

Influence of Tumor Characteristics on Early Surgical Complications in Operable Gastric Cancer

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Abstract

Original Research Article

Background: Gastric cancer is the 5th 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. **Aims:** To observe the nature of complications and correlate the tumor characteristics with nature of complications. **Methods:** Following convenience sampling 46 patients of operable gastric cancer who underwent gastrectomy in the Department of General Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), from July 2021 to June 2022 were observed for their postoperative complications rate, type, and grade by Clavien-Dindo classification system. Data were analyzed with Statistical Packages for Social Sciences (SPSS- 22.0) and Chi-square test (χ^2) was done to find out the association of complications with the tumor characteristics. **Results:** Tumor located in fundus and corpus found in 10 cases, out of which 4(40.0%) and 6(60.0%) had developed major and minor complication respectively ($p<0.05$). Five 5 cases were adenocarcinoma (signet ring), among them 1(20.0%) developed major complication and 4(80.0%) developed minor complication. Five cases were adenocarcinoma (mucinous), 3(60.0%) developed major complication and 2(40.0%) developed minor complications ($p<0.05$). Grade III lesion was observed in 20 cases, out of which 5(25.0%) developed major complication and 15(75.0%) developed minor complications ($p<0.05$). Tumor size more than 6 cm was found in 3 cases, among them 1(33.3%) had major and 2(66.7%) had minor complication. Tumor size belonged to 3 - 6 cm was found in 34 cases, out of which 4(11.8%) had developed major complication, 28(81.4%) minor complication and 2(5.9%) had no complication ($p<0.05$). Tumor located in fundus and corpus, adenocarcinoma (signet ring), adenocarcinoma (mucinous), grade III lesion, tumor size 3 cm or more, all the above were significantly ($p<0.05$) associated with severities of complications. **Conclusion:** Tumor located in fundus and corpus of the stomach, Adenocarcinoma (signet ring, mucinous), grade III lesion, Tumor size 3 cm or more were significantly associated with complications.

Keywords: Gastric carcinoma, Tumor location, Tumor grading, Tumor size.

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INTRODUCTION

Gastric cancer is the fifth most common malignancy worldwide and the third leading cause of cancer death. There is a higher incidence in developing

countries compared to developed countries [1]. In Bangladeshi male and female, it is the fifth and seventh most common cancer respectively and the 5th most common cause of cancer related death [2]. Majority of the patients present with advanced disease when it is

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inoperable and their prognosis is very poor despite availability of modern chemotherapeutic regimen. So, the only chance of cure is complete surgical resection [3]. Dikken *et al.*, (2013: p. 83) [4], observed that in European and other Western countries gastric cancer surgery is still regarded to be high risk surgery and there are major differences in outcome between countries. Complication rates 20-40% and hospital mortality rates of 10-30% are commonly reported in western series, which contrast a mortality rate 2-3% reported from Japan [5]. Bruno *et al.*, (2014, p. 1455) [6], stated that accurate grading of complications is essential to analyze surgical outcomes and an increasing number of studies are using the Clavien-Dindo classification system proposed by Dindo *et al.*, (2004) [7], for assessing gastric cancer surgery. In their study based on data from 90 consecutive patients who underwent gastrectomy for gastric neoplasia between January 2010 and February 2014 at Department of Surgery and Translational Medicine, University of Florence, Florence, Italy, out of 75 included patients 49 (65.3%) developed complications. The numbers of Clavien- Dindo Grade [8]. I, II, III, IV and V complications were 6 (8%), 24 (32%), 6 (8%), 13 (17.3%) and 0 (0%) respectively. Another study by Lamb *et al.*, (2008) [9], observed a total of 180 consecutive patients undergoing resection for gastric adenocarcinoma with curative intent between October 1992 and September 2005. Of the patients, 48 developed postoperative complications including 17 patients with a major surgical complication. The in-hospital mortality was 1.7% (3 of 180). In an article on improving the outcome in gastric cancer surgery Tegels *et al.*, (2014) [10]. mentioned that Complications following curative surgery for gastric cancer have a negative effect on overall and disease specific survival. Therefore, much effort should be made in preventing morbidity and mortality. A reduction in operative mortality for patients undergoing a potential curative resection would clearly be beneficial and interest should be focused on studies aimed at identification of per- and intra-operative complications and mortality [11]. It has been previously reported by some authors that the tumor size, tumor grade, distant metastasis was outstanding independent prognostic factor that can affect mortality and morbidity rates besides the surgical procedures [12]. Moreover, lymphnode metastasis and distant metastasis was considered to be the most important prognostic factor for gastric cancer patient [13]. But studies on the impact of clinicopathological factor on postoperative outcome after GI tumor resection are scarce, though this information is essential for preoperative risk stratification and optimal preoperative, perioperative, and postoperative treatment [14]. Therefore, in this study, we primarily aimed to evaluate the short-term complications following surgery of operable gastric cancer and to identify their association with tumor location, tumor size, histopathologic grading between those patients who undergo surgery for gastric cancer in tertiary hospital. We hope, this overall knowledge will result in a positive impact on the gastric cancer patient

