Serum Albumin and Prealbumin Levels as Predictors of Postoperative Outcomes after Total Hip Arthroplasty

Eden N Vanderhoek, Amalia Larsen, Zoe Katherine Vanderhoek, Spencer James Smith¹, Jung U Yoo², Ryland Phillip Kagan¹

¹Oregon Health & Science University, ²OHSU

INTRODUCTION:

Demand for total hip arthroplasty (THA) continues to rise, emphasizing the need to minimize related complications. Nutritional status is a crucial factor in preoperative risk stratification. Albumin and prealbumin are key biomarkers used to assess nutritional status, though each reflecting different aspects of nutrition. Serum albumin, with a half-life of about 20 days, is considered an indicator of chronic nutritional status and overall health. Prealbumin, with a half-life of about 2 days, is though to reflect more acute changes in nutritional status. Hypoalbuminemia has been consistently associated with adverse postoperative outcomes in orthopedic surgery. Recently, prealbumin has emerged as a potential biomarker that may better reflect short-term protein status compared to albumin with potential for superior efficacy as a predictor of poor surgical outcomes. This study aims to investigate the predictive value of serum albumin and prealbumin levels for major medical complications within 30 days following THA. We hypothesized that prealbumin may offer superior predictive efficacy compared to albumin.

METHODS:

This retrospective study examined patients who underwent THA at a tertiary medical center between 2012 and 2024, identified using the CPT code 27130. Patients were categorized into two groups based on preoperative serum albumin levels: low (<3.5g/dL) and normal (\geq 3.5g/dL). Similarly, patients were categorized based on preoperative serum prealbumin levels: low (<15mg/dL) and normal (\geq 15mg/dL). A secondary analysis used a prealbumin threshold of <20mg/dL to assess the impact of a different cutoff level on postoperative complications.

Additionally, patients with both low albumin and low prealbumin levels were identified and analyzed to determine if combined low values of these biomarkers had a compounded effect on complication rates.

Postoperative complications were categorized into several groups: all complications, cardiovascular complications (including acute heart failure, cardiac arrest, myocardial infarction, and stroke), infection complications (including deep surgical site infection, organ space surgical site infection, sepsis, superficial surgical site infection, unspecified infection, and urinary tract infection), wound complications (including wound disruption), pulmonary complications (including pneumonia and pulmonary embolism), and mortality.

Chi-squared analyses were employed to compare complication rates within these groups, with statistical significance set at p<0.05. Odds ratios (OR) and 95% confidence intervals (CI) were reported to quantify the strength of the associations between low biomarker levels and the incidence of complications. RESULTS:

In a cohort of 2,458 patients, hypoalbuminemia (<3.5g/dL) was seen in 339 patients, low prealbumin (<15mg/dL) in 45 patients, and low values of both biomarkers in 24 patients. Hypoalbuminemia was significantly correlated with higher overall complication rates compared to normal serum albumin (12% vs. 5%, OR 2.61, CI = 1.79 - 3.80, p<0.0001), specifically cardiovascular complications (7% vs. 2%, OR = 4.26, CI = 2.52 - 7.19, p<0.0001) and acute heart failure (2% vs. 0.3%, OR = 6.47, CI = 2.07 - 20.18, p=0.0011).

Low prealbumin (<15mg/dL) showed no significant difference in overall complication rates compared to patients with normal prealbumin levels (7% vs. 5%, OR 1.23, CI = 0.37 - 4.04, p=0.9914). Additionally, no significant differences were noted for specific complications such as cardiovascular events or infections when stratifying by prealbumin levels.

In the secondary analysis using a prealbumin threshold of <20mg/dL, no significant associations were found with postoperative complications. The overall complication rates were 12% in the <20mg/dL group versus 10% in the <20mg/dL group (OR 1.20, CI = 0.64 - 2.23, p=0.6902). Cardiovascular complications were slightly higher in the <20mg/dL group (14% vs. 10%, OR 1.48, CI = 0.57 - 3.85, p=0.6028), but this difference was not statistically significant. Other complications, such as infections and wound disruptions, also showed no significant differences between the groups.

Patients with both low albumin and low prealbumin levels did not exhibit significant differences in complication rates compared to those with normal levels of both biomarkers (4% vs. 5.5%, OR = 0.75, CI = 0.10 - 5.59, p=1.0000). Similarly, no significant variations were noted for specific complications such as cardiovascular events, infections, or wound disruptions.

DISCUSSION AND CONCLUSION:

This study supports the predictive value of preoperative serum albumin levels in patients undergoing THA. Hypoalbuminemia was associated with a higher incidence of overall complications, particularly cardiovascular events and

acute heart failure. However, prealbumin levels did not significantly predict postoperative complications, nor did the combined presence of low albumin and prealbumin levels.

These findings suggest that chronic nutritional status, as reflected by serum albumin levels, is a more important predictor of postoperative complications in THA patients compared to acute nutritional status indicated by prealbumin levels. This highlights the necessity of comprehensive preoperative nutritional assessment focusing on long-term nutritional health to better predict and mitigate the risk of complications following THA. While albumin remains a valuable marker, the predictive utility of prealbumin requires further investigation, particularly in the context of its short half-life and rapid response to changes.

