RESEARCH PAPER

Association of Preoperative Serum Albumin Levels with Postoperative Surgical Complication among Patients

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ABSTRACT

INTRODUCTION: The presence of hypoalbuminemia is notably correlated with elevated morbidity and mortality in patients undergoing surgery, as it contributes to an increase in postoperative complications.

OBJECTIVE: To determine the association of preoperative serum albumin levels with postoperative surgical complications among patients

MATERIALS AND METHODS

Study Design & Settings: Present prospective cohort study was conducted at Surgical Department Bolan Medical College/SPH, Quetta, from 14th October 2025 to 15th April 2026.

Methods: A total of one hundred thirty-four patients were selected using a consecutive sampling technique and categorized into two groups: hypoalbuminemia and normal albumin levels. A comprehensive medical history was collected for each patient, followed by clinical assessments and blood sample collection for serum albumin prior to surgery. Postoperative complications were evaluated through physical examinations, abdominal ultrasounds, and computed tomography scans.

RESULTS

Out of one hundred thirty-four patients, 58.2% and 53.7% patients were male and 41.8% and 46.3% were female with mean age of 42.4±11.1 and 41.9±11.6 years in hypoalbumenia and normal albumin group respectively. Postoperative complication were present in 49.3% and 10.4% patients including surgical site infection 31.3% and 4.5%, anastomotic leak 22.4% and 3%, gastrointestinal fistula 10.4% and 1.5%, prolonged ileus 19.4% and 1.5% and burst abdomen 7.5% and 0.0% in hypoalbumenia and normal albumin group respectively.

CONCLUSION

Low serum albumin levels before surgery are significantly correlated with a higher incidence of postoperative complications in patients

Key Words: Hypoalbumenia, morbidity, mortality, hypoalbuminemia.

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INTRODUCTION

It is estimated that around 313 million surgical procedures are performed globally each year. [1]. The American College of Surgeons (ACS) National Surgical Quality Improvement Program (NSQIP) dataset indicates that postoperative complications occur in about 13% of patients, with an all-cause mortality rate of 1.4% within 30 days following surgery. These complications encompass infections, cardiac issues, bleeding, renal problems, pulmonary complications, venous thromboembolism, neurological issues, and ultimately, death. [2]. These complications also lead to various impacts on patients, including extended hospital stays, diminished quality of life (QOL), and increased healthcare costs associated with hospitalization. [3-5] Mortality rates differ among patient populations, influenced by individual patient characteristics, the nature and urgency of the surgical procedure performed, and the quality of care provided. Identifying patients at higher risk for complications before surgery may enhance surgical outcomes.[6]

Preoperatively identifying patients who may have higher risks of complications may improve surgical care [7]. Presently, preoperative risk assessment of postoperative complications is typically based on some general tests and scores. There are various preoperative assessment protocols available to identify patients with risk of operative mortality, morbidity with specific outcomes, such as respiratory failure, wound infection or sepsis etc. [8]

Modifiable factors such as nutritional status of patient are associated with postoperative outcomes in surgical procedures. Nutritional assessment is

essential for identifying patients who are at risk of developing complications related to significant malnutrition. Low preoperative serum albumin, in particular, as a surrogate marker for nutrition status, is a strong predictor of postoperative morbidity and mortality for procedures in multiple surgical disciplines [9-12].

Decrease serum albumin level preoperatively which is a risk factor for surgical complications is associated with raised hospital cost, prolong length of hospital stay, increased burden on family and impaired quality of life. One of the best biochemical parameters to assess nutritional status is estimating the serum albumin level and it is the simple and cost-effective method. Albumin is a direct measure of nutritional and immunological status and one of the essential components in wound healing process [13-15]. Different studies reported the relationship of preoperative serum albumin levels with postoperative surgical complications, such as Bhuyan K, et al. reported the hypoalbumenia in 77 (70%) patients, and normal albumin in 33 (30.0%) patients. Postoperative complication was reported in 45.5% hypoalbumenia and 5.5% normal albumin patients and mortality in 18.0% hypoalbumenia and 3.0% normal albumin patients. Most common postoperative complication in hypoalbumenia and normal albumin patients was skin and soft tissue infections 36.0% and 15.0%, followed by respiratory tract infections 25.0% and 6.0% and fistula 2.6% and 0.0% [14]. Another study by Kumar S, et al. reported the hypoalbumenia in 120 patients (63.1%) patients, and normal albumin in 70 (36.9%) patients. Postoperative complication was reported in 45.8% hypoalbumenia and 3.1%normal albumin patients and mortality in 14.2% hypoalbumenia and 0.0% normal albumin patients. Most common postoperative complication was surgical site infection 59.1%, followed by anastomotic leak 28%, gastrointestinal fistula 5.4%, prolonged ileus 4.3%, and burst abdomen 3.2% [15].