management and thus help to improve the outcomes of surgery for operable gastric cancer in the future.

OBJECTIVES OF THE STUDY

General Objectives

- To observe the nature of complications and correlate the tumor characteristics with nature of complications.

Specific Objectives

- To observe the association between tumor location & the frequency of complications following surgery.
- To observe the association between tumor size & the frequency of complications following surgery.
- To observe the association between tumor grade & the frequency of complications following surgery.

MATERIALS AND METHODS

This was a Descriptive Quasi Experimental study. The patients were selected convenience sampling technique. A total of 46 patients were included in this study. The study was conducted in the Department of General Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh. At July 2021- June 2022 (one year).

Inclusion Criteria

- All patient with operable gastric cancer irrespective of age and sex

Exclusion Criteria

- Patients with metastatic gastric cancer.
- Patients with loco-regional advanced disease.

Data Collection Procedure

The study was conducted in the Department of General Surgery, BSMMU over a period of one year. 46 cases of diagnosed carcinoma of stomach that fulfill the selection criteria were included in the study. A checklist prepared by the researcher would use as data collection tool considering the variables such as age, sex, clinical findings, laboratory investigation including upper GIT endoscopy with biopsy (for histopathological confirmation), Ba-meal study of upper GIT in selected cases, Ultrasonogram of the whole abdomen and chest x-ray as staging investigations or contrast enhanced CT scan of abdomen and chest if required.

After taking all preoperative preparation, including improvement of nutritional status, correction of anaemia (if present), correction of dehydration, correction of electrolytes imbalance and assessment of anesthetic fitness of all cases would be sent for operation. After exploration of the abdomen operability had assessed and surgical procedure done accordingly. Operative details and Histo-pathological details were documented. Post-operative follows up and post-

operative complication if occur recorded and managed properly. All patients were followed up starting from 1st post-operative day up to one month or till hospital stay in post-operative period. During hospital period post-operative adverse events had recorded in data sheet and later from follow up clinic or from their home over phone to know the patient condition and outcome of treatment.

Data Processing and Analysis

All the data were checked and edited in master sheet after collection. Then the data were processed and analyzed based on the aims and objectives of the study by using computer software SPSS-22.0 (Statistical Package for Social Sciences). The result was presented in tables and figures. The statistical terms that included in this study are mean, percentages, standard deviations etc. Statistical analysis had done by Chi-square (χ^2) test.

As necessary according to the nature of variables. Probability value <0.05 was considered as level of statistical significance and 95% confidence interval taken.

Ethical Consideration

Ethical clearance taken from Institutional Review Board (IRB) of BSMMU to undertake the study. According to Helsinki Declaration for Medical Research involving Human Subjects 1964, all the patients were informed about the study design, the underlying hypothesis and the right of the participants to withdraw themselves from the research at any time, for any reason. Informed written consent had obtained from each patients.

RESULTS

Table I: Distribution of the patients according to demographic characteristics. (N=46)

Variable	Frequency (n)	Percentage (%)
Age in years		
<60 Yrs.	28	60.9
>60 Yrs.	18	39.1
Mean± SD	52.15±15.82	
Range (Min-Max)	15-90	
Sex		
Male	27	58.7
Female	19	41.3
Education		
Primary	18	39.1
SSC	13	28.3
HSC	8	17.4
Graduate	4	8.7
Illiterate	3	6.5
Smoking		
Yes	33	71.7
No	13	28.3
BMI (kg/m²)		
<18.5 Underweight	28	60.9
18.5-24.9 Normal	16	34.8
>25 Overweight	2	4.3

Table I showed almost two third (60.9%) of patients belonged to age was <60 years and 18(39.1%) belonged >60 years. The mean age was 52.15±15.82 years ranged from 15 to 90 years. More than half 27 (58.7%) of patients were male and 19(41.3%) were female. More than one third 18 (39.1%) of patient's education level were primary followed by 13(28.3%)

SSC, 8(17.4%) HSC, 4(8.7%) graduate and 3(6.5%) were illiterate. Almost three fourth 33 (71.7%) of patients were smoker and 13(28.3%) were non-smoker. About two third 28(60.9%) of patients belonged to BMI <18.5 underweight followed by 16(34.8%) 18.5-24.9 normal and 2(4.3%) were >25.0 overweight.

