2 (14.3)	<0.01*
DVT	1 (1.4)	0 (0)	1 (7.1)	0.04*
PE	0 (0)	0 (0)	0 (0)	...
Stroke	1 (1.4)	1 (1.7)	0 (0)	0.63
MI	0 (0)	0 (0)	0 (0)	...
Cardio pulmonary arrest	0 (0)	0 (0)	0 (0)	...
Postoperative length of stay, mean (SD)	4.9 (5.6)	3.8 (2.9)	9.4 (10.5)	<0.01*
At least 1 complication	12 (16.2)	7 (11.7)	5 (35.7)	0.03*

# Pitt series

TABLE 2. Crude and adjusted odds ratios of SSI for prealbumin and other potential risk factors

Factor	Crude OR (95% CI)	p Value*	Adjusted OR (95% CI)	p Value†
Prealbumin $\leq$ 20 mg/dl	4.29 (1.94–9.48)	<0.01	3.28 (1.19–9.09)	0.02
Age	1.04 (1.01–1.07)	0.01	1.02 (0.98–1.06)	0.43
BMI	1.02 (0.96–1.09)	0.47	1.01 (0.94–1.09)	0.72
Duration of surgery	1.02 (0.79–1.33)	0.85		
Current smoker	0.91 (0.36–2.33)	0.85		
Albumin	0.63 (0.41–0.99)	0.04	0.72 (0.41–1.27)	0.26
Diabetes	1.73 (0.70–4.28)	0.23	3.30 (1.03–10.62)	0.05
Steroid use	1.23 (0.36–4.29)	0.75		
Male sex	0.62 (0.27–1.38)	0.24		
Spinal fusion	0.28 (0.09–0.91)	0.03	0.13 (0.04–0.51)	<0.01
Instrumented levels	1.10 (1.00–1.21)	0.05	1.14 (1.02–1.28)	0.02

\* The p value is based on a univariate logistic regression model.

† The p value is based on a multivariate logistic regression model including prealbumin, age, BMI, albumin, spinal fusion, and levels (AUC 0.75, Hosmer-Lemeshow test,  $p = 0.66$ ).

- Used multivariate logistic regression
- Found greater role for prealbumin

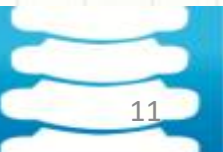
Salvetti et al. *J Neurosurg Spine* 2018

**TABLE 1. Baseline characteristics of patients**

Parameter	Prealbumin ≤20 mg/dl	Prealbumin >20 mg/dl	p Value
No. of patients	73	314	
Mean age in yrs (SD)	59.0 (12.5)	54.9 (15.4)	0.02
Mean prealbumin level in mg/dl (SD)	16.9 (3.47)	29.3 (6.3)	<0.01
Male sex, no. (%)	36 (50)	148 (47.6)	0.14
<b>Mean BMI in kg/m<sup>2</sup> (SD)</b>	<b>28.5 (6.7)</b>	<b>30.0 (6.5)</b>	<b>0.10</b>
Mean surgery time in mins (SD)	226.2 (85.3)	212.0 (89.0)	0.21
Smoking status, no. (%)	18 (24.7)	70 (22.3)	0.66
Mean albumin level in g/dl (SD)	3.72 (2.22)	3.89 (0.66)	0.54
Diabetes, no. (%)	7 (9.6)	61 (19.4)	0.05
Steroid treatment, no. (%)	5 (6.9)	32 (10.2)	0.38
Surgery type, no. (%)			0.79
Lumbar fusion	58 (79.5)	245 (78.0)	
Lumbar laminectomy	4 (5.5)	24 (7.6)	
Thoracic fusion	2 (2.7)	8 (2.6)	
Thoracic laminectomy	0 (0)	3 (1)	
Cervical fusion	8 (11.0)	33 (10.5)	
Cervical laminectomy	1 (1.4)	1 (0.32)	
Median no. of instrumented levels (IQR)	2 (2)	2 (2)	0.20

SD = standard deviation

# Lack of relationship of prealbumin to BMI



# How does MSSIC address nutrition?

- BMI
- Albumin and prealbumin added to the data dictionary beginning with January 2020 cases

