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The Impact of Prealbumin on Postoperative Length of Stay in Elderly Orthopedic Patients.

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ABSTRACT

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The purpose of this research was to evaluate whether serum prealbumin levels would serve as a predictor of hospital length of stay for elderly orthopedic patients who underwent hip replacement surgery. The study consisted of a set of 54 patients admitted to a hospital in Bristol, Tennessee. Patients with depleted prealbumin levels, low to low/normal prealbumin levels, or normal prealbumin levels were analyzed. Data collected from a retrospective chart review included: age, length of stay, serum glucose, sodium, potassium, hematocrit, hemoglobin, BUN, creatinine, WBC, prealbumin, and post operative diet consumption. Data were analyzed using analysis of variance for treatment effects. Because of the limited size of the data set, probabilities approaching $p< 0.10$ were considered and levels of $p<0.05$ were considered significant. The research failed to show a significant relationship between prealbumin levels at admission and length of patient stay during post-operative recovery.

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CHAPTER 1

INTRODUCTION

Research has shown that as much as 50% of hospitalized patients are considered to be malnourished on admission.[1,6,9] Malnutrition results in increased susceptibility to infection, wound healing complications, and overgrowth of bacteria in the gastrointestinal tract that can lead to longer recovery times and increased healthcare costs. Determining the level of serum prealbumin (PAB), a hepatic protein, is a sensitive and cost-effective method of assessing the severity of illness resulting from malnutrition in patients who are critically ill or have a chronic disease.[1] The use of screening questionnaires alone may miss or delay identification of malnourished patients. Prealbumin screening alerts healthcare workers to the nutritional status of the patient. Early nutrition screening and intervention has been shown to reduce morbidity and mortality among hospitalized patients.[2] Albumin, transferrin, and prealbumin have historically been indicators in clinical practice to nutritional status. While there is evidence that nutritional status and protein intake do not significantly correlate with serum hepatic protein levels, compelling evidence suggests that serum hepatic protein levels correlate with morbidity and mortality.[3] Some hospitals have adopted prealbumin screening to help identify patients at high risk for malnutrition, thereby, allowing timelier nutrition intervention from a registered dietitian. This information might be used as an indicator to initiate nutritional intervention in patients with low serum prealbumin levels, resulting in an enhancement of nutritional status pre-surgery and a concurrent shorter length of recovery post-surgery.

Problem Statement

Increasing numbers of elderly patients, who often suffer from malnutrition, are being admitted to acute care hospitals within the United States.[4] Although the association between poor nutrition and illness has long been recognized, reliable, objective, short-term screening methods are not available for evaluating nutritional risk.[1] Early recognition of poor nutritional status and early intervention has been shown to decrease length of stay and improve patient outcomes.[1] Prealbumin is the earliest laboratory indicator of nutritional status and has become the preferred marker for malnutrition because it correlates with patient outcomes in a wide variety of clinical conditions.[1] An increase of prealbumin levels of 4-5 mg/dl per week is commonly seen in response to successful nutritional therapy. Routine prealbumin testing, as part of the nutrition screening process, helps identify patients who may not have been recognized by standard screening protocols.[2]

The rise in health care costs and longer hospital stays has led health care providers to continuously try to meet the challenges of cost containment. By providing alternative therapies, such as medical nutrition therapy, healthcare providers are able to decrease the number of more costly procedures and length of stay in many cases. Nutrition screening and intervention play an intricate role in the medical nutrition therapy process.

The purpose of this study is to evaluate the use of prealbumin levels collected at patient admission as a predictor of length of hospital stay in orthopedic surgical patients who have undergone hip replacement surgery. Patients considered at nutritional risk at Bristol Regional Medical Center are identified as those patients who have: (a) a prealbumin level of less than 17 mg/dl, (b) decubitus ulcers, (c) below 80% percent Ideal Body Weight (IBW), (d) surgical

patients who are 80 years of age or older, or (e) unintentional weight loss of 10 pounds or more in one month.

