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Preoperative serum albumin levels among postoperative surgical complications with patients undergoing laparotomy at Bolan Medical College Quetta

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Abstract

Introduction: *Hypoalbumenia is significantly associated with increased morbidity and mortality in surgical patients due to increased postoperative surgical complications.*

OBJECTIVE: *To determine the connection of preoperative serum albumin levels among postoperative surgical complications with patients undergoing laparotomy at Bolan Medical College Quetta*

Methodology: *Prospective cohort study was conducted at surgical department Bolan Medical College Quetta, from December 2022 to December 2023. Total 134 patients selected by consecutive sampling technique were divided into two groups i.e., Exposed (hypoalbumenia) and unexposed group (normal albumin). Detailed medical history of each patient was obtained followed by clinical evaluation and blood sample collection before surgery for serum albumin. After surgery postoperative complications were confirmed through physical examination followed by abdominal ultrasound and computed tomography.*

Results: *Out of 134 patients, 39 (58.2%) and 36 (53.7%) patients were male and 28 (41.8%) and 31 (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 33 (49.3%) and 7 (10.4%) patients including surgical site infection 21 (31.3%) and 3 (4.5%), anastomotic leak 15 (22.4%) and 2 (3%), gastrointestinal fistula 7 (10.4%) and 1 (1.5%), prolonged ileus 13 (19.4%) and 1 (1.5%) and burst abdomen 5 (7.5%) and 0 (0.0%) in hypoalbumenia and normal albumin group respectively.*

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 undergoing laparotomy.*

Keywords: Hypoalbumenia, morbidity, mortality, hypoalbuminemia.

INTRODUCTION

It is estimated that approximately 313 million surgical procedures occur per year throughout the world [1]. According to American College of Surgeons (ACS) National Surgical Quality Improvement Program (NSQIP) dataset, postoperative complications from surgical procedures observed in approximately 13% of patients and all-cause

mortality in 1.4% of patients within 30 days after surgery. These complications include infectious, cardiac, bleeding, renal, pulmonary, venous thromboembolic, neurological, and finally death [2]. These complications also produce the number of impacts on patients, such as prolong hospital stay, decreased quality of life (QOL), and increased healthcare cost of hospitalization [3-5], whereas mortality varies between patient populations, depending on patient characteristics, the type and urgency of surgery undertaken, and the quality of care delivered [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].

A modifiable factor such as nutritional status of patient is 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].

The rationale of the study is preoperative identification of patients who may have higher risks of complications by detecting the level of serum albumin preoperatively and then its association with development of postoperative surgical complications. Local data is scarce regarding association of preoperative serum albumin levels with postoperative surgical complications. Therefore, current study helpful in determining the association of preoperative serum albumin levels with postoperative surgical complications. Preoperative serum albumin helpful in predicting the

postoperative surgical complications that can increase the early management and decrease the rate of morbidity and mortality.

METHODOLOGY:

Data Collection Procedure:

This study was performed after the permission of Research department of Bolan Medical College Quetta and written informed consent for the study was obtained from the patient who fulfill the inclusion criteria. Patients fulfilling the inclusion criteria were included in the study and divided into two groups i.e., Exposed group (hypoalbumenia) and Unexposed group (normal albumin). Detailed medical history of each patient including name, gender and age was obtained. Weight and height of each patient was measured by using digital weight machine and stadiometers. BMI of each patient was calculated by using above mentioned formula. Before surgery blood sample of each patient was collected in aseptic environment and sent to laboratory for confirmation of serum albumin level. Surgery was performed by surgeon with post-fellowship and experience of ≥ 5 years. After surgery each patient was evaluated for postoperative complications defined earlier. Each patient was followed for 30 days for postoperative complications i.e., surgical site infection, anastomotic leak, gastrointestinal fistula, prolonged ileus and burst abdomen. Postoperative complications were assessed as per operational definition. For confirmation of postoperative complication physical examination of each patient was performed along with abdominal ultrasound and CT scan. Data was recorded in proforma by researcher.
After collection of data the analyses was conducted by using Statistical Package for Social Science (SPSS) software, Version 22.

Mean and standard deviation was calculated for quantitative variables like age (years), height (m), weight (Kg), BMI (Kg/m^2), monthly income (PKR), preoperative serum albumin level (g/dL) and duration of procedure (mins). Frequency and percentages were computed for qualitative variables like gender, age in groups (years), place of residence, diagnosis, comorbids (Diabetes mellitus, hypertension and smoking) and postoperative complications (surgical site infection, anastomotic leak, gastrointestinal fistula, prolonged ileus and burst abdomen). Chi-square test was used to compare both groups in order to assess association between hypoalbuminemia and post-operative complications. Relative risk (RR) was also compare. RR > 1 was considered as significant. Effect modifier like gender, age in groups (years), BMI, place of residence, socioeconomic status, duration of procedure, diagnosis, comorbids (Diabetes mellitus, hypertension and smoking) and smoking were controlled through stratification. Post stratification chi-square test was used by taking p-value ≤ 0.05 as significant. RR was also be calculated to assess association.

