



Original Article

Association of Haemoglobin and Serum Albumin Level with Short Term Surgical Complications in Operable Gastric Cancer

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Abstract

Background: Gastric cancer is the fifth most common cause of cancer-related death in Bangladesh. Curative resection remains the main modality of its successful treatment but the rate of postoperative complications is still high. Besides surgical factors, patient's clinicopathological characteristics influence complications. This study was aimed to find out the association of the patients' haemoglobin and serum albumin levels with short-term surgical complications in operable gastric cancer.

Methodology: Following convenience sampling, 32 patients of operable gastric cancer who underwent gastrectomy in the Department of General Surgery, Bangabandhu Sheikh Mujib Medical University, from July 2019 to June 2020 were observed for their clinicopathological characteristics and postoperative complications. Data were analyzed with SPSS version 23 and Chi-square (χ^2) test was done to find out the association of complications with the patients' haemoglobin and serum albumin levels.

Result: Out of the 32 patients 12 (37.50%) patients developed complications. Thirty days mortality was 6.30%. Preoperative low Hb level (Male < 13 gm/dl & female < 11.50 gm/dl), low albumin level (< 3.50 gm/dl) and postoperative lowest Hb level (< 9 gm/dl) were significantly associated with complications (p-value 0.018, 0.003 and <0.001 respectively). In univariate regression analysis of different patient factors for developing complications BMI (<18.50 kg/m²), Preoperative Hb level (Male <13 and female <11.50), Postoperative lowest Hb level (<09 gm/dl), and preoperative serum albumin (<3.50gm/dl) had significant (p<0.05) association with complications but in multivariate regression analysis Postoperative lowest Hb level (<09 gm/dl) and S. Albumin level (<03.50 gm/dl) were found to be independently associated with complications (p<0.05).

Conclusion: Our patients are generally malnourished having low BMI along with low haemoglobin and serum albumin levels. As these factors lead to increased complications in gastrointestinal surgery, perioperative correction of low haemoglobin and serum albumin levels should be done adequately to reduce postoperative complications in patients with operable gastric cancer.

Key words: Haemoglobin and serum albumin level, short term surgical complications, operable gastric cancer.

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Introduction

Gastric cancer is the fifth most common malignancy worldwide and the third leading cause of cancer death¹. Although multi-modal therapy can improve survival of gastric cancer patients, surgery is generally considered as the only treatment modality that can cure it². But the incidence of complications following gastric cancer surgery is still unacceptably high at 17.9- 40.1%³. Patient's clinicopathological and intraoperative characteristics are associated with postoperative complications and complications following curative surgery for gastric cancer have a negative effect on overall and disease-specific survival⁴. Moreover postoperative complications are associated

with an increased length of hospitalization, economic cost, and hospital mortality^{5,6}. So, strategies to reduce postoperative complications for patients undergoing a potentially curative resection would be beneficial and interest should be focused on studies aimed at the evaluation of postoperative complications and mortality.

In an effort to observe the association of risk factors attributable to postoperative complications following gastric cancer surgery, many studies^{7,8} from abroad have been published. Unfortunately, very few studies in Bangladesh have observed the short term surgical complications following surgery in operable gastric cancer and none has observed their association with patient's clinicopathological factors. But knowing the incidence of complications following surgery enables surgeons a better basis for judging and improving their practice. Moreover identifying the association of patient factors with complications assists in clinical decision making regarding patient risk stratification, preparation, and timing of surgery or taking appropriate measures in the perioperative period. This is why this study was designed to observe the incidence of short term surgical complications and their association with patient's haemoglobin and serum albumin level in operable gastric cancer.

Patients and methods:

This prospective case series study was conducted in the Department of General Surgery, BSMMU over one year from July 2019- June 2020. Any diagnosed case of carcinoma stomach who seemed to be operable after the initial clinical and radiological assessment was targeted for entry in the study but a final assessment for operability was done at laparotomy. Among them, 32 patients those who fulfilled the inclusion criteria and underwent an appropriate surgical procedure (Total or Subtotal gastrectomy) were finally included in the study. Patient's demographic characteristics, preoperative investigation findings, operative and histopathological details were recorded in the data collection sheet. All patients were followed up starting from 1st postoperative day up to one month for any complications. During hospital period complications were managed properly and recorded in datasheet.