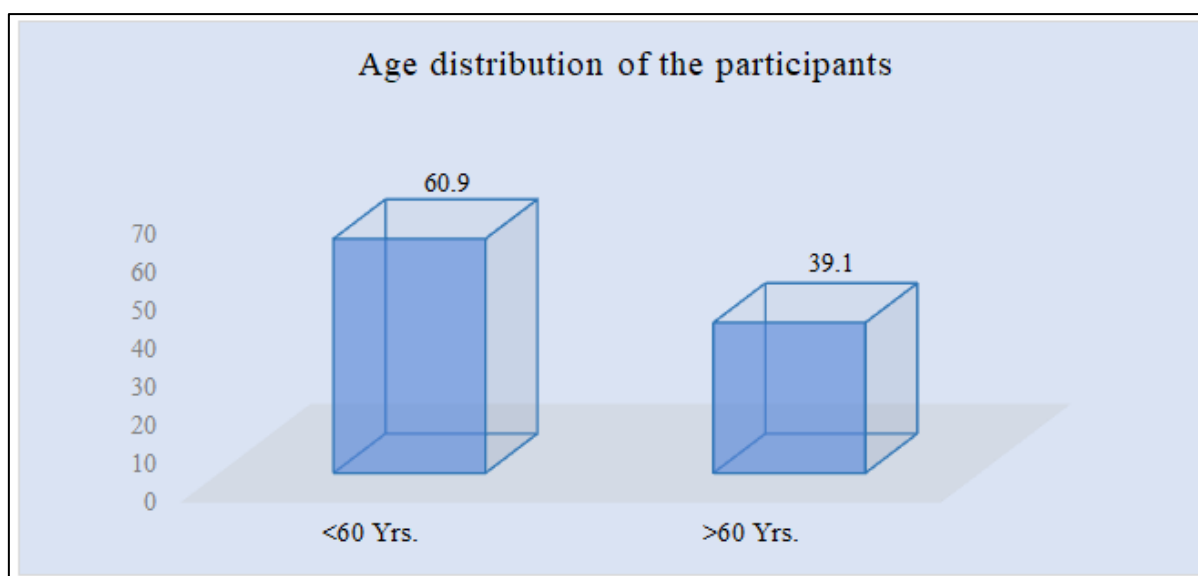


Figure 1: Column chart showed age group wise patients distribution. (N=46)

Table II: Distribution of the patients according to Co-morbidity. (N=46)

Co-morbidity	Frequency (n)	Percentage (%)
DM		
Yes	16	34.8
No	30	65.2
HTN		
Yes	11	23.9
No	35	76.1
IHD		
Yes	6	13.0
No	40	87.0
COPD		
Yes	4	8.7
No	42	91.3

Table II showed more than one third (34.8%) of patients had DM followed by 11(23.9%) HTN, 6(13.0%) IHD and 4(8.7%) were COPD.

Table III: Distribution of the patients according to investigations. (N=46)

Investigations	Mean± SD	Range (Min-Max)
HB (g/dl)	9.54±1.5	6.5-12.9
S. albumin (g/dl)	3.14±0.48	2.3-4.5

Table III showed the mean HB was 9.54±1.5 g/dl ranged from 6.5 to 12.9 g/dl. The mean S. albumin was 3.14±0.48 g/dl ranged from 2.3 to 4.5 g/dl.

Table IV: Distribution of patients according to operative findings of the patients. (N=46)

Operation Note	Frequency (n)	Percentage (%)
Duration of operation (hr.)		
Mean ±SD	3.28±0.43	
Range (Min-Max)	2.5-4.5	
Pre operative blood transfusion (n=23)		
1 Units	8	34.8
2 Units	13	56.6
3 Units	1	4.3
4 Units	1	4.3

Per operative blood transfusion		
1 Units	11	23.9
2 Units	33	71.8
3 Units	2	4.3
Type of resection		
Subtotal gastrectomy	39	84.8
Total gastrectomy	6	13.0
Antrectomy	1	2.2

Table IV showed the mean duration of operation was 3.28 ± 0.43 hr ranged from 2.5 to 4.5 hr. A total of 23 patients need pre-operative blood transfusion, where 13(56.6%) patients need 2 units. Almost three

fourth (71.8%) of patients need 2 units per operative blood transfusion. Majority (84.8%) of patients had subtotal gastrectomy resection followed by 6(13.0%) total gastrectomy and 1(2.2%) has antrectomy.