RESULTS

In current study 134 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).

In table 1 descriptive statistics of continuous variable of age (in years) was done, where mean and standard deviation of age was 42.4 ± 11.1 (19-60) and 41.9 ± 11.6 (18-60) years in hypoalbumenia and normal albumin group respectively.

In table 2 descriptive statistics of continuous variable of height (in m) was done, where mean and standard deviation of height was 1.38 ± 0.27 (0.93-1.61) and 1.26 ± 0.19 (0.90-1.64) m in hypoalbumenia and normal albumin group respectively.

In table 3 descriptive statistics of continuous variable of weight (in Kg) was done, where mean and standard deviation of weight was 58.5 ± 14.5 (31 and 57.4 ± 13.5 (30-115) Kg in hypoalbumenia and normal albumin group respectively.

In table 4 descriptive statistics of continuous variable of BMI (Kg/m^2) was done, where mean and standard deviation of BMI was 25.5 ± 5.2 (16.5-34.5) and 25.8 ± 4.7 (16.6-34.0) Kg/m^2 in hypoalbumenia and normal albumin group respectively.

In table 5 descriptive statistics of continuous variable of monthly income (in PKR) was done, where mean and standard deviation of monthly income was 26000.0 ± 8000.0 (12000-50000) and 26000.0 ± 8000.0 (12000-50000) PKR in hypoalbumenia and normal albumin group respectively.

In table 6 descriptive statistics of continuous variable of serum albumin (in g/dL) was done, where mean and standard deviation of serum albumin was 2.7 ± 0.4 (2.1-3.4) and 4.5 ± 0.6 (3.6-5.4) g/dL in hypoalbumenia and normal albumin group respectively.

In table 7 descriptive statistics of continuous variable of duration of procedure (in min) was done, where mean and standard deviation of duration of procedure was 83.7 ± 27.9 (45.0-139.0) and 78.8 ± 27.0 (45.0-137.0) min in hypoalbumenia and normal albumin group respectively.

In table 8 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.

In table 9 distribution of 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.

In table 10 distribution of 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.

In table 11 distribution of 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.

In table 12 distribution of 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.

In table 13 distribution of 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.

In table 14 distribution of 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.

In table 15 distribution of 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.

In table 16 distribution of 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.

In table 17 distribution of 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.

Table: 1 DESCRIPTIVE STATISTICS OF CONTINUOUS VARIABLE (AGE) (n=134)

Age	Hypoalbumenia	Normal Albumin
N	67	67
Min.	19	18
Max.	60	60
Mean	42.4	41.9
Std. Deviation	11.1	11.6

Table: 2 DESCRIPTIVE STATISTICS OF CONTINUOUS VARIABLE (HEIGHT) (n=134)

Height (m)	Hypoalbumenia	Normal Albumin
N	67	67
Min.	0.93	0.90
Max.	1.61	1.64
Mean	1.38	1.26
Std. Deviation	0.27	0.19

Table: 3 DESCRIPTIVE STATISTICS OF CONTINUOUS VARIABLE (WEIGHT) (n=134)

Weight (Kg)	Hypoalbumenia	Normal Albumin
N	67	67
Min.	31	30
Max.	135	115
Mean	58.5	57.4
Std. Deviation	14.5	13.5

Table: 4 DESCRIPTIVE STATISTICS OF CONTINUOUS VARIABLE (BMI) (n=134)

BMI (Kg/m^2)	Hypoalbumenia	Normal Albumin
N	67	67
Min.	16.5	16.6
Max.	34.5	34.0
Mean	25.5	25.8
Std. Deviation	5.2	4.7

Table: 5 DESCRIPTIVE STATISTICS OF CONTINUOUS VARIABLE (MONTHLY INCOME) (n=134)

Monthly Income (PKR)	Hypoalbumenia	Normal Albumin
N	67	67
Min.	12000	12000
Max.	50000	50000
Mean	26000.0	26000.0
Std. Deviation	8000.0	8000.0

Table: 6 DESCRIPTIVE STATISTICS OF CONTINUOUS VARIABLE (SERUM ALBUMIN) (n=134)

Serum Albumin (g/dL)	Hypoalbumenia	Normal Albumin
N	67	67
Min.	2.1	3.6
Max.	3.4	5.4
Mean	2.7	4.5
Std. Deviation	0.4	0.6

Table: 7 DESCRIPTIVE STATISTICS OF CONTINUOUS VARIABLE (DURATION OF PROCEDURE) (n=134)

Duration of Procedure (min)	Hypoalbumenia	Normal Albumin
N	67	67
Min.	45.0	45.0
Max.	139.0	137.0
Mean	83.7	78.8
Std. Deviation	27.9	27.0

