



E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2020; 6(1): 1270-1273
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www.orthopaper.com
Received: 16-11-2019
Accepted: 19-12-2019

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Evaluation and role of prealbumin levels on postoperative stay in orthopaedic surgical patients

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DOI: <https://doi.org/10.22271/ortho.2020.v6.i1q.1994>

Abstract

In this present research study we tried to evaluate whether serum Prealbumin levels would serve as a prognosticator of length of stay in hospital for elderly orthopaedic patients who have undergone hip replacement surgery. Our study consisted of a set of 54 patients admitted to a Malla Reddy Institute of Medical Sciences in the year 2014. After initial examinations all the patients were categorized with decreased Prealbumin levels, normal Prealbumin levels, or increased prealbumin levels were monitored during their stay in hospital. The physical parameters data was collected that includes: patients age, length of stay, blood glucose, hemoglobin, RBC, WBC, Prealbumin, and post-operative diet intake. The experimental data was analyzed using SPSS software and probabilities approaching $p < 0.10$ were considered and levels of $p < 0.05$ were deemed to be significant. Our research study shows a substantial and significant relationship between Prealbumin levels at admission and length of patient stay during post-operative recovery.

Keywords: orthopaedic surgical patients, whether serum prealbumin levels

Introduction

Proper nutrition is vital for overall health and well-being. Malnutrition is a severe problem in older adults which may lead to different health-related complications. The elderly population who has been suffering from mild to moderate malnutrition has higher chances of having weak immunity, risk of infections, poor wound healing rate, decreased bone density leads to falls and fractures, high risk of hospitalization [1-4]. There is a well-established association between poor nutrition and illness has long been recognized, but due to lack of reliable, objective, short-term screening methods it is difficult to assess and monitor nutritional risk and its health concerns [1]. Early recognition of poor dietary status and early intervention has been shown to decrease the prolonged hospitalization and ameliorate patient condition and outcomes [1].

Prealbumin is the protein synthesized by the human liver. The liver uses this protein to synthesize other essential proteins; prealbumin also acts as a carrier for thyroid hormones. If any person suffering from infections, inflammation or poor nutrition, then clinicians use the screen test to evaluate the levels of prealbumin from blood samples from such people to assess their nutritional status. Prealbumin is one of the preliminary diagnostic tests to evaluate the nutritional status and nowadays estimating the levels of prealbumin became the preferred marker for diagnosis of malnutrition because it correlates with patient health status in a wide variety of clinical conditions [2, 3, 5].

The successful nutritional therapy can increase of prealbumin levels of 4-5 mg/dl per week. Random testing of prealbumin must be included in the nutrition screening process, which helps identify patients who may not have been diagnosed malnourished by standard screening protocols [2].

In recent times the rise in health care costs and more prolonged hospital stays has led health care providers to try to meet the challenges of expenses management continuously. During such period alternative therapies can be offered, such as medical nutrition therapy, healthcare providers can reduce the number of more costly procedures and lengthy hospitalization in many cases. In this way, nutrition screening and intervention play an intricate role in the medical nutrition therapy process.

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Earlier research studies have shown that as much as 50% of hospitalized patients are diagnosed as malnourished on hospital admission [5-7]. Malnutrition results in weak immunity which increases susceptibility to infection, reduced wound healing rate and overgrowth of bacteria in the gastrointestinal tract that can lead to longer recovery times and increased healthcare costs. Assessing the prealbumin level is a reliable, cost-effective and sensitive method of determining the severity of illness in patients with chronic diseases or who are critically ill [4].

Screening of prealbumin levels can alert healthcare workers to the nutritional status of the patient. Whereas customized screening questionnaires alone cannot help to identify the malnourishment in patients. Earlier research study has highlighted the correlation between initial nutrition screening and nutritional intervention has been shown to decrease the rate of morbidity and mortality among patients who were hospitalized for longer days [3,4] The conclusion from earlier studies has prompted us to assess the prealbumin levels as an indicator to commence nutritional intervention in patients with low serum prealbumin levels, resulting in an improvement of nutritional status pre-surgery and a concurrent shorter length of recovery post-surgery. In this study we tried to use of prealbumin levels as a prognosticator of the length of hospital stay in orthopaedic surgical patients who have undergone hip replacement surgery.

Materials and Methods

Participants: A retrospective study was conducted to demonstrate the effectiveness of using prealbumin screening for hospitalized elderly orthopaedic surgical patients as a prognosticator of postoperative complications and length of stay in hospital. The study was conducted on patients admitted in the Department of Orthopaedic at Malla Reddy Institute of Medical Sciences. Subjects consisted of patients admitted for both elective and non-elective hip replacement surgery. Fifty-five orthopaedic patients, admitted during January 2014-December 2014, were placed into three groups based on pre-surgery prealbumin levels and evaluated using various parameters. Fifteen male patients and 40 female patients were included in the study. The higher percentage of females was most likely due to the higher prevalence of osteoporosis among women. The mean age was 76 years. Patients were classified as having depleted prealbumin levels, low to low/normal prealbumin levels, and/or normal prealbumin levels. Prealbumin levels were obtained prior to surgery to accurately assess visceral protein status.