Table V: Distribution of patients according to tumor location. (N=46)

Tumor location	Frequency (n)	Percentage (%)
Pylorus	2	4.3
Antrum	34	73.9
Body	8	17.4
Body and cardia	1	2.2
Fundus and Body	1	2.2

Table V showed almost three fourth (73.9%) of patient's tumor location was found antrum followed by

8(17.4%) body, 2(4.3%) pylorus, 1(2.2%) body & cardia and 1(2.2%) found fundus and body.

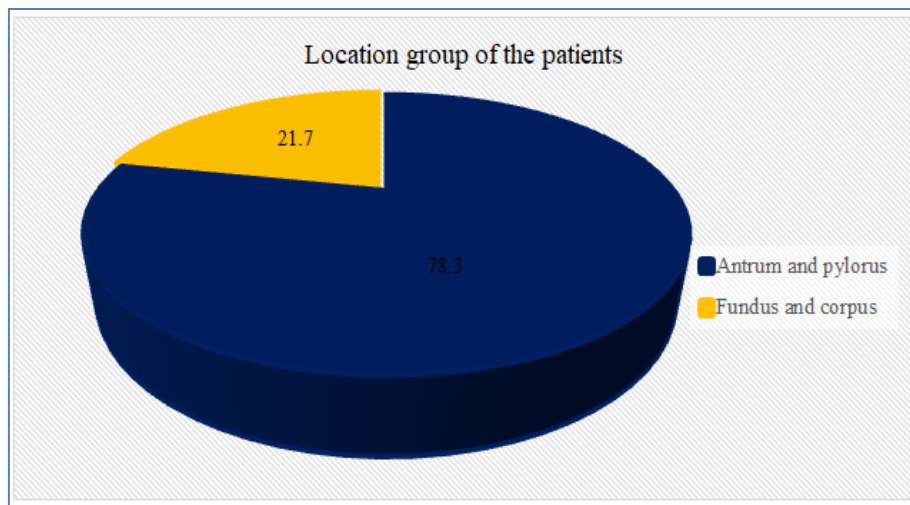


Figure 2: Pie chart showed location group wise patients. (N=46)

Figure 2 showed majority (78.3%) of patient's tumor location group had antrum and pylorus and 10(21.7%) had fundus and corpus.

Table VI: Distribution of patients according to histological type of tumor. (N=46)

Histological type of tumor	Frequency (n)	Percentage (%)
Adenocarcinoma	36	78.2
Adenocarcinoma (signet ring cell)	5	10.9
Adenocarcinoma (mucinous)	5	10.9

Table VI showed more than three fourth (78.2%) of patients had adenocarcinoma and 5(10.9%)

had adenocarcinoma (signet ring cell) & 5(10.9%) adenocarcinoma (mucinous).

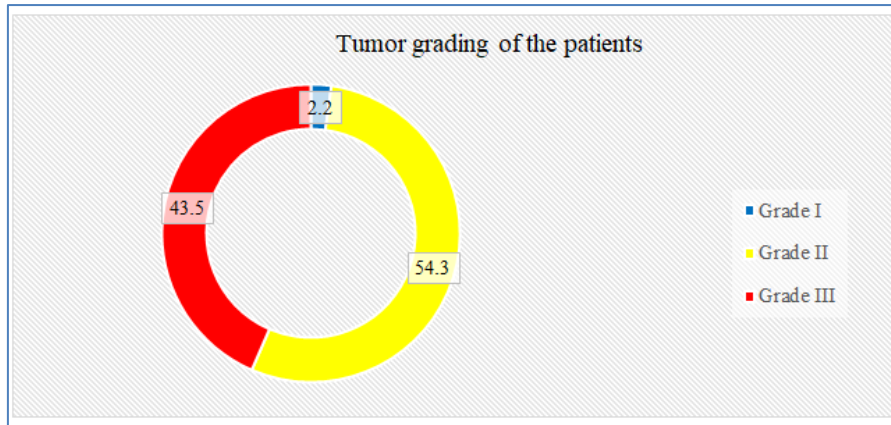


Figure 3: Ring chart showed tumor grading wise patients (N=46)

Figure 3 showed more than half (54.3%) of patients had grade-II tumor, 20(43.5%) grade-III and 1(2.2%) has Grade-I.