Hypothesis

Elderly orthopedic surgical patients who have normal serum prealbumin levels on admission have a shorter length of postoperative stay as compared to patients with depleted prealbumin levels in an acute care facility.

Null Hypothesis

There is no significant difference in the length of postoperative stay in elderly orthopedic surgical patients with low prealbumin levels as compared to patients with normal prealbumin levels in an acute care facility.

Delimitations

1. All patients had undergone hip surgery, which impaired the ability to generalize the results to other surgical procedures.
2. Subjects were restricted to those admitted to Bristol Regional Medical Center between September 2004 and December 2004.

Limitations

Limitations of the study:

1. Serum prealbumin levels are influenced by liver disease. Prealbumin is also a negative acute phase reactant, meaning the level will decrease in the presence of inflammation and in the immediate post-surgical period.

2. Research data were obtained through a retrospective chart review of elderly patients who have undergone hip surgery at Bristol Regional Medical Center. Because this study is retrospective, any nutrition intervention will have already taken place.

Assumptions

The following assumptions are critical to the study:

1. The length of the study was adequate to obtain the data for analysis.
2. Data related to the patients physical status, medical history, and blood tests were analyzed and recorded accurately.
3. Post-surgical oral intake was recorded accurately.

Definition of Terms[5]

Elderly: a person 65 years of age or older.

Retrospective: review of past events.

Malnutrition: poor nutritional status resulting from either undernutrition or overnutrition. It can result from inadequate intake, disorders of digestion or absorption, or excessive intake of nutrients.

Protein-calorie Malnutrition: undernutrition resulting from inadequate intake, digestion, or absorption of protein or calories.

Prealbumin (PAB): a serum protein synthesized by the liver with half-life of two days. Normal range is 18.0 to 35.0 mg/dL**.** Changes rapidly in malnutrition and during nutritional repletion.

Albumin: serum protein that is slow to change during malnutrition and nutritional repletion because of long half-life (14-20 days).

Transferrin: serum protein with a shorter half-life than albumin (7-8 days), responds quickly to undernutrition.

Serum Glucose: the level of glucose present in the blood.

Polypharmacy: taking excessive medications.

Dysphagia: difficulty in swallowing.

Aspiration: the misdirection of gastric contents into the larynx and lower respiratory tract.

Ideal Body Weight (IBW): an estimate of healthy weight-for-height for adults.

Medical Nutrition Therapy: involves the assessment of the nutritional status of patients with a condition, illness, or injury that puts them at risk. This includes review and analysis of medical and diet history, laboratory values, and anthropometric measurements. Based on the assessment, nutrition modalities most appropriate to manage the condition or treat the illness are chosen and include: (1) diet modification and counseling, (2) specialized nutrition therapies (i.e. supplementation and/or enteral feeding).

Nutrition Assessment: the process used to evaluate nutritional status, identify malnutrition, and determine which individuals need aggressive nutritional support.

Registered Dietitian: a nutritional professional who has completed a baccalaureate degree in dietetics or a related area at a regionally accredited US college, completed a supervised clinical experience, and passed a national examination administered by the Commission on Dietetic Registration. Registered dietitians are qualified to perform nutrition screening, assessment, and treatment.

Morbidity: relating to disease.

Mortality: causing or subject to death.

Acute Care Facility: institution where the sick or injured receive medical care.

Enteral nutrition: nutrition delivered into any part of the gastrointestinal tract. Enteral feedings are given either by mouth or by tube.

Parenteral nutrition: delivery of nutrients through the intravenous route.

CHAPTER 2

REVIEW OF LITERATURE

Due to the aging baby boomers and longer life expectancies, the number of middle aged and elderly patients admitted to acute care hospitals is on the rise.[4] Clinicians are challenged to develop optimal treatment plans for individuals who often suffer from complex or multiple diseases. In addition, limited availability of healthcare resources must be taken into account.[4] Medical Nutrition Therapy has helped healthcare providers reduce the number of more costly procedures by implementing alternative treatment plans. When protein-calorie malnutrition has been recognized among hospitalized patients, early nutritional intervention can potentially help reduce the number of complications associated.