Data Collection: A data sheet was designed to obtain relevant information for the study. Information obtained from the medical chart included: prealbumin levels (mg/dL), blood glucose (mg/dL), haemoglobin (g/dL), RBC (millions/ μ L), WBC (μ L), length of hospital stay, surgical procedure, age, primary diagnosis, secondary diagnoses, medical nutrition therapy (if applicable), anthropometrical data, and oral intake after surgery. The independent variables were prealbumin levels and provision of medical nutrition therapy.

Dependent variables included: (1) length of stay, and (2) rehabilitation transfer to the skilled nursing unit. Prealbumin was measured by standard protocol as defined by Malla Reddy Institute of Medical Sciences. Reliability of prealbumin levels, as well as all standard blood chemistry analysis, was determined by standard laboratory analysis with instrumentation routinely calibrated in accordance with GLP

procedures.

Statistical analysis: Data for each group being studied were collected and organized for entry into a data file using SPSS statistical software. Patients were classified into three groups as having a depleted prealbumin level (<16 mg/dL), low to low/normal prealbumin level (17-20 mg/dL), and/or normal prealbumin level (>21 mg/dL) as determined through a pre-surgical blood draw.

All other variables (blood chemistry, post-surgical oral intake) were entered and analyzed to determine if those variables might have impacted length of hospital stay. A detailed one-way analysis of variance (ANOVA) was conducted to determine treatment effects.

Results

This study was conducted to determine if using serum prealbumin as a screening tool for identifying patients at nutritional risk in an attempt to reduce healthcare costs by decreasing patient length of stay. Elderly orthopaedic surgery patients were separated into three groups based on admission pre-surgery serum prealbumin level. Nutrition assessments and interventions were performed on subjects considered to have depleted prealbumin values (<17 mg/dL) and/or surgical patients greater than 80 years of age. Data related to additional blood chemistry parameters, health conditions, and oral intake after surgery were collected and analyzed to determine if other factors potentially impacted length of stay in the hospital.

The null hypothesis was that there would be no significant difference in the length of postoperative stay for elderly orthopaedic surgical patients with depleted prealbumin levels compared to patients with normal prealbumin levels in an acute care facility.

Fifty-five patients were reviewed during the study. All subjects were elderly patients who had undergone hip replacement surgery. Fifty-four subjects had pre-surgery serum prealbumin values available while one subject did not have this lab data available. The patients were divided into three treatment groups: 14 subjects had a prealbumin level less than or equal to 16 mg/dL, 13 subjects had prealbumin levels between 17-20 mg/dL, and 27 subjects had prealbumin levels greater than or equal to 21 mg/dL. Regression analysis of individual serum prealbumin levels as compared to length of stay was not taken into consideration due to the limited sample size.

To determine if the prealbumin levels impacted length of stay in the three treatment groups, a one-way analysis of variance (ANOVA) test was performed using Minitab statistical software. ANOVA is a test that compares more than two means. Analysis indicated that there was no statistical difference between the three prealbumin groups ($p > 0.75$) with regard to length of stay in the hospital at $p < 0.05$ (Table 1)

Table 1: Effect of Pre-surgery Serum Prealbumin (PAB) Level on Length of Hospital Stay (days) in Hip Replacement Surgery Patients.

No. patients	Serum PAB Level*	Length of stay (days)	Standard Deviation
14	≤16 mg/dl	12	4.83
13	17 – 20 mg/dl	11	7.93
27	≥ 21 mg/dl	13	7.20

*Level of serum prealbumin obtained from pre-surgery blood draw

It was noted that patients with prealbumin levels less than or equal to 16 mg/dL tended to consume less food after surgery

compared to the patients with prealbumin levels greater than or equal to 17 mg/dL. Although this test was statistically significant ($p = 0.099$) possibly due to the small sample size, there did appear to be a trend between post-operative intake and pre-surgery serum prealbumin level. The ability of the patient to quickly regain a normal level of nutrient consumption may relate to shorter hospital stays and faster recovery times. Because of the limited size of the data set no definite conclusions could be made regarding this trend (Table 2).