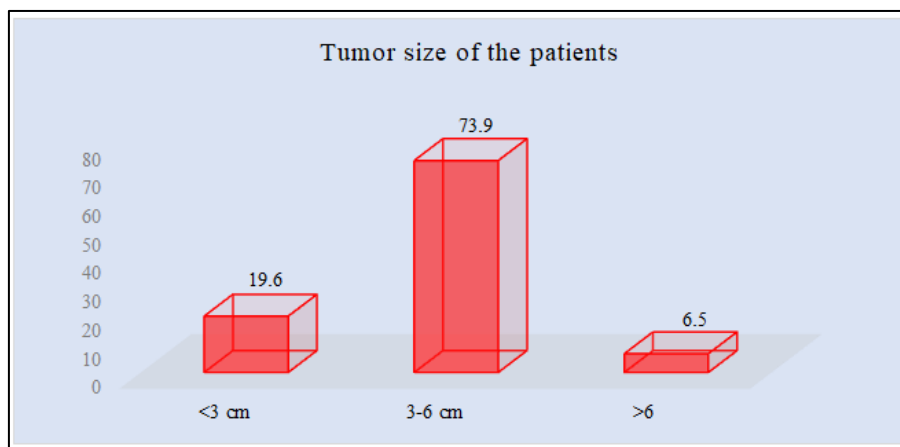


Figure 4: Column chart showed tumor size wise patients distribution. (N=46)

Figure 4 showed almost three fourth (73.9%) of patients belonged to tumor size was 3-6 cm, 9(19.6%) was <3 cm and 3(6.5%) belonged >6 cm.

Table VII: Distribution of patients according to other pathological characteristics of the tumor. (N=46)

Variable	Frequency (n)	Percentage (%)
Lymph node retrieved		
<15	41	89.1
>15	5	10.9
Mean± SD	12.04±6.15	
Range (Min-Max)	2-34	
Margin		
Free	44	95.7
Involved	2	4.3
PTNM- staging		
PT2PN2PMx	25	54.3
PT2PN3aPMx	5	10.9
PT2PN3bPMx	3	6.5
PT2PN1PMx	9	19.5
PT3PN3aPMx	1	2.2
PT3PN3abPMx	1	2.2
PT1PN1PMx	1	2.2
PT3PN2PMx	1	2.2
PTNM-stage1		
IB	1	2.2

IIA	9	19.6
IIB	25	54.3
IIIA	4	8.7
IIIB	7	15.2

Table VII showed majority (89.1%) of patients belonged <15 lymph node retrieved and 5(10.9%) belonged >15. The mean lymph node retrieved was 12.04±6.15 ranged from 2 to 34. Almost all (95.7%)

patients had found free margin and 2(4.3%) had involved. More than half (54.3%) of patients PTNM-staging was PT2PN2PMx. More than half (54.3%) of patients PTNM-stage I was IIB.

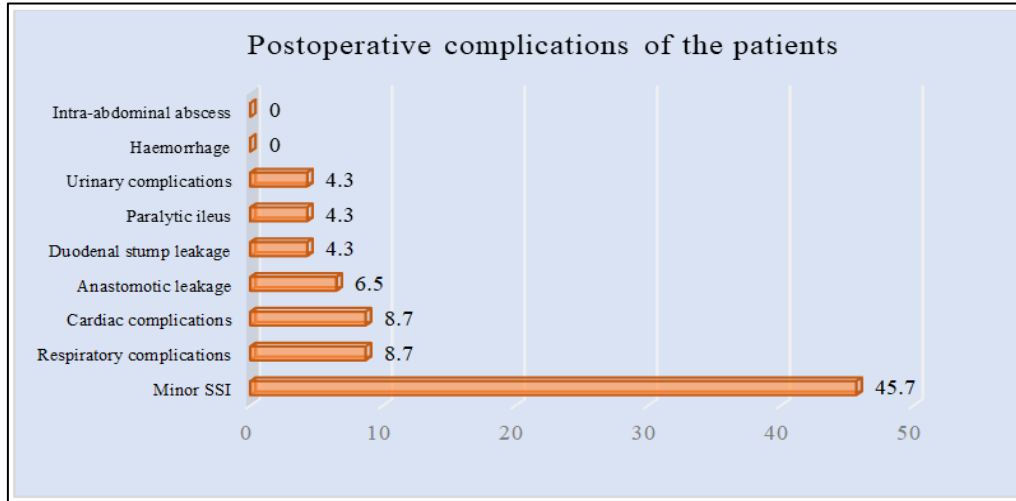


Figure 5: Bar chart showed postoperative complications wise patients. (N=46)