Protein-calorie malnutrition (PCM) is a wasting condition resulting from an inadequate intake of calories and protein.[4] This condition can shorten the life expectancy in elderly patients if not recognized early due to poor wound healing after surgery. The prevalence of PCM in hospitalized patients has increased to approximately 50%.[1,6] Despite substantial evidence of the crucial role protein calorie malnutrition (PCM) plays in the occurrence of complications, increased length of stay, and cost for hospitalized patients, a standard screening tool for monitoring nutritional status is seldom used. Prealbumin screening is one useful tool that may be used in hospitals in order to identify patients with protein-calorie malnutrition (PCM) resulting in the provision of earlier medical nutrition therapy. This review of literature includes: (1) protein-calorie malnutrition (PCM), (2) the role of visceral protein status in identifying PCM, (3) factors that influence nutritional status among elderly patients, (4) physiological factors that impact serum prealbumin levels, and (5) the cost-effectiveness of medical nutrition therapy.

Protein-Calorie Malnutrition

Protein-calorie malnutrition (PCM) is a potentially fatal body-depletion disorder. PCM develops when consumption of protein and energy (calories) is insufficient to meet the nutritional needs of the body. Elderly people have a high risk for developing PCM due to multiple problems associated with decreased oral intake of food and fluids. Difficulty chewing, swallowing, pain, nausea, and lack of appetite are among the most common reasons that many elderly hospital patients cannot meet nutritional needs through oral intake. PCM occurs in one of every two surgical patients and in 48% of all other hospital patients in the United States.[7] PCM is also prevalent among patients with other complications including: AIDS, cancer, renal failure, inflammatory bowel disease, and other illnesses that impair the ability of the body to absorb nutrients. Depleted nutrient status caused by PCM can lead to bleeding, diarrhea, hyperglycemia, kidney disease, and malabsorption.[5] Repletion of nutrient losses is often a challenge as nutrient requirements are increased in patients with fever, infection, tumors, trauma, surgery, and burns. Nutritional intervention treatment is designed to meet calorie and protein requirements, restore normal body composition, and resolve the underlying condition that caused the deficiency.[7]

The Role of Visceral Protein Status in PCM

Serum hepatic protein (albumin, transferrin, and prealbumin) levels have historically been used to assess nutritional status. Determining the level of prealbumin, a hepatic protein, may be a sensitive and cost-effective method of assessing the nutritional status of patients who are critically ill or have a chronic disease.[1] While albumin levels have been used as a determinant of nutritional status, they are relatively insensitive to acute changes in nutritional status and may be affected by the hydration state and renal function of the patient. Albumin, the

traditional indicator for PCM, has a half-life of 20 days and is present in large quantities in the body. Only conditions where chronic protein intake deficiency occurs will result in low albumin levels. Serum prealbumin, the preferred marker for protein-calorie malnutrition, is a transport protein for thyroid hormones. It transports Vitamin A (retinol) in combination with retinol-binding protein. Prealbumin is synthesized in the liver and migrates ahead of albumin during electrophoresis.[1,8] With a short half-life of two days, it is a better indicator of protein-calorie malnutrition (PCM) than albumin (Table 1).[1,3,8]

Table 1.[1] Characteristics of Plasma Protein in Use as Nutritional Markers

Protein	*Molar weight*	*Half-life (days)*	*Normal Range*
Albumin	65,000	20	3.30 to 4.80 g/dL
Transferrin	76,000	10	0.16 to 0.36 g/dL
Prealbumin	54,000	2	16.0 to 35.0 mg/dL

A normal prealbumin level is 16-35 mg/dL using a nephelometric protein analyzer. Serum prealbumin concentrations between 11-15 mg/dL are considered below normal, indicating nutritional risk. Nutritional risk is high when prealbumin levels drop below 11 mg/dL, and poor outcome is predicted when a level of less than 5 mg/dL is obtained.[9]