Methodology:

This research was conducted with the approval of Bolan Medical College/SPH Quetta, and written informed consent was obtained from patients meeting the inclusion criteria. Patients who met these criteria were categorized into two groups: the Exposed group (hypoalbuminemia) and the Unexposed group (normal albumin levels). A comprehensive medical history for each patient, including their name, gender, and age, was collected. The weight and height of each patient were measured using a digital weighing scale and stadiometers. The Body Mass Index (BMI) for each patient was calculated using the aforementioned formula. Prior to surgery, blood samples were collected from each patient in a sterile environment and sent to the laboratory to confirm serum albumin levels. The surgical procedure was performed by a surgeon with a post-fellowship experience of five years or more. Following the surgery, each patient was monitored for postoperative complications as previously defined. Patients were followed for a period of 30 days to assess for complications such as surgical site infections, anastomotic leaks, gastrointestinal fistulas, prolonged ileus, and burst abdomen. Postoperative complications were evaluated according to operational definitions, and confirmation of these complications was achieved through physical examinations, abdominal ultrasounds, and CT scans.

Data was meticulously recorded in a proforma by the researcher. Analyses were performed using the Statistical Package for Social Sciences (SPSS), Version 22.

The mean and standard deviation were calculated for quantitative variables, including age, height, weight, BMI, monthly income, preoperative serum albumin levels (g/dL), and duration of the procedure. Frequency and percentages were calculated for qualitative variables such as gender, age categories (in years), place of residence, diagnosis, comorbidities (including diabetes mellitus, hypertension, and smoking), and postoperative complications (including surgical site infection, anastomotic leak, gastrointestinal fistula, prolonged ileus, and burst abdomen). The Chi-square test was employed to compare the two groups to evaluate the relationship between hypoalbuminemia and postoperative complications. Additionally, relative risk was assessed, with a relative risk greater than 1 deemed significant, and a p-value of 0.05 considered as the threshold for significance.

Result:

In current study one hundred and thirty four patients were included who fulfill the inclusion criteria of the study and divided into two groups i.e., Exposed group (hypoalbumenia) and Unexposed group (normal albumin).

Descriptive statistics were conducted for the continuous variable of age (in years), revealing a mean and standard deviation of 42.4 ± 11.1 (ranging from 19 to 60) for the hypoalbuminemia group and 41.9 ± 11.6 (ranging from 18 to 60) for the normal albumin group. Similarly, for the continuous variable of height (in meters), the mean and standard deviation were found to be 1.38 ± 0.27 (ranging from 0.93 to 1.61) for the hypoalbuminemia group and 1.26 ± 0.19 (ranging from 0.90 to 1.64) for the normal albumin group. Regarding weight (in kilograms), the mean and standard deviation were 58.5 ± 14.5 (ranging from 31 to 135) for the hypoalbuminemia group and 57.4 ± 13.5 (ranging from 30 to 115) for the normal albumin group. For the body mass index (BMI in Kg/m^2), the mean and standard deviation were 25.5 ± 5.2 (ranging from 16.5 to 34.5) for the hypoalbuminemia group and 25.8 ± 4.7 (ranging from 16.6 to 34.0) for the normal albumin group. The analysis of monthly income (in PKR) indicated a mean and standard deviation of 26000.0 ± 8000.0 (ranging from 12000 to 50000) for both the hypoalbuminemia and normal albumin groups. For serum albumin levels (in g/dL), the mean and

standard deviation were 2.7 ± 0.4 (ranging from 2.1 to 3.4) for the hypoalbuminemia group and 4.5 ± 0.6 (ranging from 3.6 to 5.4) for the normal albumin group. Lastly, the duration of the procedure (in minutes) had a mean and standard deviation of 83.7 ± 27.9 (ranging from 45.0 to 139.0) for the hypoalbuminemia group and 78.8 ± 27.0 (ranging from 45.0 to 137.0) for the normal albumin group. (In table 1)