Figure 5 showed almost half (45.7%) of patients had minor SSI followed by 4(8.7%) respiratory complications, 4(8.7%) cardiac complications, 3(6.5%)

anastomotic leakage, 2(4.3%) duodenal stump leakage, 2(4.3%) paralytic ileus, 2(4.3%) urinary complications and not found haemorrhage & intra-abdominal abscess.

Table VIII: Distribution of patients according to grade(C-D) of complications. (N=46)

Grade	Frequency (n)	Percentage (%)
Grade-I		
Yes	28	60.9
Null	18	39.1
Grade-II		
Yes	3	6.5
Null	43	93.5
Grade-IIIa		
Yes	1	2.2
Null	45	97.8
Grade-IIIb		
Yes	2	4.3
Null	44	95.7
Grade-IVa		
Yes	2	4.3
Null	44	95.7
Grade-IVb		
Null	46	100.0
Grade-V		
Null	46	100.0

Table VIII showed it was observed that almost three fourth (60.9%) of patients had Grade-I, 3(6.5%)

grade-II, 1(2.2%) grade-IIIa, 2(4.3%) grade-IIIb, 2(4.3%) grade-IVa, no found grade-IVb and Grade-V.

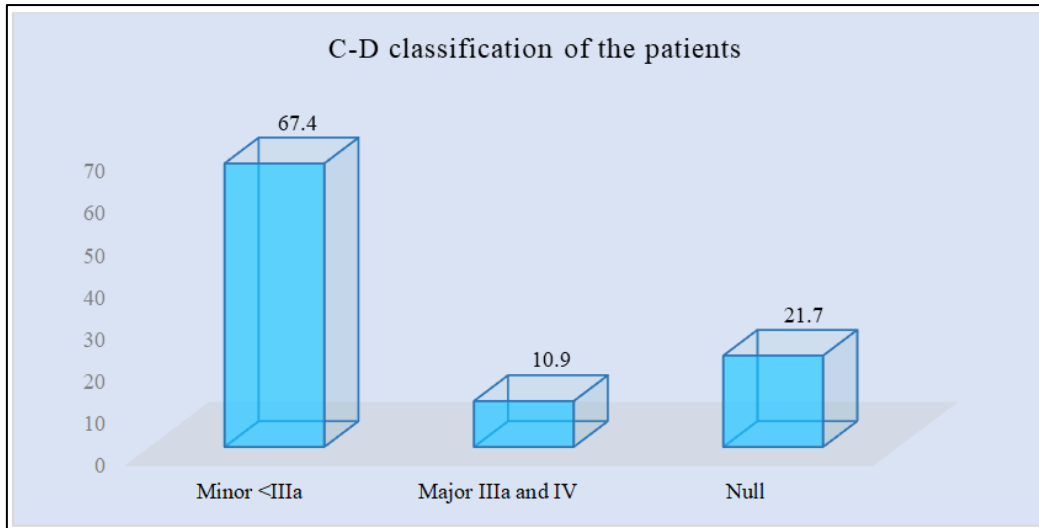


Figure 6: Column chart showed severity of complications of study patients according to C-D classification. (N=46)

Figure 6 showed more than two third (67.4%) of patients belonged minor <IIIa severity, 5(10.9%) major IIIa and IV and 10(21.7%) had null.

Table IX: Association between severity of complications with tumor characteristics (n=46)

Tumor characteristics	n	Severity of complications						P-value
		Major (n=5)		Minor (n=31)		Null (n=10)		
		n	%	n	%	n	%	
Location of tumor								
Antrum and pylorus	36	1	2.8	25	69.4	10	27.8	0.001
Fundus and corpus	10	4	40.0	6	60.0	0	0.0	
Histological type								
Adenocarcinoma	36	1	2.8	25	69.4	10	27.8	0.001
Adenocarcinoma (signet ring)	5	1	20.0	4	80.0	0	0.0	
Adenocarcinoma (mucinous)	5	3	60.0	2	40.0	0	0.0	
Tumor grading								
I	1	0	0.0	0	0.0	1	100.0	0.002
II	25	0	0.0	16	64.0	9	36.0	
III	20	5	25.0	15	75.0	0	0.0	
Tumor size (cm)								
<3	9	0	0.0	1	11.1	8	88.9	0.001
3-6	34	4	11.8	28	82.4	2	5.9	
>6	3	1	33.3	2	66.7	0	0.0	

