International Journal Dental and Medical Sciences Research
Volume 3, Issue 5, Sep-Oct 2021 pp 784-790 www.ijdmsrjournal.com ISSN: 2582-6018

Role of Serum Albumin in Pre Operatively Determining Post Operative Morbidity and Mortality

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Submitted: 30-09-2021 Revised: 05-10-2021 Accepted: 08-10-2021

ABSTRACT
Background: Hypoalbuminemia has been shown to be associated with increased mortality and morbidity rates in both hospitalized patients. In this study we aim to study the role Serum Albumin in pre operatively determining post operative morbidity and mortality. Also, to establish the association between pre-operative serum albumin and surgical outcome and to test the validity and clinical applicability of this investigation in predicting operative risk in a series of patients undergoing major surgical procedures. **Methods:** The present study is a retrospective observational case control study comprising of 100 patients. The 50 patients who developed post operative complications within 30 days of the procedure comprise the case study groups, rest 50 form the control group. To see the association between the variables (risk predictors) and the presence of post operative complications, P value is calculated to determine statistical significance. **Results:** Association of serum albumin with post operative complications is statistically significant (p value <0.05). Albumin level was found to be a stronger predictor of morbidity and mortality for surgery as compared to other variables. The mean hospital stay was found to be 8.19 days in patients with hypoalbuminemia as compared to patients with normal serum albumin in which the mean hospital stay is 6.94. **Conclusion**: Pre-operative hypoalbuminemia can be used as both an independent predictive factor for post-operative complications and as prognostic parameter regarding overall survival in post operative period and prolonged hospital stay.

Keywords: Preoperative, Serum Albumin, Post operative Mortality, Morbidity

I. INTRODUCTION

Risk has always followed surgery but its prediction has been more recent. Surgical decision-making has evolved over time from what was once little more than personal experience and intuition. Malnourished patients are at higher risk of postoperative complications and death, if compared to well-nourished patients submitted to similar surgeries. Nutritional assessment is essential for identifying patients who are at an increased risk of developing post-operative complications. A variety of nutritional indices have been found to be valuable in predicting patient outcome.

Albumin is a better prognostic indicator than anthropomorphic markers of nutritional status because of its ability to detect protein-energy malnutrition, which is not necessarily accompanied by lower body weight and may not be clinically recognizable, but is associated with significantly increased risk of morbidity and mortality. (Reference range of serum albumin is 3.5 – 5.0g/dL).

Hypoalbuminemia has been shown to be associated with increased mortality and morbidity rates in both hospitalized patients[1-4] and samples of community-dwelling elderly persons.[5,6] In surgery, an association between hypoalbuminemia and adverse outcome has been recognized for many years.

In an early series of 26 patients, most operated on for diseases of the digestive tract, Jones and Eaton[7] found that postoperative edema was associated with low concentrations of serum albumin and serum protein, which they attributed to preoperative and postoperative undernutrition.

Reinhardt et al. [3] reviewed the hospital courses of 2060 veterans and found the 30 day mortality in 1551 patients with a normal serum albumin concentration to be 1.7 percent. In contrast, in 509 patients with serum albumin concentrations less than 3.5 g/100 ml, a death rate of 24.6 percent was found. A linear relationship between the degree of hypoalbuminemia and hospital mortality was found.

Even when patients are segregated by type of surgery or stress, albumin remains a strong predictor of outcome. Rich et al[4] found that patients undergoing cardiac surgery who had lower serum

International Journal Dental and Medical Sciences Research
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albumin levels showed a trend toward having higher postoperative mortality rates and had significantly higher rates of several complications than did patients with higher serum albumin levels, while controlling for other risk factors. Patients with hypoalbuminemia experienced a higher frequency of infective endocarditis, emergency surgery, transfusion of red blood cells, platelets and fresh frozen plasma, post-operative placement of intra-aortic balloon pumps, and gastrointestinal dysfunction, as well as significantly longer lengths of hospital stays, compared to patients with normal serum albumin.

Serum albumin level less than 3 g/dl was associated with increased post-operative morbidity and mortality according to studies done by Leite et al, Golub et al, Brown et al and Mullen et al. [8]According to Foley et al post-operative complication rate was higher when albumin was lower than 2.5 g/dl ($p<0.001$) According to Beghetto et al it was concluded that serum albumin level was the strongest predictive parameter for death and hospital infection (<3.5g/dl).