Later information was collected from follow-up clinic or from their home over the phone to know the patient condition and any new complications. For all patients, we analyzed the following parameters: preoperative serum Hb (PRE-Hb) & s. albumin level, lowest postoperative Hb (LOW-Hb) level along with other variables and postoperative complications. Patients were grouped based on having normal or low PRE-Hb and s. albumin level. They were also grouped by lowest postoperative Hb (LOW-Hb) level ≥ 09 or < 09 gm/dl respectively. Data were analysed by using computer software SPSS-23 (Statistical Package for Social Sciences). Statistical analysis was done by Chi-square (X²) test. Probability value < 0.05 was considered as the level of statistical significance and 95% confidence interval was taken.

Approval for the study was taken from Institutional review board (IRB), BSMMU, Dhaka to carry out this study (Memo no- BSMMU/2019/9325; Date- 3/9/2019).

Operational definitions

Haemoglobin level: Preoperative haemoglobin (PRE-Hb) is the latest Hb level of the patient in gm/dl within 7 days before surgery after which the patient did not receive any transfusion. Normal value is 13- 18 gm/dl in male and 11.5- 16.5 gm/dl in female. LOW-Hb is the lowest Hb from the operative day until postoperative day 7.

Serum albumin level: Preoperative serum albumin in gm/dl. Normal value is 3.5- 5 gm/dl.

Short term surgical complications: For this study short term surgical complication was defined as any of the complications that occurred within 30 days of surgery.

Operable gastric cancer: Operable gastric cancer is that gastric cancer patient in whom gastric resection was possible with curative intent. The criteria for unresectability for cure were 1) Locoregionally advanced Disease- a) Infiltration of the root of the mesentery or para-aortic lymph node highly suspicious on imaging or confirmed by biopsy. b) Invasion or encasement of major vascular structures (excluding the splenic vessels) and 2) Distant metastasis or peritoneal seedlings.

Results

Table- I. Distribution of the patients according to demographic characteristics (n=32).

Variable		Number(n)	Percentage(%)
Age	≤ 60	23	71.90
	> 60	09	28.10
Sex	Male	23	71.90
	Female	09	28.10
BMI (kg/m ²)	Underweight	09	28.10
	Normal	20	62.50
	Overweight or obese	03	09.40
Habit of smoking	Yes	18	56.20
	No	14	43.80
Comorbidity	Diabetes mellitus	07	21.90
	Hypertension	06	18.80
	Cardiopulmonary diseases	04	12.50

Out of 32 patients, 23 (71.90%) were aged ≤60 years and majority patients were male 23 (71.90%). Twenty (62.50%) patients were with normal BMI and 14 (53.20%) had other comorbidities. Lower radical gastrectomy was performed in 28 (87.50%) and total gastrectomy was performed in 4 (12.50%) patients. Mean Preoperative Hb (PRE-Hb) level of the study subjects was 11.76±2.41 gm/dl and mean Lowest postoperative Hb (LOW-Hb) level of the study subjects was 10.19±1.52 gm/dl. The mean Preoperative serum

albumin level of the study subjects was 03.43 ± 0.46 gm/dl.

Complications were observed in 12 (37.50%) cases of the study subjects and 30 days mortality was observed in 2 (6.30%) cases. The mean postoperative hospital stay of the patients was 15.41±06.38 days. Out of 02 deaths one patient died on 2nd POD due to acute myocardial infarction. The other patient developed duodenal stump leakage and underwent 2nd laparotomy on 10th POD. Ultimately he died on 13th POD due to multi-organ dysfunction syndrome.

Table- II. Distribution of patients according to individual complications, their management and 30-days mortality (n= 12).

