



Original Research

Association of low perioperative prealbumin level and surgical complications in long-segment spinal fusion patients: A retrospective cohort study



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HIGHLIGHTS

- Nutritional status may affect outcomes in patients having long-segment spinal fusion.
- Mean perioperative prealbumin levels were low in this cohort.
- Low perioperative prealbumin was linked with higher infection rates.

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ABSTRACT

Background: Spinal surgery places significant physiological and nutritional burden on the patient. Complications are common and can impact long-term clinical outcomes. Therefore, it is important to identify factors associated with perioperative complications to potentially mitigate the lasting effects on patient outcomes. The significant impact of malnutrition on surgical outcomes has been well established; however, there is a paucity of data in the spine literature. Our objective was to evaluate perioperative prealbumin level in patients undergoing long-segment spinal fusion and its relationship to surgical outcomes and complication rates.

Materials and methods: Patients who underwent long-segment (≥ 7) spinal fusions in whom a serum prealbumin level was obtained within 10 days of surgery were identified. Demographic, clinical, operative, and postoperative parameters were examined. Prealbumin levels were dichotomized using a threshold value of 11 mg/dL into low (< 11 mg/dL) and high (≥ 11 mg/dL) groups.

Results: Among the 47 patients identified, the mean prealbumin level was 12.2 mg/dL, with 20 patients (43%) in the low group and 27 (57%) in the high group. Patients with low prealbumin were more likely to undergo a longer fusion (11.6 vs. 9.1 levels, $p = 0.003$). They were also significantly more likely to develop an infectious complication than those in the high prealbumin group (50% vs. 15%, $p = 0.012$), most commonly urinary tract infection (9/14, 64%). There was no significant difference in rates of noninfectious complications between the two groups. Multiple binary logistic regression analysis revealed only low prealbumin was significantly associated with postoperative infection (OR 6.673, 95% CI 1.236–36.024).

Conclusions: Low prealbumin levels were associated with higher rates of infections in patients undergoing long-segment posterior spinal fusion procedures. Further investigations are needed to better define this association and to determine whether effective interventions may be implemented in this subset of patients to attenuate this relationship.

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1. Introduction

Spinal surgery, in particular long-segment spinal fusion, places a significant physiological and nutritional burden on the patient. Complications are common in this patient population [1–3], and it

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has been shown that perioperative complications can impact long-term clinical outcomes [4]. Therefore, it is important to identify those factors that may be associated with perioperative complications in this patient population to potentially mitigate the lasting effects on patient outcomes.

While several serum markers of nutritional status have been utilized in prior studies including total protein, transferrin, and absolute lymphocyte count, albumin is used more frequently given its low cost and availability [5]. Serum albumin has been shown to predict postoperative morbidity and mortality [6,7,27]; however, prealbumin has a much shorter serum half-life than albumin and is therefore ideal for assessing patients' current nutritional status [8,9]. This is important because malnourished patients are at greater risk for complications, have longer hospitalizations, and face higher mortality rates but supplementary nutritional support has been shown to mitigate these effects [6,10,11].

The significant impact of malnutrition on surgical outcomes has been well established in many surgical specialties [12–14]; however, there is a paucity of data in the spine literature. We sought to evaluate the perioperative nutritional status of patients undergoing long-segment spinal fusion operations and its relationship to surgical outcomes and complication rates by utilizing serum prealbumin level measurements. This initial retrospective study explored the operative parameters, hospital course, resource utilization, and surgical outcomes according to perioperative nutritional status as assessed by serum albumin level measurement.

2. Methods

2.1. Study population

After obtaining appropriate approval from the Institutional Review Board with waiver of consent, we queried the hospital's comprehensive clinical database to identify adult patients (18 years and older) who underwent long-segment, thoracolumbar, posterior spinal fusions between December 1, 2010, and December 1, 2015. For the purposes of this study, long-segment fusions were defined as involving 7 or more vertebral segments. Experienced spine surgeons performed all surgical procedures.

2.2. Data collection

All patients included in our analysis had prealbumin levels obtained within 10 days of surgery, with a mean time between surgery and prealbumin assessment of 3 ± 2.4 days and a median of 3 days. Serum prealbumin levels were dichotomized into "low" (<11 mg/dL) and "high" (≥ 11 mg/dL) groups, based on previously published guidelines defining the level at which supplementary nutritional support should be initiated [19].