Engelman et al observed that albumin less than 2.5 g/dl ($p<0.001$) and BMI less than 20kg/m2 ($p<0.005$) and greater than 30 kg/ m2 ($p <0.005$) was associated with increase in post-operative complications.

The prognostic value of serum albumin also extends to critically ill patients. A low serum albumin concentration correlates with increased length of stay in the intensive care unit (ICU) and with complication rates, such as ventilator dependency and the development of new infection. The daily trend of serum albumin can be a useful tool in predicting the weaning capability of patients needing mechanical ventilation. Non-survivors of critical illness have lower serum albumin concentrations than survivors, In one study, non-survivors had lower serum albumin concentrations on admission to the ICU, and their albumin concentrations decreased more rapidly in the first 24±48 h.

II. MATERIAL AND METHODS

Sample size: The present study is a retrospective observational case control study comprising of 100 patients. 50 cases and 50 control. All patients undergoing major clean surgical procedures – General Surgery, Oncosurgery, Neurosurgery, Urosurgery, Plastic Surgery, Cardio thoracic Surgery in a tertiary care hospital were included in the study with their due consent for participation in the study. The 50 patients who developed post operative complications within 30 days of the procedure comprise the case study groups, rest 50 form the control group comprising of the patients undergoing the above mentioned procedures but not developing complications.

Method of collection

Inclusion criteria:

1. All patients undergoing major clean surgical procedures (ASA I-V) – General Surgery, Oncosurgery, Neurosurgery, Urosurgery, Plastic Surgery, Cardio thoracic Surgery.
2. >12 years and < 70 years of age.
3. Serum Albumin levels measured not more than 30 days before surgery.
4. No history of previous surgery in last 1 year.

Rigid objective criteria to define morbidity:

- Septicemia- positive blood culture associated with hypotension and hypoperfusion.
- Acute Kidney Injury- Proven by renal function tests.
- Intraabdominal sepsis- Intraabdominal purulent collection proved by imaging techniques
- Fistulas – Radiographically documented or through drain fluid observation
- UTI- quantitative culture of greater than 10 ^5 organisms/ml
- Wound infection- presence of discharge from the surgical site.
- Wound dehiscence- parting of the layers of the surgical wound
- Burst abdomen- all the layers split open with the protrusion of the viscera
- DIC- prolonged PT/aPTT with thrombocytopenia and raised fibrinogen and d dimer level in blood
- Ventilatory assisstance for more than 24 hours after the surgery.
- Shock- hypotension, hypoperfusion and treatment with systemic vasopressor and ionotropic agents
- CCF- requires treatment with digitalis and diuretics.

Exclusion criteria:

1.Loss of weight of more than 10 kgs in 6 months prior to surgery.
2.Surgeries with infective etiology.
3.HIV positive patients
4.Taking steroids
5.History of recent radiotherapy
6.Patients with liver disease/ nephrotic syndrome/ CCF/ IHD/ chronic respiratory disease.

The patients who fall under the criteria defining morbidity or had mortality, were included in the case group. The control group included patients falling the inclusion criteria but had not developed complications.

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A statistical analysis of the pre operative data as a part of pre anesthesia checkup was done.
All the significant pre operative parameters and post operative complications were documented in the proforma. The data was compiled and tabulated to determine the association between the variables (risk predictors) and the presence of complications. P value was calculated to evaluate serum albumin level as a predictor of operative mortality and morbidity in relation to two other variables which are established predictors of post op complications, i.e. ASA grade and hematocrit .

III. OBSERVATIONS AND RESULTS

Total 100 patients are there in the study group. Out of which, 50 patients who developed post operative complications, are in the case group and 50 patients who did not develop complications, were included in the control group.
Out of 100 patients, there were 48 female and 52 male patients.
The mean age group in case study group is 48.24 years with standard deviation of 15.715 years.
The mean age group in control group is 48.28 years with standard deviation of 17.075 years.

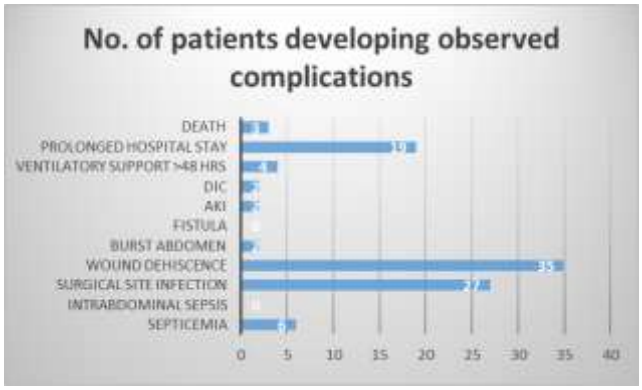

FIGURE 1- Chart depicting various complications along with their frequency in case study group

Figure 1 shows the number of patients developing various post op complications. There was incidence of more than 1 complication in a single patient.