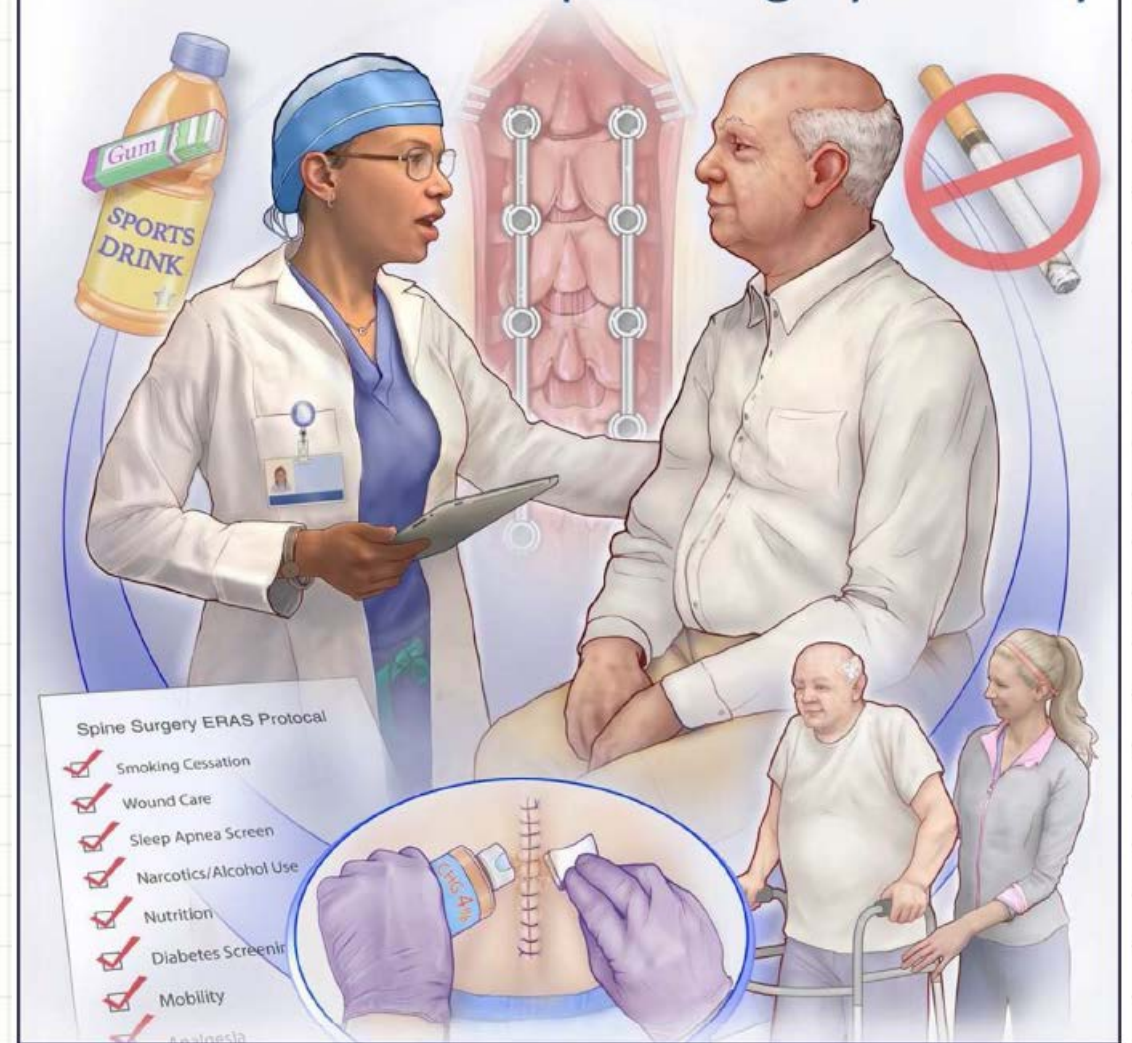


# ERAS



Ali et al. *Clin Neurol Neurosurg* 2018

## Enhanced Recovery After NEUROsurgery: A Patient-Centered Spine Surgery Pathway



# What should we do moving forward?

- Measure albumin and prealbumin
  - Will help with identification of patients and risk stratification
- Consider nutrition consult on the basis of Strong for Surgery checklist, albumin and prealbumin levels
- Nutritional supplement 2-4 hours prior to surgery





**QUESTIONS, COMMENTS AND  
IDEAS?**