Original Research Article

Correlation of serum albumin levels with early outcome and complications among gastric cancer surgery patients

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ABSTRACT

Background: Serum albumin, a marker of nutritional status, has been associated with surgical outcomes. This study evaluated the correlation between serum albumin levels and early postoperative complications in gastric cancer surgery patients.
Methods: A prospective cross-sectional observational study was conducted from July 2017 to March 2019 at the National Institute of Cancer Research and Hospital (NICRH), Dhaka. Forty patients with biopsy-proven operable gastric carcinoma were included using purposive sampling. Serum albumin levels were measured preoperatively and postoperatively, and complications were assessed. Data were analysed using SPSS version 22, with statistical significance set at $p < 0.05$.
Results: The mean preoperative serum albumin level was 3.8 ± 0.4 gm/dl, which significantly decreased to 3.3 ± 0.2 gm/dl postoperatively ($p < 0.05$). Postoperative hypoalbuminemia (<3.5 gm/dl) was observed in 52.5% of patients and was significantly associated with complications, including wound infections (38.1%), pneumonia (14.29%), urinary tract infections (28.57%), and duodenal sump leaks (9.52%). No complications were observed in patients with serum albumin levels ≥ 3.5 gm/dl ($p < 0.001$).
Conclusions: Serum albumin is a reliable predictor of postoperative complications in gastric cancer surgery. Maintaining adequate serum albumin levels through nutritional optimization can significantly reduce morbidity, especially in resource-constrained settings. These findings underscore the need for integrating serum albumin monitoring into routine perioperative care.

Keywords: Gastric cancer, Hypoalbuminemia, Nutritional status, Postoperative complications, Serum albumin, Surgical outcome

INTRODUCTION

Gastric cancer remains a significant global health burden, with nearly 1.09 million new cases and approximately 768,000 deaths reported annually, making it the fifth most common malignancy and the third leading cause of cancer-related mortality worldwide.[1] Its prevalence is disproportionately higher in East and Southeast Asia, with South Asia, including Bangladesh, witnessing a steady increase in incidence due to lifestyle changes, Helicobacter pylori infection, and limited access to early detection programs.[2,3] Despite advances in treatment modalities, including surgical interventions like gastrectomy, the prognosis of gastric cancer patients remains suboptimal, especially in low-resource settings like Bangladesh, where late-stage diagnoses are common.[4] These alarming statistics underline the urgent need for targeted interventions and research to improve outcomes in gastric cancer management. Surgical resection, particularly gastrectomy, remains the cornerstone of curative treatment for localized gastric cancer. However, the procedure is associated with significant postoperative morbidity and mortality, with complication rates ranging from 20% to 40% globally.[5,6] Complications such as surgical site infections, anastomotic leaks, and delayed wound healing substantially impact recovery and healthcare costs.[7,8] Identifying reliable predictors of surgical outcomes is critical for tailoring perioperative care and improving patient prognosis. Nutritional status, particularly serum albumin levels, has emerged as a key determinant of postoperative outcomes, given its pivotal role in wound healing, immune response modulation, and oncotic pressure maintenance.[9,10] Serum albumin, a protein synthesized by the liver, plays a crucial role in maintaining plasma oncotic pressure, transporting hormones and nutrients, and exerting antioxidant and anti-inflammatory effects.[9] Hypoalbuminemia, defined as serum albumin levels below 3.5 gm/dl, is a marker of malnutrition and a negative acute-phase reactant that signifies systemic inflammation.[11] Studies have consistently demonstrated that low preoperative serum albumin levels are associated with increased surgical risks, including prolonged hospital stays, delayed oral intake, and higher rates of wound complications and mortality.[10,12] For instance, a prospective study found that patients with hypoalbuminemia experienced significantly longer hospital stays and higher rates of surgical site infections compared to their normoalbuminemic counterparts.[11] Moreover, a perioperative cohort study in abdominal surgery revealed that a 15% reduction in serum albumin within the first two postoperative days strongly correlated with adverse outcomes, highlighting its utility as an early predictor of complications.[13] The correlation between serum albumin and surgical outcomes extends to oncological surgeries as well. In ovarian cancer patients undergoing cytoreductive surgery, preoperative hypoalbuminemia was associated with a 3.6-fold increase in severe complications and significantly reduced overall survival.[14] Similarly, a study in colorectal surgery identified early postoperative albumin decreases as a