Patients selected for aggressive nutritional support as a result of early screening can be monitored for success using prealbumin level as an indicator.[1] A response in serum prealbumin can be anticipated as early as four days after supplementation is started, with a definitive response at eight days.[1] Because prealbumin is more reactive, patients with a normal serum albumin level can have a depleted prealbumin level simultaneously. If albumin is used as the preferred indicator for PCM, patients may not receive timely nutritional assessment and intervention.

One group of researchers compared nutritional risk screening based on serum albumin versus prealbumin levels. One hundred percent of the patients deemed to be at severe risk based on albumin levels were also at risk when prealbumin levels were assessed, and 43% percent of the patients who were at moderate risk based on albumin levels were determined to be at severe risk based on prealbumin levels.[9] In patients with a high-risk for malnutrition, prealbumin levels determined bi-weekly during hospitalization can alert the physician and the dietitian to declining nutritional status, allow for responsive treatment, improve patient outcome, and shorten hospitalization in an increasingly cost-conscious economy.[1]

Robinson et al. determined the effectiveness of a nutrition-screening protocol, prealbumin, retinol binding protein, and albumin in identifying malnourished hospitalized patients.[2] A nutrition screening protocol consisting of a nurse administering a questionnaire to patients was used prospectively in medical and surgical patients followed by requesting an evaluation by a Registered Dietitian (RD) only if nutritional issues were identified. Serum prealbumin, albumin, and retinol-binding protein were collected and used to screen and identify malnourished patients. The lab values were correlated to the RD classification of patient nutritional status. The nutrition-screening protocol, classified 104 of 320 patients (33%) as malnourished. However, 43% of the patients were not deemed at nutritional risk and did not receive a nutritional assessment. Prealbumin was shown to be a significant predictor of nutritional status ($p<0.05$), whereas retinol-binding protein and albumin were not. Prealbumin screening identified 50% (162/320) of the patients as being malnourished.[2] Furthermore, 50% of the patients who were not evaluated by an RD were identified as malnourished using prealbumin criteria. The nutrition-screening protocol took 1.2 days longer to determine malnourishment

when compared with prealbumin; thus, it was concluded that prealbumin screening has the potential to quickly identify those patients requiring nutritional intervention.[2]

Physiological Factors that Impact Serum Prealbumin Levels

Although clinical findings support the sensitivity of prealbumin, alterations in concentration in various clinical conditions affect the accuracy of the measurement. Stress and inflammation have been shown to affect the concentration of rapid turnover proteins in critically ill patients.[8] Decreased plasma concentration of prealbumin is seen with advanced liver disease, and this is the result of a reduced rate of protein synthesis. In chronic renal failure, the plasma concentrations of prealbumin are elevated because of the decreased catabolism in the kidney. Nutritional status is often difficult to interpret because of initially high values of prealbumin in patients with renal failure; however, for patients with chronic renal failure, the trends in concentration of prealbumin, rather than the actual values, can be used to monitor the adequacy of therapy implications. Despite these limitations, prealbumin more adequately fulfills the sensitivity criteria of an ideal protein parameter and a useful tool to monitor nutritional status and response to nutrition therapy. [8]

Factors that Influence Nutritional Status among Elderly Patients

Protein-calorie malnutrition is common in geriatric patients in the acute-care hospital.[4] Nelson et al. found that the incidence of malnutrition was 39% in the elderly population.[9] Chewing problems, dysphagia, polypharmacy, and dementia are several of the common causes of malnutrition among this population. Dysphagia develops in almost all patients with degenerative diseases of the central nervous system (CNS).[10] The incidence of dysphagia is between 40-70% in the elderly population thereby increasing the risk for aspiration pneumonia.[10] Additionally, aspiration occurs in approximately 40-50% of stroke patients with dysphagia.[10]