Figure 2 depicts that the highest frequency of incidence of complications is- wound dehisence, surgical site infections, prolonged hospital stay and septicemia.

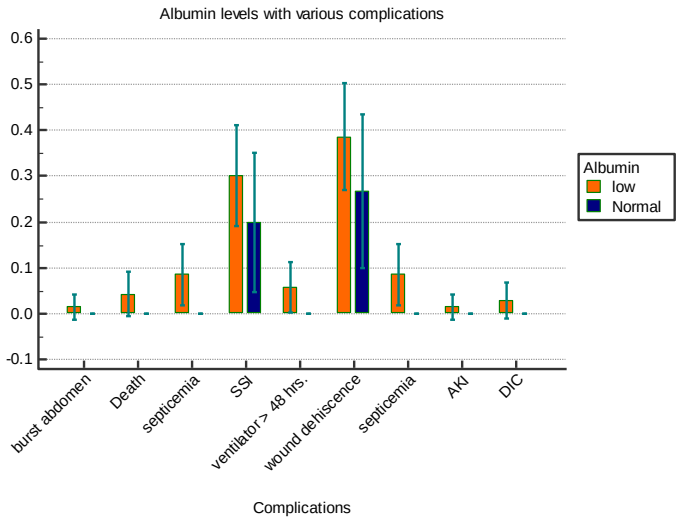

Figure 2. Albumin levels in various complications

This graph shows contribution of low albumin in development of various complications. There is higher incidence of hypoalbuminemia in the patients developing complications as compared to normal albumin levels.

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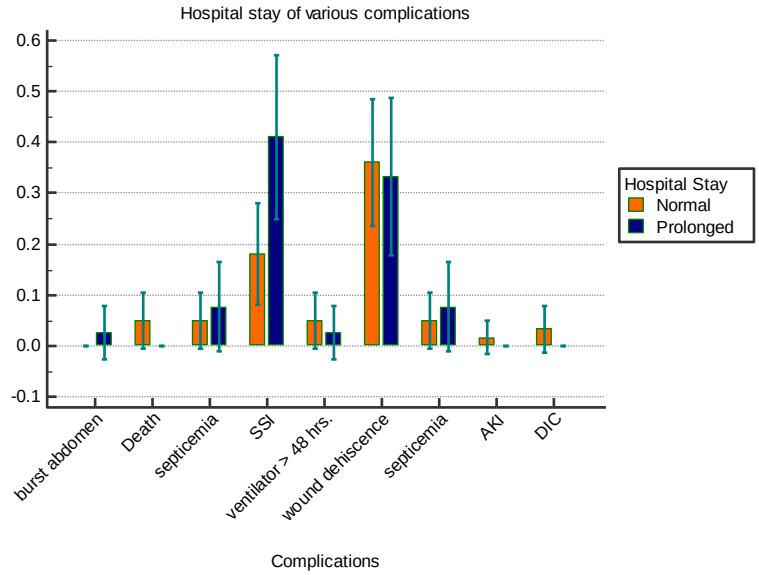

Figure 3. Duration of hospital stay in various complications.

Figure 3 shows the affect of complications on hospital stay. In case of septicemia and SSI, there is very evident increase in the duration of hospital stay.

All these charts depict that the presence of these risk factors have affected the surgical outcome, with clear evidence of presence of hypoalbuminemia in the patients developing complications.

STATISTICAL SIGNIFICANCE USING PEARSON CHI SQUARE TEST

TABLE 1

Association of albumin with complications					
			Albumin range group		**Total**
			High	**Low**	
group	**Case**	**Count**	**11**	**39**	**50**
		% of Total	**11.0%**	**39.0%**	**50.0%**
	Control	**Count**	**25**	**25**	**50**
		% of Total	**25.0%**	**25.0%**	**50.0%**
Total		**Count**	**36**	**64**	**100**
		% of Total	**36.0%**	**64.0%**	**100.0%**
Chi-Square Test					
	Value	**df**	**P value**		

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Pearson Chi-Square	**8.507[a]**	**1**	**.004**

P value for serum albumin levels for cases and control is 0.004 which is suggestive of stastical relation between serum albumin and adverse surgical outcomes as p value <0.05 is stastically significant.