Table 2: Effect of Pre-surgery Serum Prealbumin (PAB) Level on Subsequent Post-Operative Nutrient Intake in Patients Undergoing Hip Replacement Surgery

No. patients	Serum PAB Level*	Oral Intake	Standard Deviation
14	≤16 mg/dl	2.36	0.490
13	17 – 20 mg/dl	2.77	0.720
27	≥ 21 mg/dl	2.81	0.680

Oral intake represents the mean value (3 day average) of those group percent of food consumed with 1 being 0-25%, 2 being 26-50%, 3 being 51-75%, and 4 being 76-100%. Length of stay post surgery tended to be less for patients who consumed more nutrients while recovering after surgery. Patients who consumed between 76 to 100% of their meals had a shorter length of stay in the hospital (mean hospital stay of 9.4 days) as compared to those consuming 26 to 50% of their meals (mean hospital stay 14.4 days). This trend was evident across all levels of post operative nutrient intake (Table 3).

Table 3: Impact of Post-Operative Nutrient Intake on Hospital Length of Stay in Post-Hip Replacement Surgery.

No. patients	P.O Intake	Serum PAB Level*	Mean length of stay (days)*	Standard Deviation
0	0 to 25%	≤14 mg/dl	-	-
14	26 to 50%	≤16 mg/dl	14	7.32
13	51 to 75%	17 – 20 mg/dl	12	6.31
27	76 to 100%	≥ 21 mg/dl	9	4.83

*Mean length of stay between P.O intake groups ($p > 0.16$)

P.O Intake represents post-operative nutrient intake measured as a percent of the meal consumed post-surgery. Although the effect of post-operative nutrient intake on length of stay in the hospital was statistically significant (p -value = 0.164) the trend was evident. It is hypothesized that the relationship between post-surgery intake and length of patient stay would become significant given a large enough population pool. This is particularly interesting given the fact that pre surgery serum prealbumin levels tended to predict nutrient intake post surgery, all tending to support the premise that pre-surgical serum prealbumin levels do indeed impact the length of stay in the hospital post hip-replacement surgery.

Discussion and Conclusion

By investing in alternative therapies and expanded patient treatment, healthcare providers are noticing a decrease in more costly procedures and hospital length of stay. With the tremendous rise in healthcare, healthcare providers are challenged to contain costs. Identifying and adequately coding protein-calorie malnutrition can increase Medicare payments to hospitals [8]. Malnutrition is highly widespread among hospitalized patients and is associated with morbidity and mortality among this population.3 Providing Medical Nutrition Therapy (MNT) to patients at nutritional risk helps

reduce complications related to malnutrition [9]. Early nutrition screening and intervention has been associated with better patient outcomes. Malnutrition in hospitalized patients is well documented in the literature and is especially prevalent among the elderly population [1-5]. Early detection of malnutrition in critically ill elderly patients enables prompt and aggressive intervention with supplemental nutrition. After nutrition screening identifies those at risk, appropriate medical nutrition therapy may lead to improved health status resulting in better quality of life and healthcare savings [8-10].

Although the association between poor nutrition and illness has been long recognized, a short-term screening tool to evaluate nutritional risk in the hospital setting is seldom implemented. Determining the level of Prealbumin is a sensitive and cost-effective method for assessing the nutritional status of patients who are critically ill or have a chronic disease [10]. Assessing Prealbumin levels on admission helps to identify those patients at nutritional risk [11]. With a short half-life of two days, it is a better indicator of protein-calorie malnutrition than other serum proteins [9]. Serum Prealbumin is a reliable outcome indicator of patient response to nutrition support [8]. An increase in Prealbumin can be anticipated within four days after nutrition support and supplementation with a high-calorie/high-protein formula. Determining the level of serum Prealbumin allows earlier assessment and intervention in patients at nutritional risk.

The results of this study showed remarkable difference in serum Prealbumin levels and postoperative length of stay between the three study groups [12]. Patients with depleted Prealbumin levels did have a slight increase in postoperative length of stay as determined by the one-way ANOVA test.

However, there was a trend noted between serum Prealbumin and oral intake after surgery. Patients with normal Prealbumin levels demonstrated better oral intake after surgery as opposed to patients with lower Prealbumin levels [13-15]. Thus, it may be conjectured that decreased Prealbumin levels impact appetite and oral ingestion. Furthermore, patients who demonstrated decreased oral intake after surgery tended to have a more extended hospital stay compared to the patients with adequate oral intake. Decreased oral intake may lead to malnutrition that may reduce muscle strength, increasing the risk of infections, and impairing mental performance [13]. Additional variables have been analyzed to determine if there was any impact on the length of hospital stay. Numerous studies have noted a significant correlation between poor blood glucose control and more extended hospital stay. Hyperglycaemia at time of hospitalization has been associated with increased hospital mortality in critically ill patients; however, it was not yet clear whether hyperglycaemia in patients admitted to general hospital wards is also associated with poor outcomes [13-14]. Our study found that patients with higher blood glucose levels had a 3.6 fold (95% CI 1.4 to 8.9) higher risk of mortality and significantly longer length of hospital stay.

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