Texture modification and/or alternative nutrition support may be required to meet nutritional needs and prevent dehydration. Excessive medication use, or polypharmacy, has also been linked to the development of malnutrition in the elderly. In a retrospective analysis of more than 875,000 patients in long-term care facilities, 55% of the patients met criteria for polypharmacy. Furthermore, people who are depressed tend to have more complaints and doctors may prescribe more medication in an effort to treat those symptoms.[11] Despite the cause, PCM often results in longer hospital stays for this population.[4]

Muhlethaler et al. conducted a comprehensive literature review and found seven studies that compared outcomes in elderly patients with and without protein-calorie malnutrition. Results from the literature review found some of the selected malnutrition indicators (<80% IBW, anthropometric measurements less than the 5th percentile, albumin <30 g/L, prealbumin <15 mg/dL, transferrin <2 mg/dL, mini-mental status questionnaire <20 out of 30 points, basic activities of daily living (ADLs), and creatinine clearance <30 ml/min) to be statistically significant ($p<0.05$) predictors of mortality or hospital readmission.[4] The same researchers then conducted a prospective longitudinal study to determine whether nutritional assessment might add independent prognostic information on long-term survival and quality of life in geriatric patients. At hospital admission, 35.9% of the patients were found to have an abnormally low arm-muscle circumference, and 20-40% of patients had serological indicators of protein malnutrition. Low arm-muscle circumference, subnormal serum prealbumin, and decreased average body weight were strongly associated with increased mortality. Serum albumin, transferrin, and triceps skin-fold thickness did not show such a statistically significant association.[4] The researchers concluded that malnutrition is a major independent predictor of adverse outcome in elderly hospitalized patients.

The stress of surgery or trauma increases protein and energy requirements due to an increase in metabolic demand. Studies have found that malnourished patients undergoing surgery have an increased risk of sepsis in the postoperative period and poor wound healing complications.[12] Researchers from New Zealand investigated the prevalence of protein and energy malnutrition in elderly patients with a fracture of the proximal femur. They found that 42% percent of patients had at least two indicators of protein and energy malnutrition present on admission to the hospital.[12] Once it had been determined that a patient was malnourished or unable to take adequate oral nutrition, several interventions were able to be considered.

Dietary supplementation, orally or enterally, has shown positive outcomes in elderly surgical patients. Delmi et al. investigated the effects of nutritional supplementation on 59% patients recovering from hip fracture with a mean age of 82. Results from the study showed that many patients were poorly nourished on admission and did not take in adequate nutrition when offered. They further found that supplemented patients had higher serum albumin levels and decreased lengths of stay as compared to the control group. The rate of complications and mortality was also noted to be lower six months after surgery in the supplemented group.[13]

Cost-effectiveness of Medical Nutrition Therapy

The diagnosis-related groups/prospective payment system (DRG-PPS) was instituted by Medicare in 1983. This system classifies patients by diagnosis, age, and surgical procedure. DRGs are devised to predict and control use of hospital resources.[14] In the acute-care setting, factors contributing to an increase in the demand for medical nutrition therapy include the aging of the population, the higher acuity level of hospitalized patients, and the coexistence of malnutrition with chronic disease.[15] Because malnutrition is considered a co-morbidity under the diagnostic-related group (DRG) payment system, identifying and properly coding for PCM could

increase Medicare payments to hospitals. Medical nutrition therapy has been shown to lower healthcare costs by reducing: the incidence of medical complications, length of hospitalizations, number of readmissions, amount of surgery, and patient treatment needs. [15] Among hospitalized adults, additional costs for patients with malnutrition were $5,575 per surgery patient and $2,477 per medical patient.[15] Many studies have found the incidence of malnutrition in hospitals ranging from 30% to 55%.[1,6] The elderly represent 12.6% of the population in the United States and account for 36% of health care costs ($302 billion).[15] One study that researched the impact of nutritional status among patients hospitalized for more than seven days found that patients who did not consume enough to meet nutritional needs had significantly higher hospital charges and a higher likelihood of complications.[16]