Table IX showed it was observed that 10 cases had tumor located in fundus and corpus and all of them had developed complication, where 4(40.0%) major complication and 6(60.0%) minor complication. The difference was statistically significant ($p<0.05$) with severity of complications. Five cases were adenocarcinoma (signet ring) and another 5 cases were adenocarcinoma (mucinous). In adenocarcinoma (signet ring) cases, 1(20.0%) case developed major complication and 4(80.0%) minor complication. In adenocarcinoma (mucinous), 3(60.0%) cases developed major complication and 2(40.0%) minor complication. The difference was statistically significant ($p<0.05$) with

severity of complications. Grade III lesion was found in 20 cases, where 5(25.0%) cases developed major complication and 15(75.0%) minor complication. The difference was statistically significant ($p<0.05$) with severity of complications. Tumor size more than 6 cm was found in 3 cases, where 1(33.3%) case developed major complication and 2(66.7%) minor complication. Tumor size belonging to 3-6 cm was found in 34 cases. Among them 4(11.8%) cases developed major complication, 28(82.4%) minor complication and 2(5.9%) had null. The difference was statistically significant ($p<0.05$) with severity of complications.

Table X: Post-operative hospital stay (days) of study patients. (N=46)

Post-operative hospital stay (days)	Frequency (n)	Percentage (%)
≤15	27	58.6
>15	19	41.4
Mean± SD	14.52±5.62	
Range (Min-Max)	2-28	

Table X showed more than half 27(58.6%) of patient's post-operative days level was ≤15 days and 19(41.4%) was >15 days. The mean post-operative day was 14.52±5.62 days ranged from 2 to 28 days.

DISCUSSION

This study was carried out with an aim to observe the nature of complications and correlate the tumor characteristics with nature of complications following surgery. In this present study it was observed that 60.9% of patients having gastric cancer age belonged to less than 60 years and the mean age was 52.15±15.82 years. Similar observations also observed by Kang *et al.*, (2016), Mohri *et al.*, (2015), Xiao *et al.*, (2015) and Kunisaki *et al.*, (2009) [15- 18]. On the other hand, Yuan *et al.*, (2019), Norero *et al.*, (2019), Jeong *et al.*, (2018) [19- 21] studies observed higher mean age in patients having gastric cancer. Gastric cancer rates are about twice as high in males as in females. Gender is an important factor affecting the occurrence of gastric cancer, where stomach cancer rates worldwide are about twice as high in males compared to females [22]. Similarly, in this current study it was also observed that gastric cancer was more common in male (58.7%) subject. Tobacco smoking has been causally linked to gastric cancer but several aspects of the association remain imprecisely quantified. Similarly, in the present study it was observed that almost three fourth (71.7%) of patients were smoker and 28.3% were non-smoker. Praud *et al.*, (2018) [23], study showed that the risk increased with duration of smoking, to reach 1.33 times with 95%CI: 1.14–1.54 for more than 40 years of smoking and decreased with increasing time since stopping cigarette smoking ($p<0.05$) and became similar to that of never smokers 10 years after stopping. In this current study it was observed that 60.9% of patients belonged to BMI <18.5 kg/m² underweight followed by 34.8% 18.5-24.9 kg/m²normal and 4.3% were >25 kg/m² overweight. Underweight is a simple and reliable predictor of a worse long-term outcome among gastric cancer patients [20- 24]. In this present study it was observed that DM and HTN were more common comorbidities, which were 34.8% and 23.9% respectively. Hypertension and diabetes significantly increased the incidence of postoperative complications following laparoscopic gastrectomy especially in elderly patients [19- 24]. According to Wei *et al.*, (2020) Liu *et al.*, (2018) and Ye *et al.*, (2015) [26- 28] both low preoperative haemoglobin (pRE-Hb) and postoperative lowest Hb (LOW-Hb) levels are a reflection of preoperative nutritional status and significantly associated with surgical outcome. In this current study it