Individual complications	n (%)	Management	30-days mortality and day of death	Cause
Anastomotic failure	1 (3.1)	Conservative (required TPN)		
Duodenal stamp leakage	1 (3.1)	Operative(under GA)	Yes13 th POD	MODS
Stomal obstruction	1 (3.1)	Operative(under GA)		
Minor SSI	4 (12.5)	Conservative		
Respiratory complications	1 (3.1)	Conservative		
Urinary complications	1 (3.1)	Conservative (antibiotic)		
Cardiac complications	1 (3.1)	Conservative	Yes2 nd POD	AMI
Prolong ileus	2 (6.3)	Conservative		

Table- III. Association of complications with preoperative Hb (PRE- Hb) level and postoperative lowest Hb (LOW- Hb) level (n=32).

Hemoglobin level		Complications		P-value*
		Yesn (%)	Non (%)	
PRE- Hb(gm/dl)	Male \geq 13 and female \geq 11.50	01 (09.09)	10 (90.91)	0.018
	Male < 13 and female < 11.50	11 (50)	10 (50.00)	
LOW- Hb(gm/dl)	\geq 09	04 (17.39)	19 (82.61)	< 0.001
	< 09	08 (88.89)	01 (11.11)	

*P-value was determined by chi-square test.

Development of complications was statistically significantly associated with both low pre-operative and lowest postoperative Hb concentration (P=0.018, < 0.001 respectively). Among patients having normal (Male \geq 13 gm/dl and female \geq 11.50 gm/dl) PRE- Hb concentration only 09.09% had developed complications while in low PRE- Hb group (Male < 13 gm/dl and female < 11.50 gm/dl) 50% had developed complications. Similarly, among patients having lowest post-operative Hb (LOW- Hb) \geq 09 gm/dl only 17.39%

had developed complications and among patients having LOW- Hb concentration < 09 gm/dl 88.89% had developed complications.

Complications rate was statistically significantly higher among patients having preoperative serum Albumin level < 3.50 gm/dl than patients having serum albumin level \geq 3.50 gm/dl (P=0.003). In serum albumin < 3.50 gm/dl group 69.23% had developed complications while in \geq 3.50 gm/dl group only 15.79% had developed complications.

Table- IV. Association between complications and preoperative serum albumin level of the patients (n =32)

Variable		Complications		P-value*
		Yes n (%)	Non (%)	
S. Albumin(gm/dl)	\geq 3.50	03 (15.79)	16 (84.21)	0.003
	< 3.50	09 (69.23)	04 (30.77)	

*P-value was determined by chi-square test.

Table- V. Univariate analysis of the risk factors for developing complications (n=32).

Variables	Odds ratio	95% CI	p-value
Age (> 60 years)	1.286	0.255 – 6.492	0.761
Sex (Male)	0.778	0.154 – 3.927	0.761
Diabetes	2.833	0.509 – 15.770	0.234
Hypertension	0.273	0.028 – 2.676	0.265
Smoking	0.667	0.158 – 2.821	0.582
BMI (<18.50 kg/m ²)	5.667	1.067 – 30.085	0.042
Pre-operative Hb level (Male <13 and female <11.50)	11.00	1.187 – 101.979	0.035
Post-operative lowest Hb level(<09 gm/dl)	38.01	3.654 – 395.211	0.002
S. Albumin level(<03.50 gm/dl)	12.00	2.181 – 66.031	0.004

Table- VI. Multivariate analysis of risk factors for developing complications (n=32).

Variables	Odds ratio	95% CI	p-value
BMI (<18.50 kg/m ²)	7.134	0.397 – 128.169	0.182
Pre-operative Hb level (Male <13 and female <11.50)	11.791	0.317 – 438.172	0.181
Post-operative lowest Hb level(<09 gm/dl)	30.580	1.602 – 583.592	0.023
S. Albumin level(<03.50 gm/dl)	23.554	1.459 – 380.312	0.026

Univariate regression analysis of different patient factors for developing complications was done. BMI (<18.50 kg/m²), Pre-operative Hb level (Male <13 and female <11.50), post-operative lowest Hb level (<09 gm/dl), and preoperative serum albumin (<3.50gm/dl) had significantly higher odds of developing complications (p<0.05).