Distribution of gender was done; in this study 39 (58.2%) and 36 (53.7%) patients were male and 28 (41.8%) and 31 (46.3%) were female in hypoalbumenia and normal albumin group respectively, age in groups was done; in this study enrolled patients were grouped as; in 18-30 years 10 (14.9%) and 12 (17.9%) patients, in 31-40 years 14 (20.9%) and 13 (19.4%) patients, in 41-50 years 27 (40.3%) and 26 (38.8%) patients and in 51-60 years 16 (23.9%) and 16 (23.9%) patients in hypoalbumenia and normal albumin group respectively, place of residence was done; in this study 41 (61.2%) and 37 (55.2%) patients were from urban place and 26 (38.8%) and 30 (44.8%) were from rural place in hypoalbumenia and normal albumin group respectively, socioeconomic status was done; in this study enrolled patients were grouped as; in lower class 34 (50.7%) and 33 (49.3%) patients, in middle class 26 (38.8%) and 28 (41.8%) patients and in higher class 7 (10.4%) and 6 (9%) patients in hypoalbumenia and normal albumin group respectively, BMI in groups was done; in this study enrolled patients were grouped as; in underweight 5 (7.5%) and 3 (4.5%) patients, in normal weight 26 (38.8%) and 21 (31.3%) patients, in overweight 21 (31.3%) and 29 (43.3%) patients and in obese 15 (22.4%) and 14 (20.9%) patients in hypoalbumenia and normal albumin group respectively, duration of procedure was done; in this study enrolled patients were grouped as; in ≤ 60 min 23 (34.3%) and 25 (37.3%) patients and in > 60 min 44 (65.7%) and 42 (62.7%) patients in hypoalbumenia and normal albumin group respectively, disease was done; in this study enrolled patients were suffering from; typhoid perforation in 35 (52.2%) and 30 (44.8%) patients and TB perforation in 32 (47.8%) and 37 (55.2%) patients in hypoalbumenia and normal albumin group respectively, DM was done; in this study DM was present in 11 (16.4%) and 13 (19.4%) patients and absent in 56 (83.6%) and 54 (80.6%) patients in hypoalbumenia and normal albumin group respectively, HTN was done; in this study HTN was present in 47 (70.1%) and 45 (67.2%) patients and absent in 20 (29.9%) and 22 (32.8%) patients in hypoalbumenia and normal albumin group respectively, smoking was done; in this study smoking was present in 21 (31.3%) and 20 (29.9%) patients and absent in 46 (68.7%) and 47 (70.1%) patients in hypoalbumenia and normal albumin group respectively., postoperative complication was done; in this study complications were present in 33 (49.3%) and 7 (10.4%) patients and absent in 34 (50.7%) and 60 (89.6%) patients in hypoalbumenia and normal albumin group respectively, surgical site infection was done; in this study surgical site infection was present in 21 (31.3%) and 3 (4.5%) patients and absent in 46 (68.7%) and 64 (95.5%) patients in hypoalbumenia and normal albumin group respectively.

Table 2 presents the distribution of anastomotic leaks; in this study, anastomotic leaks were observed in 15 patients (22.4%) and 2 patients (3%), while they were absent in 52 patients (77.6%) and 65 patients (97%) in the hypoalbuminemia and normal albumin groups, respectively. Additionally, gastrointestinal fistulas were noted; in this study, gastrointestinal fistulas occurred in 7 patients (10.4%) and 1 patient (1.5%), with absences recorded in 60 patients (89.6%) and 66 patients (98.5%) in the hypoalbuminemia and normal albumin groups, respectively. Prolonged ileus was also assessed; in this study, prolonged ileus was present in 13 patients (19.4%) and 1 patient (1.5%), while it was absent in 54 patients (80.6%) and 66 patients (98.5%) in the hypoalbuminemia and normal albumin groups, respectively. Lastly, burst abdomen occurrences were evaluated; in this study, burst abdomen was present in 7.5% of patients and absent in 92.5% of patients in the hypoalbuminemia group, while it was absent in 100.0% of patients in the normal albumin group.