Demographic, clinical, intraoperative, and postoperative information was collected on all patients. Demographic and social data included age, race/ethnicity, sex, body mass index (BMI), American Society of Anesthesiologists (ASA) Physical Status Classification System Grade, previous thoracolumbar fusion, active tobacco use, active alcohol use, preoperative opioid use, preoperative corticosteroid use, employment status, and insurance type. Relevant medical history including the presence of type 2 diabetes, hypertension, pulmonary comorbidities (i.e., asthma, chronic obstructive pulmonary disease, pulmonary embolism, bronchitis), and cardiac comorbidities (i.e., atrial fibrillation, heart murmur, arrhythmia, myocardial infarction, coronary artery disease, congestive heart failure, mitral valve prolapse) was also obtained. Preoperative diagnoses were recorded as scoliosis/degenerative (flat back syndrome, degenerative myelopathy), tumor, or other (including osteomyelitis, trauma, etc.)

Intraoperative variables included number of spinal levels fused, whether an osteotomy was performed, whether the procedure was part of a two-staged surgery, surgical time, estimated blood loss, and intraoperative blood transfusion. Postoperative variables consisted of total length of stay, readmission within 30 days of index discharge, noninfectious postoperative complications, and discharge destination. All patients were also evaluated for the development of both wound- and non-wound-related infection in the postoperative period. Non-wound-related infection was defined as culture positive urinary tract infection (UTI), pneumonia, or sepsis during the course of the patient's hospitalization.

2.3. Statistical analysis

Continuous variables in all cases were analyzed utilizing unpaired Student's t-test, while categorical variables were analyzed utilizing the Fisher Exact test. We performed a univariate analysis to identify factors associated with lower or higher prealbumin levels. We performed both univariate and multiple binary logistic regression analysis for variables associated with the development of postoperative infection. For the multiple binary logistic regression model, we included all variables with a $p < 0.20$ in our univariate analysis except discharge destination and length of stay as we believed that infection may have directly impacted these factors. Whether the patient had a two-staged procedure or required intraoperative blood transfusion was also included in the multiple binary logistic regression analysis as these were likely to affect infection rates and differed widely between the lower and higher prealbumin groups. In all analyses, $p < 0.05$ was considered statistically significant. All statistical analysis was performed using SPSS V20.0 (IBM Corporation, Armonk NY).

3. Results

3.1. Prealbumin

Among the 47 patients who met our criteria for inclusion, the mean prealbumin level was 12.2 mg/dL with a standard deviation of 5.4 mg/dL. Twenty patients (43%) were categorized in the "low prealbumin" group and twenty-seven patients (57%) were categorized in the "high prealbumin" group. In our univariate analysis, demographic factors in the two groups were similar (Table 1), including age, BMI, sex, insurance type, employment status, and race/ethnicity. There were also no statistically significant differences in preoperative variables including ASA grade and the rates of tobacco/alcohol use, preoperative opioid use, preoperative corticosteroid use, hypertension, diabetes, pulmonary comorbidities, and cardiac comorbidities between the groups. Preoperative diagnosis classification in the two groups was similar, with scoliosis/deformity as the most common diagnosis. The two groups had comparable rates of prior thoracolumbar fusions.

Patients in the lower prealbumin group were more likely to have undergone a longer fusion than those in the higher prealbumin group (11.6 ± 3.3 levels versus 9.1 ± 2.1 levels, $p = 0.003$). Patients in both groups had similar rates of blood transfusion, intraoperative blood loss, and surgical time. Pre- and postoperative hematocrit levels were not significantly different between the two groups. The rate of osteotomies was comparable in the two groups.

Postoperatively, patients in the low prealbumin group were significantly more likely to develop an infectious complication than those in the higher prealbumin group (50% versus 15%, $p = 0.012$). The most common infection was UTI (9/14, 64%, Table 2). There was no significant difference in rates of noninfectious complications between the two groups. The most common noninfectious complication was pulmonary edema requiring diuresis, which

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