sensitive marker for predicting complications and guiding safe patient discharge.[13] These findings underscore the clinical importance of serum albumin as a cost-effective and universally available prognostic marker that can inform perioperative strategies to mitigate risks and optimize recovery. In resource-constrained settings like Bangladesh, where nutritional deficits are prevalent, and healthcare infrastructure is limited, the relevance of serum albumin as a predictive biomarker becomes even more pronounced. Addressing hypoalbuminemia preoperatively through nutritional interventions and assessing its impact on outcomes can significantly improve the quality of care for gastric cancer patients. However, existing literature on this topic is primarily derived from high-income countries, with limited data from South Asia to reflect regional nuances in healthcare delivery and patient demographics.[3,4] This gap necessitates localized research to evaluate the applicability of serum albumin as a prognostic tool in Bangladeshi patients undergoing gastric cancer surgery. This study aimed to investigate the correlation between preoperative serum albumin levels and early postoperative outcomes in gastric cancer surgery patients in Bangladesh. By focusing on a population with unique dietary patterns, comorbid conditions, and healthcare challenges, this research seeks to provide evidence-based insights to inform clinical decision-making and improve perioperative management. The findings are expected to bridge existing knowledge gaps and contribute to the global discourse on optimizing surgical outcomes through nutritional assessment and intervention.

METHODS

This prospective cross-sectional observational study was conducted from July 2017 to March 2019 at the Department of Surgical Oncology, National Institute of Cancer Research and Hospital (NICRH), Mohakhali, Dhaka. Ethical clearance was obtained from the institutional review board (IRB) of NICRH, ensuring adherence to ethical standards. The study population included patients diagnosed with gastric carcinoma who were admitted to NICRH for operative treatment. A purposive, non-randomized sampling technique was employed to select a sample size of 40 patients.

Inclusion criteria encompassed patients with biopsy-proven operable gastric carcinoma who were willing to participate in the study, while exclusion criteria included patients with a history of another malignancy, prior gastric surgery, stage IV disease, those deemed unfit for surgery, and those unwilling to participate.

Patients presenting with primary gastric carcinoma were screened and selected based on these criteria, with the diagnosis confirmed through clinical, radiological, and histopathological evaluations. After obtaining informed consent, detailed patient histories and thorough physical examinations were conducted. Data were collected using a structured case record form, which included patient

interviews and clinical records. Surgical outcomes were assessed by evaluating postoperative complications and measuring serum albumin levels preoperatively and postoperatively. All collected data were meticulously compiled, sorted, and analysed using the Statistical Package for Social Sciences (SPSS) software version 22. Quantitative data were summarized as frequencies, percentages, and mean±standard deviation (SD), and statistical significance was set at $p < 0.05$. Continuous variables, such as serum albumin levels, were compared between preoperative and postoperative states using paired sample t-tests, while comparisons of proportions between groups were conducted using Z proportion tests.

RESULTS

The baseline characteristics of the study participants (n=40) revealed that the mean age was 65.16±10.28 years, with the majority of patients (32.5%) aged between 56 and 65 years, followed by 25% aged 66 to 75 years, 22.5% aged 76 to 80 years, and 20% aged 45 to 55 years. The sample predominantly consisted of males, accounting for 70% of the participants, while females made up 30%. Regarding body mass index (BMI), half of the participants (50%) fell within the normal range of 18.5-24.9 kg/m^2, 40% were overweight (BMI 25-30 kg/m^2), and 10% were classified as obese (BMI>30 kg/m^2), with a mean BMI of 24.15±3.30 kg/m^2.

Tabe 1: Distribution of baseline characteristics among the participants (n=40).

Baseline characteristics	Frequency	Percentage
Age (years)		
45-55	8	20.00
56-65	13	32.50
66-75	10	25.00
76-80	9	22.50
Mean±SD	65.16±10.28	
Sex		
Male	28	70.00
Female	12	30.00
BMI (kg/m^2)		
18.5-24.9	20	50.00
25-30	16	40.00
>30	4	10.00
Mean±SD	24.15±3.30	

Table 2: Distribution of participants by habitual risk factors (n=40).

Habitual risk factors	Frequency	Percentage
Smoking	28	70.00
Beetle leaf and nut consumption	36	90.00
Alcohol consumption	8	20.00

Among the participants (n=40), the majority (90%) reported consuming betel leaf and nut, while 70% were smokers. Alcohol consumption was less prevalent, with 20% of the participants reporting habitual use.

Table 3: Distribution of anatomical site of cancer (n=40).

