

## INITIAL PREALBUMIN LEVEL AND ABILITY TO NORMALIZE PREALBUMIN ARE HIGHLY PREDICTIVE OF INCREASED MORTALITY AND MORBIDITY IN ELDERLY TRAUMA PATIENTS

### Surgery

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### ABSTRACT

Prealbumin is a well characterized indicator of nutritional status more recently found to be an inverse inflammatory marker. At our urban level 1 trauma center, we sought to study the relationship between malnutrition and outcomes in elderly trauma patients. Using prealbumin as a surrogate marker for nutritional status, we hypothesized that patients with reduced prealbumin on initial evaluation have worse outcomes, and in patients where initial prealbumin that was reduced, ability to correct is associated with improved outcomes.

We performed a retrospective cohort study involving 200 consecutive patients over the age of 65 admitted to our trauma service. Based on initial prealbumin, patients were divided into 3 groups - below 5 mg/dL, 5-10 mg/dL and greater than 10 mg/dL. Prealbumin was then re-assessed 4 days after admission and patients were again divided into 2 groups based on ability to normalize prealbumin. Data obtained included age, gender, revised trauma score (RTS), injury severity score (ISS), days on a ventilator, ICU length of stay (ICU-LOS), hospital length of stay (HLOS), survival, initial prealbumin, and ability to correct prealbumin within 4 days after admission.

Of the 200 patients enrolled, patients were divided into 3 groups using initial prealbumin - 71 patients below 5 mg/dL, 101 patients 5-10 mg/dL, and 28 patients greater than 10 mg/dL. There were 180 patients who were hospitalized for over a 4 day period. Normalization of prealbumin was achieved in 128 patients while 52 patients did not. Mean age was 79.2 years. RTS was found to be decreased in patients with initial prealbumin below 5 mg/dL in comparison to the other groups (11.3 vs. 11.8 vs. 11.8,  $p = 0.0002$ ), with greater ISS (25.1 vs. 18.8 vs. 19.7,  $p < 0.0001$ ), ICU LOS (days) (11.3 vs. 3.9 vs. 3.0,  $p < 0.0001$ ), ventilator days (7.9 vs. 0.8 vs. 0.1,  $p < 0.0001$ ), HLOS (days) (17.4 vs. 7.8 vs. 7.1,  $p < 0.0001$ ) and decreased survival (66% vs. 95% vs. 100%,  $p < 0.0001$ ). Patients with prealbumin corrected within 4 days had lower ISS (19.9 vs. 29.2,  $p < 0.0001$ ), as well as reduction in ventilator days (0.9 vs. 10.1,  $p < 0.0001$ ), ICU LOS (days) (4.2 vs. 13.8,  $p < 0.0001$ ), HLOS (days) (8.3 vs. 21.3,  $p < 0.0001$ ) and improved survival (94% vs. 63%,  $p < 0.0001$ ).

Prealbumin is able to provide short term information regarding current nutritional status and response to therapy. Recent evidence suggest prealbumin may be a prognostic indicator for risk of malnutrition and inflammation in critically ill trauma patients. In management of critically ill trauma patients, prealbumin can provide a valuable clinical indication of response to therapeutic intervention and potentially guide management strategy.

### KEYWORDS

Revised trauma score (RTS), Injury Severity Score (ISS), Hospital length of stay (HLOS)

### INTRODUCTION

Prealbumin is a well characterized indicator of nutritional status more recently found to be an inverse inflammatory marker. Although well described in certain surgical subpopulations, prealbumin has limited data within the trauma patient population.<sup>1</sup> At our urban level 1 trauma center, we sought to study the relationship between malnutrition and outcomes in elderly trauma patients. Using prealbumin as a surrogate marker for nutritional status, we hypothesized that patients with reduced prealbumin on initial evaluation have worse outcomes, and in patients where initial prealbumin that was reduced, ability to correct is associated with improved outcomes.

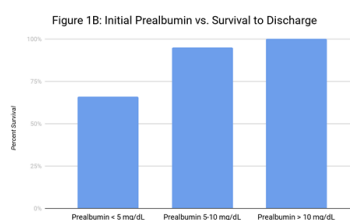
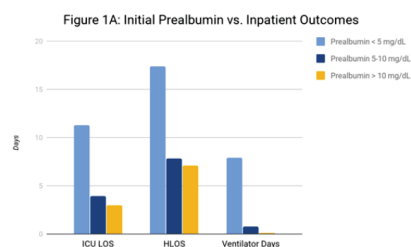
### MATERIALS AND METHODS