Table: 8 DISTRIBUTION OF GENDER (n=134)

Gender	Hypoalbumenia	Normal Albumin
Male	39 (58.2%)	36 (53.7%)
Female	28 (41.8%)	31 (46.3%)
Total	67 (100.0%)	67 (100.0%)

Table: 9 DISTRIBUTION OF AGE IN GROUPS (n=134)

Age in Groups (Years)	Hypoalbumenia	Normal Albumin
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%)
Total	67 (100.0%)	67 (100.0%)

Table: 10 DISTRIBUTION OF PLACE OF RESIDENCE (n=134)

Place of Residence	Hypoalbumenia	Normal Albumin
Rural	41 (61.2%)	37 (55.2%)
Urban	26 (38.8%)	30 (44.8%)
Total	67 (100.0%)	67 (100.0%)

Table: 11 DISTRIBUTION OF SOCIOECONOMIC STATUS (n=134)

Socioeconomic Status	Hypoalbumenia	Normal Albumin
Lower	34 (50.7%)	33 (49.3%)
Middle	26 (38.8%)	28 (41.8%)
Higher	7 (10.4%)	6 (9%)
Total	67 (100.0%)	67 (100.0%)

Table: 12 DISTRIBUTION OF BODY MASS INDEX (BMI) (n=134)

BMI	Hypoalbumenia		Normal Albumin	
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%)
Total	67 (100.0%)		67 (100.0%)	

Table: 13 DISTRIBUTION OF DURATION OF PROCEDURE (n=134)

Duration of Procedure	Hypoalbumenia	Normal Albumin
≤ 60 min	23 (34.3%)	25 (37.3%)
> 60 min	44 (65.7%)	42 (62.7%)
Total	67 (100.0%)	67 (100.0%)

Table: 14 DISTRIBUTION OF DIAGNOSIS (n=134)

Diagnosis	Hypoalbumenia	Normal Albumin
Typhoid Perforation	35 (52.2%)	30 (44.8%)
TB Perforation	32 (47.8%)	37 (55.2%)
Total	67 (100.0%)	67 (100.0%)

Table: 15 DISTRIBUTION OF DIABETES MELLITUS (DM) (n=134)

DM	Hypoalbumenia	Normal Albumin
Yes	11 (16.4%)	13 (19.4%)
No	56 (83.6%)	54 (80.6%)
Total	67 (100.0%)	67 (100.0%)

Table: 16 DISTRIBUTION OF HYPERTENSION (HTN) (n=134)

HTN	Hypoalbumenia	Normal Albumin
Yes	47 (70.1%)	45 (67.2%)
No	20 (29.9%)	22 (32.8%)
Total	67 (100.0%)	67 (100.0%)

Table: 17 DISTRIBUTION OF SMOKING (n=134)

Smoking	Hypoalbumenia	Normal Albumin
Yes	21 (31.3%)	20 (29.9%)
No	46 (68.7%)	47 (70.1%)
Total	67 (100.0%)	67 (100.0%)

DISCUSSION

Laparotomy is a most common abdominal surgery performed either as an elective or emergency surgery. Albumin is the major protein of human plasma. It constitutes approximately 60% of the total plasma protein and its normal serum concentration is 3.5–5.0 g/dl. A serum level of less than 3.4 g/dl is considered hypoalbuminemia [16-18]. Decreased level of serum albumin in patients undergoing surgery increases the risk of worse outcomes i.e., increased morbidity, complications and in some cases mortality. Different studies suggest that normalizing serum albumin before surgery may result in more favorable postoperative outcomes [19-20].

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 39 (58.2%) and 36 (53.7%) and female patients were 28 (41.8%) and 31 (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 [21]. Lalhruaizela S, et al.. reported the 64.7% and 35.3% female patients [22]. 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 (23-24) years in hypoalbumenia and normal albumin group respectively. Majority of the patients were in age group of 41-50 years with 27 (40.3%) and 26 (38.8%) patients, followed by 51-60 years with 16 (23.9%) and 16 (23.9%)

patients, 31-40 years with 14 (20.9%) and 13 (19.4%) patients and 18-30 years with 10 (14.9%) and 12 (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 [21]. Lalhruaizela S, et al.. reported also reported the higher mean age of patients i.e., 48.25 ± 15.16 years [22]. 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 33 (49.3%) and 7 (10.4%) patients in hypoalbumenia and normal albumin group respectively. Most commonly reported complication was surgical site infection in 21 (31.3%) and 3 (4.5%) patients, anastomotic leak in 15 (22.4%) and 2 (3%) patients, gastrointestinal fistula in 7 (10.4%) and 1 (1.5%) patients, prolonged ileus in 13 (19.4%) and 1 (1.5%) patients and burst abdomen in 5 (7.5%) and 0 (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 [25]. 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 undergoing laparotomy. 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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