Anatomical site	Frequency	Percentage
Proximal stomach	14	35.00
Distal stomach	26	65.00

The anatomical distribution of gastric cancer among the participants (n=40) showed that the majority (65%) had cancer in the distal stomach, while 35% had cancer in the proximal stomach.

Table 4: Distribution of type of surgery among the participants (n=40).

Type of surgery	Frequency	Percentage
Total gastrectomy	10	25.00
Lower radical gastrectomy	26	65.00
Upper radical gastrectomy	4	10.00

Regarding the types of surgery performed among the participants (n=40), the majority (65%) underwent lower radical gastrectomy, followed by 25% who had total gastrectomy. Upper radical gastrectomy was performed in 10% of the participants.

Table 5: Mean serum albumin level in patient with gastric carcinoma.

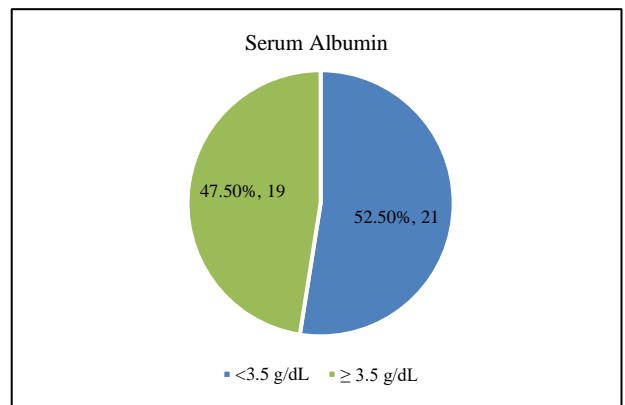| Variables	Mean±SD	P value
Pre-operative serum albumin level	3.8±0.4 gm/dl	<0.05
Post-operative serum albumin level	3.3±0.2 gm/dl	

Figure 1: Distribution of postoperative serum albumin level among participants (n=40).

The majority of participants (65%) underwent lower radical gastrectomy, followed by 25% who underwent total gastrectomy, and 10% who underwent upper radical gastrectomy. The mean preoperative serum albumin level was 3.8±0.4 gm/dl, which significantly decreased postoperatively to 3.3±0.2 gm/dl, with a p value of <0.05, indicating a statistically significant reduction in serum albumin levels after surgery.

Figure 1 illustrates the distribution of postoperative serum albumin levels among the participants (n=40). The majority of patients (52.5%) had postoperative serum albumin levels below 3.5 gm/dl, while 47.5% had levels equal to or greater than 3.5 gm/dl, indicating a substantial proportion of participants experiencing hypoalbuminemia post-surgery.

Table 6: Association of postoperative serum albumin and postoperative complication (n=40).

Variables	Serum albumin (gm/dl) ≥3.5 (n=19)		Serum albumin (gm/dl) <3.5 (n=21)		P value
	N	%	N	%	
Wound infection	0	0.00	8	38.10	<0.001
Pneumonia	0	0.00	3	14.29	<0.001
Peritonitis	0	0.00	2	9.52	<0.001
Urinary tract infection	0	0.00	6	28.57	<0.001
Duodenal sump leak	0	0.00	2	9.52	<0.001
No complication	19	100.00	0	0.00	<0.001

The association between postoperative serum albumin levels and postoperative complications among the participants (n=40) revealed significant differences. Patients with serum albumin levels <3.5 gm/dl experienced notably higher rates of complications, including wound infection (38.1%), pneumonia (14.29%), peritonitis (9.52%), urinary tract infection (28.57%), and duodenal sump leak (9.52%). In contrast, no complications were observed in patients with serum albumin levels ≥3.5 gm/dl. This difference was statistically significant for all complications, with a p value of <0.001. Additionally, 100% of patients with serum albumin levels ≥3.5 gm/dl had no postoperative complications, emphasizing the critical role of maintaining adequate serum albumin levels in reducing surgical risks.