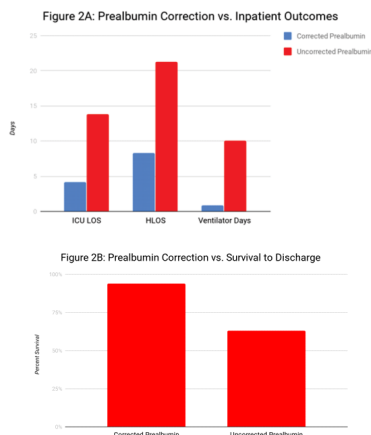
We performed a retrospective cohort study involving 200 consecutive patients over the age of 65 admitted to our trauma service. Based on initial prealbumin, patients were divided into 3 groups - below 5 mg/dL, 5-10 mg/dL and greater than 10 mg/dL. Prealbumin was then re-assessed 4 days after admission and patients were again divided into 2 groups based on ability to normalize prealbumin. No additional intervention aimed at improving nutritional status was performed in either group. As this was a retrospective data analysis using de-identified data, we sought and obtained exemption from our institutional review board for the study of human subjects. Data obtained included age, gender, revised trauma score (RTS), injury severity score (ISS), days on a ventilator, ICU length of stay (ICU-LOS), hospital length of stay (HLOS), survival, initial prealbumin, and ability to correct prealbumin within 4 days after admission. One way analysis of variance (ANOVA) was then performed using JMP Statistical Software ©.

### RESULTS

Of the 200 patients enrolled, patients were divided into 3 groups using initial prealbumin - 71 patients below 5 mg/dL, 101 patients 5-10 mg/dL, and 28 patients greater than 10 mg/dL. There were 180 patients who were hospitalized for over a 4 day period. Normalization of prealbumin was achieved in 128 patients while 52 patients did not.

Mean age was 79.2 years. RTS was found to be decreased in patients with initial prealbumin below 5 mg/dL in comparison to the other groups (11.3 vs. 11.8 vs. 11.8,  $p = 0.0002$ ), with greater ISS (25.1 vs. 18.8 vs. 19.7,  $p < 0.0001$ ), ICU LOS (days) (11.3 vs. 3.9 vs. 3.0,  $p < 0.0001$ ), ventilator days (7.9 vs. 0.8 vs. 0.1,  $p < 0.0001$ ), HLOS (days) (17.4 vs. 7.8 vs. 7.1,  $p < 0.0001$ ) and decreased survival (66% vs. 95% vs. 100%,  $p < 0.0001$ ) (Figures 1A & 1B). Patients with prealbumin corrected within 4 days had lower ISS (19.9 vs. 29.2,  $p < 0.0001$ ), as well as reduction in ventilator days (0.9 vs. 10.1,  $p < 0.0001$ ), ICU LOS (days) (4.2 vs. 13.8,  $p < 0.0001$ ), HLOS (days) (8.3 vs. 21.3,  $p < 0.0001$ ) and improved survival (94% vs. 63%,  $p < 0.0001$ ) (Figures 2A & 2B).





## DISCUSSION

The role of prealbumin (also known as transthyretin) is well established as a marker of nutritional status.<sup>2</sup> With a two day half life, as opposed to albumin (which has a half life of twenty days), prealbumin is able to provide short term information regarding current nutritional status and response to therapy.<sup>3-5</sup> Within the surgical population, low prealbumin levels in elective surgery have been associated with higher incidence of postoperative complications,<sup>6-8</sup> infections,<sup>4</sup> and mortality.<sup>9</sup> As a greater understanding of the clinical role of prealbumin developed, subsequent evaluation found this theory to understate the role of prealbumin as a negative inflammatory marker.<sup>3</sup> Three mechanisms are currently used to explain this phenomenon:

1. Cytokine release accentuates acute phase reactant production (CRP) while concurrently reducing production of other proteins, such as prealbumin.<sup>10</sup>
2. Cytokines responsible for chemotaxis result in capillary leaking of proteins with concurrent fluid resuscitation to result in a compound dilutional effect.<sup>11</sup>
3. Systemic Inflammatory Response results in a cytokine cascade to create a feedback loop of cytokine release as a result of tissue injury.<sup>12</sup>

Although well described in select surgical subpopulations, it was not until Cheng et al, released a study in 2015 suggesting the role of prealbumin as a prognostic indicator for risk of malnutrition and inflammation in critically ill trauma patients. The clinical outcomes described suggested that low prealbumin levels were associated with higher incidence of infection, hospital and ICU length of stay as well as increased mortality.<sup>1</sup>

In an attempt to better understand the role of prealbumin in the critically ill trauma subpopulation, we sought to categorize patients incrementally based on initial prealbumin and correction within 4 days. Our hypothesis was two-fold:

1. Critically ill trauma patients with reduced prealbumin on initial evaluation have worse outcomes.
2. Of patients with initial prealbumin that is reduced, ability to correct prealbumin is associated with improved outcomes.

Our data reiterates a known understanding that low prealbumin is associated with poor outcomes but also provides incremental data. Specifically, patients with prealbumin under 5 mg/dL on initial evaluation had markedly worse outcomes including increased ventilator days, ICU length of stay, hospital length of stay and mortality. Additionally, this data suggests that correction of prealbumin can improve the same outcomes. In management of critically ill trauma patients, prealbumin can provide a valuable clinical indication of response to therapeutic intervention and potentially guide management strategy.

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