Table No. 1: Descriptive Statistics of Continuous Variables (Age, Height, Weight (KG), BMI, Monthly Income (PKR), Serum Albumin (g/dL) and Duration of Procedure (min

Age	**Hypoalbumenia**	**Normal Albumin**
Mean ± Std. Deviation	42.4 ± 11.1	41.9 ± 11.6
Height		
Mean ± Std. Deviation	1.38 ± 0.27	1.26 ± 0.19
Weight (KG)		
Mean ± Std. Deviation	58.5 ± 14.5	57.5 ± 13.5
BMI		
Mean ± Std. Deviation	25.5 ± 5.2	25.8 ± 4.7
Monthly Income (PKR)		
Mean ± Std. Deviation	26000.0±8000.0	26000.0±8000.0
Serum Albumin (g/dL)		
Mean ± Std. Deviation	2.7 ± 0.4	4.5 ± 0.6
Duration of Procedure (min)		
Mean ± Std. Deviation	83.7 ± 27.9	78.8 ± 27.0

Table: 2 Distributions of Gender, Age in Groups, Place of Residence, Socioeconomic Status, BMI, Duration of Procedure, Diagnosis, DM, HIN, Smoking, Complications, Surgical Site Infection, Anastomotic Leak, Gastrointestinal Fistula, Prolonged Ileus, Burst Abdomen

Gender	Hypoalbumenia	Normal Albumin
Male	39 (58.2%)	36 (53.7%)

Female	28 (41.8%)	31 (46.3%)
Age in Groups (Years)		
18-30	10 (14.9%)	12 (17.9%)
31-40	14 (20.9%)	13 (19.4%)
41-50 27	(40.3%)	26 (38.8%)
51-60	16 (23.9%)	16 (23.9%)
Place of Residence		
Rural	41(61.2%)	37(55.2%)
Urban	26 (38.8%)	30(44.8%)
Socioeconomic Status		
Lower	34 (50.7%)	33 (49.3%)
Middle	26 (38.8%)	28 (41.8%)
Higher	7 (10.4%)	6 (9%)
BMI		
Underweight	5 (7.5%)	3 (4.5%)
Normal weight	26 (38.8%)	21 (31.3%)
Overweight	21 (31.3%)	29 (43.3%)
Obese	15 (22.4%)	14 (20.9%)
Duration of Procedure		
≤60 min	23 (34.3%)	25 (37.3%)
> 60 min	44 (65.7%)	42 (62.7%)
Diagnosis		
Typhoid Perforation	35 (52.2%)	30 (44.8%)
TB Perforation	32 (47.8%)	37 (55.2%)
DM		
Yes	11 (16.4%)	13 (19.4%)
No	56 (83.6%)	54 (80.6%)
HIN		
Yes	47 (70.1%)	45 (67.2%)
No	20 (29.9%)	22 (32.8%)
Smoking		
Yes	21 (31.3%)	20 (29.9%)
No	46 (68.7%)	47 (70.1%)
Complications		
Yes	33 (49.3%)	7 (10.4%)
No	34 (50.7%)	60 (89.6%)
Surgical Site Infection		
Yes	21 (31.3%)	03 (4.5%)
No	46 (68.7%)	64 (95.5%)
Anastomotic Leak		
Yes	**15 (22.4%)**	**2 (3%)**
No	**52 (77.6%)**	**65 (97%)**
Gastrointestinal Fistula		
Yes	**7 (10.4%)**	**1 (1.5%)**
No	**60 (89.6%)**	**66 (98.5%)**
Prolonged Ileus		
Yes	**13 (19.4%)**	**1 (1.5%)**
No	**54 (80.6%)**	**66 (98.5%)**
Burst Abdomen		
Yes	**5 (7.5%)**	**0 (0.0%)**
No	**62 (92.5%)**	**67 (100.0%)**

DISCUSSION

Laparotomy is a frequently performed abdominal surgical procedure, conducted either on an elective basis or as an emergency intervention. Albumin serves as the primary protein found in human plasma, accounting for roughly 60% of the total plasma protein content, with a normal serum concentration ranging from 3.5 to 5.0 g/dl. A serum level below 3.4 g/dl is classified as hypoalbuminemia. [16-18]. A reduced concentration of serum albumin in surgical patients heightens the likelihood of adverse outcomes, including elevated morbidity, complications, and in certain instances, mortality. Various studies indicate that achieving normal serum albumin levels prior to surgery could lead to improved postoperative results. [19-21].