DISCUSSION

This study aimed to evaluate the correlation between serum albumin levels and early postoperative complications in patients undergoing gastric cancer surgery. The findings revealed a statistically significant reduction in serum albumin levels postoperatively (from 3.8±0.4 gm/dl preoperatively to 3.3±0.2 gm/dl postoperatively, p<0.05). Additionally, postoperative hypoalbuminemia (<3.5 gm/dl) was strongly associated with an increased incidence of complications, including wound infections, pneumonia, peritonitis, urinary tract infections, and duodenal sump leaks, all of which were entirely absent in participants with serum albumin levels ≥3.5 gm/dl. This highlights the critical role of serum albumin as a predictor of surgical outcomes and emphasizes the importance of maintaining adequate nutritional status before and after surgery. The observed association between hypoalbuminemia and postoperative complications aligns with findings from previous studies. The study by Bhuiyan demonstrated that hypoalbuminemia (<30 gm/l) was a significant risk factor for both infectious and non-infectious complications in cancer patients undergoing surgery, underscoring the importance of serum albumin in predicting morbidity.[15] Similarly, Issangya et al reported that a perioperative decrease in serum albumin was an independent predictor of adverse outcomes, including surgical site infections and delayed wound healing.[12] These findings strongly support the observed outcomes in the current study, where hypoalbuminemic patients experienced significantly higher rates of complications. The role of serum albumin in maintaining plasma oncotic pressure and supporting immune function is well-documented. Munteanu et al emphasized that low perioperative albumin levels are closely associated with surgical stress and postoperative complications, including wound infections and anastomotic leaks.[16] This is consistent with the current study, where 38.1% of patients with hypoalbuminemia developed wound infections compared to none in the normoalbuminemic group. Furthermore, Kang et al highlighted that preoperative hypoalbuminemia (<3.5 gm/dl) is a strong predictor of severe postoperative complications, particularly in elderly gastric cancer patients.[17] These findings reinforce the critical threshold of 3.5 gm/dl for postoperative serum albumin, as observed in the present study. The complete absence of complications in patients with postoperative serum albumin levels ≥3.5 gm/dl in this study is particularly noteworthy. This aligns with Rohith et al, who found a significant reduction in surgical site infections and wound dehiscence in patients with albumin levels above this threshold.[18] Additionally, Dokcu and Çaparlar identified the c-reactive protein-to-albumin ratio as a predictor of postoperative complications, further emphasizing the role of serum albumin as a marker of surgical outcomes. Although previous studies have primarily focused on the predictive value of preoperative albumin levels, the current study highlights the importance of monitoring postoperative albumin levels as well. Munteanu et al and Issangya et al

both emphasized that postoperative decreases in albumin are indicative of surgical stress and inflammation, making it a useful marker for early detection of complications.[12,16] The findings of the present study strongly support these conclusions, as postoperative hypoalbuminemia was a reliable predictor of complications. The implications of these findings are particularly relevant in resource-constrained settings like Bangladesh, where nutritional deficiencies are prevalent. Bhuiyan emphasized the need for nutritional interventions in cancer patients with hypoalbuminemia to mitigate the risk of complications.[15] Similarly, Kang et al advocated for tailored perioperative care in hypoalbuminemic patients to improve outcomes.[17] The results of the current study underscore the importance of addressing nutritional deficits and maintaining adequate serum albumin levels in gastric cancer patients to reduce postoperative morbidity. In conclusion, this study reaffirms the critical role of serum albumin as a predictor of postoperative complications in gastric cancer surgery. The significant association between hypoalbuminemia and increased complication rates emphasizes the need for early nutritional assessment and intervention.

The findings are consistent with existing literature and highlight the potential of serum albumin as a cost-effective and widely available tool for risk stratification in surgical oncology. Future studies could explore the impact of targeted nutritional interventions on improving postoperative outcomes in hypoalbuminemic patients.

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

This study highlights the critical role of serum albumin levels in predicting postoperative complications in gastric cancer surgery patients. The significant reduction in serum albumin levels from preoperative to postoperative states underscores the physiological stress of surgery and its impact on nutritional status. The findings demonstrate that hypoalbuminemia (<3.5 gm/dl) is strongly associated with an increased risk of complications, including wound infections, pneumonia, and urinary tract infections, while patients with serum albumin levels ≥3.5 gm/dl were entirely free of complications. These results emphasize the importance of preoperative nutritional assessment and perioperative interventions aimed at maintaining adequate serum albumin levels to optimize surgical outcomes. Given the prevalence of malnutrition in resource-constrained settings like Bangladesh, integrating serum albumin monitoring into routine clinical practice could significantly improve postoperative care and reduce morbidity. Further research is warranted to explore targeted nutritional strategies and their impact on long-term outcomes in gastric cancer patients.

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Cite this article as: Shoaib TH, Biswas GC, Parveen SS, Prova MT, Haque ME, Fatema K, et al. Correlation of serum albumin levels with early outcome and complications among gastric cancer surgery patients. Int J Res Med Sci 2025;13:1039-44.