T test for comparision of p-values

TABLE 2

Comparison							
	group	**N**	**Mean**	**SD**	**t value**	**df**	**P value**
Serum albumin	**Case**	**50**	**3.128**	**.5131**	**3.965**	**98**	**<0.001**
	Control	**50**	**3.434**	**.1858**			
Hematocrit value	**Case**	**50**	**35.774**	**4.9862**	**0.910**	**98**	**0.365**
	Control	**50**	**35.088**	**1.8828**			
Days of hospital stay	**Case**	**50**	**8.00**	**2.330**	**0.990**	**98**	**0.325**
	Control	**50**	**7.48**	**2.894**			

This analysis using t test on independent variables confirms the previous tests in which the p values were calculated and the comparative chart depicts strong association of serum albumin as risk predictor.

IV. DISCUSSION

Surgical decision-making has evolved over time from what was once little more than personal experience and intuition. However, in some situations this may become so complex that the decision-making process itself can be as challenging as the technical aspects of the surgery. All surgical procedures have complications, which may be considered to be a necessary occupational risk for surgeons. By surgical risk, we mean the risk of major morbidity and mortality to the patient in the perioperative period. Yet risk to both the patient and surgeon is relative.

Role of nutrition in surgical outcome

Nutritional assessment is essential for identifying patients who are at an increased risk of developing post-operative complications. A variety of nutritional indices have been found to be valuable in predicting patient outcome. In our study preoperative serum albumin was used as nutritional assessment as serum albumin is a better indicator of nutritional assessment as compared to other anthropometric parameters.

Since organic defense decrease and malnutrition were recognized as potential factors for higher morbidity and mortality rates in the postoperative period, many studies have dealt with the early detection of immunosuppression and malnourishment in surgical patients.[6, 7]Malnourished patients are at higher risk of postoperative complications and death, if compared to well-nourished patients submitted to similar surgeries. Besides, nutrition therapy has improved clinical prognosis and quality of life.[8]

Role of serum albumin as risk predictor

In the present study it is very clear that the serum albumin reflects the outcome of the surgery.

In the present study, out of total 50 patients who developed complications, 39 had low albumin <3.5gm/dl while 11 patients had albumin value normal >3.5gm/dl as shown in figure 1.

As tabulated in figure 2 which shows the frequency of various complications, wound dehiscence and surgical site infection were the most common complications.

Pearson chi square test in table 1 shows that there was evidence of stastical significance in association of serum albumin with surgical complications. (p value =0.004).

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Table 5: Reference range of serum albumin in other studies mentioned earlier and the association of hypoalbuminemia with adverse surgical outcome

Study name	Sr albumin(gm/dl) associated with increased complications	p value
Gibbs et al	<2.1	<0.001
Beghetto et al	< 3.5	< 0.05
Leite et al	< 3	< 0.05
Brown et al	< 3	< 0.05
Engelman et al	< 2.5	< 0.001
Foley et al	< 2.5	< 0.001
This study	< 3.5	< 0.01

The duration of hospital stay also depends on the presence or absence of complications which in turn is influenced by pre op risk factors. A detailed analysis of association of the risk predictors with duration of hospital stay is suggestive of association of serum albumin with the duration of stay. The mean stay was found to be 8.19 days in patients with hypoalbuminemia as compared to patients with normal serum albumin in which the mean hospital stay is 6.94.The p value was calculated to be 0.022 which is statistically significant.

Albumin is no doubt the healer protein of the body. As the albumin level decreases the complications faced by the patients drastically increases.

V. CONCLUSION

Pre-operative assessment of seum albumin can be used both as a predictive factor for post operative morbidity and mortality and as prognostic parameter regarding overall survival in post operative period.

There is strong evidence of serum albumin in association with post-operative complications including surgical site infections, wound dehiscence, septicemia, prolonged hospital stay and even death in absence of any pre operative sepsis or any existing co morbidities.

There is a role of pre operative hematocrit as a risk predictor of surgical outcome, however no such association was found between pre op ASA grades and surgical outcome.

Significant association between serum albumin and prolonged hospital stay lays the impetus on identifying the risk predictors as prolonged hospital stay Identification of this risk factor will enables us to plan and provide appropriate perioperative care for individual patients. Cost considerations are reasons for preferring a shorter postoperative stay.

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