Preoperative serum albumin is considered as a good predictor in predicting the postoperative surgical complications and outcomes, whereas local data is very much scared regarding association of preoperative serum albumin levels with postoperative surgical complications. Therefore, current study was designed in tertiary care hospital for predicting association of postoperative surgical complications with serum albumin.

In current study 134 patients were evaluated who fulfilled the inclusion criteria and equally distributed into hypoalbumenia and normal albumin group. Out of which male patients were 58.2% and 53.7% and female patients were 41.8% and 46.3%. Different other studies on preoperative serum albumin also reported the higher male patient undergoing surgery such as, Garg T, et al. reported the 77% and 65% male patients and 23% and 35% female patients [22]. Lalhruaizela S, et al.. reported the 64.7% and 35.3% female patients [23]. All similar studies are reporting that male patients are mostly suffering from disease that requires abdominal surgery.

In current study, majority of the patients with age of > 40 years were suffering from disease and undergoing laparotomy. Mean age of patients was 42.4 ± 11.1 (19-60) and 41.9 ± 11.6 (18-60) years in hypoalbumenia and normal albumin group respectively. Majority of the patients were in age group of 41-50 years with 40.3% and 38.8% patients, followed by 51-60 years with 23.9% and 23.9% patients, 31-40 years with 20.9% and 19.4% patients and 18-30 years with 14.9% and 17.9% patients in hypoalbumenia and normal albumin group respectively. Garg T, et al. reported the higher mean age of patients 73 and 67 years in hypoalbumenia and normal albumin group respectively [22]. Lalhruaizela S, et al.. reported also reported the higher mean age of patients i.e., 48.25 ± 15.16 years [23]. But all studies are reporting that elder patients are mostly affected with disease that requires abdominal surgery

In current study, postoperative complications were reported in 49.3% and 10.4% patients in hypoalbumenia and normal albumin group

respectively. Most commonly reported complication was surgical site infection in 31.3% and 4.5% patients, anastomotic leak in 22.4% and 3% patients, gastrointestinal fistula in 7 (10.4%) and 1 (1.5%) patients, prolonged ileus in 19.4% and 1.5% patients and burst abdomen in 5 (7.5%) and 0.0% patients in hypoalbumenia and normal albumin group respectively.

Different studies reported the relationship of preoperative serum albumin levels with postoperative surgical complications, such as Adogwa O, et al. reported the 35.7% hypoalbumenia patients and 11.7% normal albumin patients with postoperative complications [24]. Bhuyan K, et al. reported the postoperative complication in 45.5% hypoalbumenia and 5.5% normal albumin patients. Most common postoperative complication in hypoalbumenia and normal albumin patients was skin and soft tissue infections 36.0% and 15.0%, followed by respiratory tract infections 25.0% and 6.0% and fistula 2.6% and 0.0% [14].

Another study by Kumar S, et al. reported the postoperative complication in 45.8% hypoalbumenia and 3.1% normal albumin patients. Most common postoperative complication was surgical site infection 59.1%, followed by anastomotic leak 28%, gastrointestinal fistula 5.4%, prolonged ileus 4.3%, and burst abdomen 3.2% [15]. Most commonly reported postoperative surgical complication was surgical site infection followed by anastomotic leak, gastrointestinal fistula, prolonged ileus and burst abdomen.

CONCLUSION

Preoperative serum albumin is a good predictor of postoperative surgical complications. Preoperative hypoalbuminemia is directly and significantly associated with increased postoperative surgical complications among patients. Most commonly reported postoperative surgical complication was surgical site infection followed by anastomotic leak, gastrointestinal fistula, prolonged ileus and burst abdomen.

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