Multivariate regression analysis of different patient factors for developing complications was also performed. Post-operative lowest Hb level (<09 gm/dl) and S. Albumin level (<03.50 gm/dl) were found to be independently associated with complications (p<0.05). Post-operative lowest Hb level (<09 gm/dl) had OR of 30.580 (95%CI 1.602-583.592; p=0.023), and S. Albumin (<03.50 gm/dl) had OR of 23.554 (95%CI 1.459 – 380.312; p=0.026).

Discussions

The purpose of this prospective case series study was to evaluate the association of postoperative complications with patient's haemoglobin and serum albumin levels following surgery for operable gastric cancer. In our study among 32 study subjects, 12 (37.50%) cases developed complications. This rate of complications was within the reported range of 20-46% mentioned in the summary of a most recent systematic review and meta-analysis of 64 follow-up studies following gastrectomy for cancer⁹. The mean postoperative hospital stay of our patients was 15.41±06.38 days which was more or less similar to others^{7,3}.

According to some studies^{10,11,12} both low preoperative haemoglobin (PRE- Hb) and postoperative lowest Hb (LOW-Hb) levels are a reflection of preoperative nutritional status. Moreover, LOW-Hb is also associated with intraoperative blood loss. But the relationship between perioperative anaemia and postoperative complications remains controversial in other studies^{13,14,15}. In our series the development of complications was statistically significantly

associated with both low PRE- Hb and LOW- Hb levels (P-value 0.018 and < 0.001 respectively). Our findings were similar to the observations in East- Asian series on gastric cancer surgery^{10,12,16}. One study from a resource-poor setting in India¹⁷ found no statistically significant correlation between anaemia and any surgical outcome. Another study from low-income setting from Africa¹⁸ noticed that severe anaemia predisposes to postoperative complications but mild anaemia does not. But both of their study population were of nonmalignant surgeries from different disciplines. So their observations might not be applicable for gastric cancer surgery in low-socioeconomic settings like ours where low haemoglobin is more likely to be present both for disease and socioeconomic factors.

The mean pre-operative serum albumin level of our study subjects was 03.43 ± 0.46 gm/dl. Serum albumin level < 3.50 gm/dl was significantly associated with higher postoperative complications rate than patients having serum albumin level ≥ 3.50 gm/dl (P=0.003). Our results were consistent with the results published in literatures^{16,19,20} on gastric cancer though some of them defined hypoalbuminaemia as s. albumin level < 3 gm/dl. The reason why pre-operative hypoalbuminemia is independently associated with increased risk for complications may be attributed to the fact that low serum albumin is a marker of malnutrition, cancer cachexia and chronic inflammatory activity and as such indicates post-operative complications and mortality²¹.

Univariate regression analysis of different patient factors for developing complications in present series showed that low values of BMI (<18.50 kg/m²), preoperative Hb level (Male <13 and female <11.50), postoperative lowest Hb level (<09 gm/dl), and preoperative serum albumin (<3.50gm/dl) had significantly higher odds of developing complications (p<0.05) but in multivariate regression analysis postoperative lowest Hb level (<09 gm/dl) and S.

Albumin level (<03.50 gm/dl) were found to be independently significantly associated with complications ($p<0.05$). While some of these risk factors are already described in the literatures^{3,7,19,22,23}, others are less frequently reported. Similarly, several factors, which have been described as associated with a higher complication rate, did not demonstrate a comparable association in our series.

Conclusion

Low haemoglobin and S. albumin levels are associated with increased short term post-operative complications in operable gastric cancer. So adequate correction of these factors results in better surgical outcome following gastric cancer surgery.

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Conflict of Interest

All the authors of this study do not have any financial interest or conflict with any industries or parties.

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