Hospitals are reimbursed based on patient diagnosis which may include PCM; therefore, medical nutrition therapy provided by dietetics professionals is an essential reimbursable component of comprehensive health care services.[1,15] Researchers have examined the effectiveness of using prealbumin as a routine diagnostic test for protein-calorie malnutrition and found a significant association with decreased length of stay.[15] After implementing comprehensive prealbumin testing, one hospital saw a 25% decrease in the readmission rate and realized more than $600,000 savings per year.[9] Prealbumin is an inexpensive tool for identifying protein-calorie malnutrition and measuring clinical outcomes.

Nutrition screening is mandated by Joint Commission on Accreditation of Healthcare Organizations (JCAHO), but each institution is able to choose the specific screening and assessment criteria.[9] One group of researchers developed a survey questionnaire to ascertain screening protocols and tools used by Nutrition Support Dietitians.[9] They found that height and weight, diagnosis, gastrointestinal symptoms, and serum albumin were commonly used risk

screening factors. Prealbumin as a screening parameter was used by less than 10% of dietitians surveyed, but nearly 45% stated they preferred prealbumin as a screening tool over other risk screening factors.[9] After nutrition screening is used to identify those at risk, appropriate medical nutrition therapy is able to be targeted at patients leading to improved health outcomes resulting in improved quality of life and cost savings by reducing the number of more expensive procedures.[15]

CHAPTER 3

RESEARCH METHODOLOGY

Participants

A retrospective chart review was conducted to demonstrate the effectiveness of using prealbumin screening for hospitalized elderly orthopedic surgical patients as a predictor of postoperative complications and length of stay. The study was conducted on patients admitted to the orthopedic-neurology floor and Skilled Nursing Facility (if applicable) at Bristol Regional Medical Center in Bristol, Tennessee. Subjects consisted of patients admitted for both elective and non-elective hip replacement surgery. Fifty-five orthopedic patients, admitted during September 2004-December 2005, were placed into three groups based on presurgery 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.

Development of Instrumentation

A data sheet was designed to obtain relevant information for the study (Appendix A). Information obtained from the medical chart included: prealbumin levels (mg/dL), serum glucose (mg/dL), sodium (mEq/L), potassium (mEq/L), hematocrit (%), hemoglobin (g/dL), BUN (mg/dL), serum creatinine (mg/dL), WBC (μL), 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 Bristol Regional Medical Center. 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.

Procedure

The initial research proposal was approved by an appointed committee within the department of Family and Consumer Science. The research proposal was also submitted to the Institutional Review Board (IRB) at Bristol Regional Medical Center, Bristol, Tennessee in January of 2005. The study was eligible for exempt review by the IRB because the collection of existing data was recorded in a manner that human subjects could not be identified. An informed consent was not required due to the retrospective study using a closed chart review. Implementation of the study began after approval of the project was granted by the Institutional Review Board at Bristol Regional Medical Center, Bristol, TN. A census summary report is generated monthly that includes the admit date and diagnosis of each patient admitted to the orthopedic-neurology floor. All patients admitted between September 2004 and December 2004 who underwent hip replacement surgery were included in the study.

A data collection sheet was developed to obtain relevant data needed for the study. The data collection sheet was reviewed and revised by the Committee Chair prior to obtaining data. The patients' medical record number was used to obtain charts from the medical record department. The medical record number was removed from the data collection sheet to protect the privacy of subjects and to maintain the confidentiality of data. Data collection was

conducted on patients who were admitted between September 2004 and December 2004. Fifty-five charts were reviewed and data collected. The data were then entered into a statistical software package for analysis.

Data Analysis

Data for each group being studied were collected and organized for entry into a data file using MINITAB 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 presurgical blood draw. All other variables (blood chemistry, post-surgical oral intake, percent IBW, and diagnoses) 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.

CHAPTER 4

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 orthopedic 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 orthopedic surgical patients with depleted prealbumin levels compared to patients with normal prealbumin levels in an acute care facility.

Fifty-five charts 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 datum 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, thus the null hypothesis could not be rejected at $p < 0.05$ (Table 2).

Table 2. Effect of Presurgery Serum Prealbumin (PAB) Level on Length of Hospital Stay (days) in Hip Replacement Surgery Patients.

Serum PAB Level[a]	No. patients	Length of stay (days)	Standard Deviation
≤16 mg/dl	14	12.36	4.83
17 – 20 mg/dl	13	11.46	7.93
≥ 21 mg/dl	27	13.19	7.20

[a]Level of serum prealbumin obtained from presurgery 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 not statistically significant ($p = 0.099$) possibly due to the small sample size, there did appear to be a trend between post-operative intake and presurgery 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 3). .

Table 3. Effect of Presurgery Serum Prealbumin (PAB) Level on Subsequent Post-Operative Nutrient Intake in Patients Undergoing Hip Replacement Surgery

Serum PAB (mg/dL)	Number of patients	Oral Intake	Standard Deviation
≤16 mg/dL	14	2.36	0.490
17 – 20 mg/dL	13	2.77	0.720
≥21 mg/dL	27	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 4).

Table 4. Impact of Post-Operative Nutrient Intake on Hospital Length of Stay in Post-Hip Replacement Surgery.

P.O Intake[a]	Number of patients	Mean length of stay (days)[b]	Standard Deviation
0 to 25%	0	-	-
26 to 50%	23	14.44	7.32
51 to 75%	25	11.80	6.31
76 to 100%	7	9.42	4.83

[a]P.O Intake represents post-operative nutrient intake measured as a percent of the meal consumed post-surgery.

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

Although the effect of post-operative nutrient intake on length of stay in the hospital was not 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.

CHAPTER 5

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 properly coding protein-calorie malnutrition can increase Medicare payments to hospitals. Malnutrition is highly prevalent 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 associated with malnutrition.[15] 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] 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 outcomes resulting in improved quality of life and healthcare savings .[15]

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 chronic disease.[1] Assessing prealbumin levels on admission helps to identify those patients at nutritional risk.[1] 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 no significant difference in serum prealbumin levels and postoperative length of stay between the three study groups. This may have been due to the limited sample size. Patients with depleted prealbumin levels did not have a significant 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. Thus, it may be conjectured that decreased prealbumin levels impact appetite and oral intake. Furthermore, patients who demonstrated decreased oral intake after surgery tended to have a longer 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.[17]

Additional variables have been analyzed to determine if there was any impact on length of hospital stay. Numerous studies have noted a significant correlation between poor blood glucose control and longer hospital stay. Hyperglycemia at time of admission has been associated with increased hospital mortality in critically ill patients; however, it is not known whether hyperglycemia in patients admitted to general hospital wards is also associated with poor outcomes.[18] One study found that patients with higher glucose concentrations had a 3.6 fold (95% CI 1.4 to 8.9) higher risk of death in ICU and significantly longer length of ICU stay.[19]

Expansion of this study would be worthwhile to strengthen the data and validity of the research. Continued research should be conducted to determine if low serum prealbumin levels result in decreased appetite post-surgery. If this research demonstrated a strong link between presurgery prealbumin levels of hip-replacement surgery patients and post-surgery nutrient intake, then the study should be expanded to evaluate all elderly patients undergoing surgical procedures. Future research should also include studies that implement alternative nutrition support prior to surgery for patients with depleted prealbumin levels who are unable to sustain nutritional needs through oral intake. By providing nutrition support prior to surgery, either parenterally or enterally, clinicians would be better able to measure clinical outcomes among this population by ensuring nutritional needs are being met.

Implications for Future Research

Although not a purpose of the study, poor blood glucose control appeared to have impacted length of hospital stay. Patients with elevated SG levels (≥111 mg/dL) tended to stay in the hospital longer than those with normal (<110 mg/dL) SG levels. Observations related to blood sugar control and length of stay of the patient in hospital settings has been documented in numerous studies (Appendix C).[18] It was further noted that patients admitted to the hospital with decubitus ulcers tended to have a longer length of stay in the hospital, and although not statistically significant, patients with decubitus ulcers in this study tended to have lower pre-surgery serum prealbumin levels (Appendix D).

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APPENDIX A

Data Collection Sheet: Hip Fracture Patients

Sex: Male Female Age: _____

Admit Date: _____ Discharge Date (acute): _____ LOS (acute): _____

SNU transfer? Y N Discharge Date (SNU): _____ Total LOS: _____

Hip Fracture Surgery: Elective Non-elective

Pertinent PMH: _____

Skin integrity: Intact Decubitus Ulcer Stage/ Location: _____

Infection/Sepsis documented: Y N Source of infection: _____

Good Blood Glucose Control (<140 mg/dl): Y N

If no, intervention: _____

PAB: _____ WNL Mild Moderate Severe

Suspect PAB skewed? Y N If yes, reason: _____

Diet Order: _____

Nutrition Intervention (if applicable):

Oral Supplement TF TPN Texture Change Other: _____

Average daily p.o. intake after surgery:

<25% 25-50% 50-75% 75-100% Decreased appetite: Y N

Anthropometrical Data: Ht: _____ Wt: _____ %IBW: _____

LAB DATA PRIOR TO SURGERY DATE:	LAB DATA S/P SURGERY DATE:
GLU _____ mg/dL BUN _____ mg/dL CR _____ mg/dL NA _____ mEq/L K _____ mEq/L HGB _____ g/dL HCT _____ % ALB _____ g/dL WBC _____ µL OTHER: _____ _____ _____	GLU _____ mg/dL BUN _____ mg/dL CR _____ mg/dL NA _____ mEq/L K _____ mEq/L HGB _____ g/dL HCT _____ % ALB _____ g/dL WBC _____ µL OTHER: _____ _____ _____

APPENDIX B

Subjects Prealbumin Level at Admission and Length of Stay (LOS)		
Subject	Prealbumin (mg/dL)	LOS (Days)
1	16	14
2	24	10
3	22	7
4	16	15
5	21	6
6	17	3
7	17	13
8	17	16
9	21	6
10	20	6
11	19	18
12	26	22
13	20	3
14	22	17
15	25	13
16	14	13
17	15	10
18	21	7
19	21	11
20	28	26
21	11	18
22	13	3
23	36	31
23	33	10
25	13	19
26	17	7
27	15	9

28	7	5
29	16	18
30	27	5
31	21	18
32	22	25
33	18	20
34	20	6
35	15	11
36	28	14
37	*	15
38	26	10
39	20	3
40	18	16
41	28	14
42	32	13
43	20	21
44	18	7
45	22	16
46	24	7
47	28	8
48	33	12
49	8	13
50	14	9
51	18	26
52	26	2
53	27	8
54	26	23
55	21	15

APPENDIX C

Impact of Presurgery Serum Glucose on Length of Stay in the Hospital for Hip Replacement Patients.

Glucose Level (mg/dL)[a]	Number of patients	Length of stay (days)	St Dev
≤ 110	16	7.75[b]	4.81
111 - 140	25	14.60[c]	6.88
141 - 180	10	13.70[c]	5.56
≥ 181	4	16.75[c]	6.92

[a] Presurgery serum glucose levels

[b,c]Means with different superscript are different (p≤ .004)

APPENDIX D

Impact of the Presence of Decubitus Ulcers at Admission to the Hospital on Length of Stay Post-Hip Replacement Surgery

Decubitus ulcer	Number of patients	Length of stay (days)	St Dev
Present	14	15.57[a]	7.62
Absent	41	11.59[b]	6.16

[a,b]Means with different superscript are different ($p \leq 0.054$)

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