was observed that most of the patients were anaemic, where the mean HB was 9.54±1.5 g/dl varied from 6.5 to 12.9 g/dl. It is well known that hypoalbuminemia can be an independent risk factor of postoperative complications [15- 29]. Serum albumin level <3.50 gm/dl was significantly ($p<0.05$) associated with higher postoperative complications rate than patients having serum albumin level ≥3.50 gm/dl. In this current study it was observed that the mean S. albumin was 3.14±0.48 g/dl ranged from 2.3 to 4.5 g/dl. An *et al.*, (2012) [30], reported that the duration of operation time is a significant risk factor for the development of surgical complications. The longer operation time, more bleeding and more frequent transfusion are all related. In this present study it was observed that the mean duration of operation time was 3.28±0.43 hours varied from 2.5 to 4.5 hours, which support with Yuan *et al.*, (2019), Jeong *et al.*, (2018) and Kang *et al.*, (2016) studies [15- 21]. The perioperative transfusions indicated that the patients had been in a chronic bleeding status, which is an important risk factor for complications [28- 30]. In this current study it was observed that a total of 23 patients received pre-operative blood transfusion, where 56.6% patients received 2 units and nearly three fourth 71.8% of patients received 2 units per operative blood transfusion. Xiao *et al.*, (2015) [8], study confirmed intraoperative transfusion as an independent risk, regardless of the amount and the number of blood transfusion s. Dutch Gastric Cancer Study Group Sasako, 1997; Launois *et al.*, (1991) [31, 32] mentioned in their study that total gastrectomy is a known risk factor of postoperative complications. Kang *et al.*, (2016) [15], study also showed that total gastrectomy is an independent risk factor of severe postoperative complication in elderly gastric cancer patients. According to type of resection in this present study it was observed that 84.8% of patients had subtotal gastrectomy resection followed by 13.0% total gastrectomy and 2.2% antrectomy. Similar observations regarding the type of resection were also observed by Yuan *et al.*, (2019), Norero *et al.*, (2019) and Kang *et al.*, (2016) [15- 20]. In the current study, regarding the association between severities of complications with tumor characteristics, it was observed that tumor located in fundus and corpus found in 10 cases and all had developed complications, where 40.0% and 60.0% had developed major and minor complications respectively, which showed that tumor located in fundus and corpus was significantly ($p<0.05$) associated with severity of complications. In earlier study, Sah *et al.*, (2009) [33], reported that gastric cancer surgery is highly heterogenous in its extent and post-operative complication is still higher. Norero *et al.*, (2019) [19], showed in the univariate analyses;

esophagogastric junction (EGJ) tumor location was predictive factors for severe morbidity. In multivariate analysis, esophagogastric junction tumor location remained statistically significant ($p < 0.05$) variables. The authors observed tumor location in the EGJ and gastric wall involvement beyond the muscular layer as predictors of severe postoperative morbidity. In their study, Wang *et al.*, (2016) [34], mentioned that 46 patients experienced at least one major complication, where 32 patients had distal tumor location, 9 had medium third and 5 patients had proximal tumor location. In a study, Nelen *et al.*, (2018) [35], emphasized that in multivariate analysis factors associated with morbidity were: ASA grade, type of resection, receipt of neoadjuvant chemotherapy and tumor location. In our study, regarding the association between histological types with severities of complications it was observed that 5 cases were adenocarcinoma (signet ring) and another 5 cases were adenocarcinoma (mucinous). All adenocarcinoma (signet ring) and adenocarcinoma (mucinous) had developed complications. In adenocarcinoma (signet ring) cases, 20.0% and 80.0% developed major and minor complications respectively. In adenocarcinoma (mucinous) cases 60.0% developed major complication and 40.0% minor complications. Adenocarcinoma (signet ring) and Adenocarcinoma (mucinous) showed significant ($p < 0.05$) association with severities of complications. The 2010 WHO classification recognizes four major histologic patterns of gastric cancers: tubular, papillary, mucinous and poorly cohesive (including signet ring cell carcinoma), plus uncommon histologic variants [36]. Tubular adenocarcinoma is the most common histologic type of early gastric carcinoma. Lamb *et al.*, (2008) [9], observed a total of 180 consecutive patients undergoing resection for gastric adenocarcinoma between October 1992 and September 2005. Of the patients, 48 developed postoperative complications including 17 patients with a major surgical complication. Hospital mortality was 1.7% (3 of 180). In this study, regarding the association between tumor grading with severities of complications, it was observed that grade III lesion was observed in 20 cases and all grade III tumor cases had developed complication, where 25.0% developed major complication and 75.0% developed minor complications. Grade III showed significant ($p < 0.05$) association with severities of complications. In a study, Jeong *et al.*, (2018) [21], reported that the overall morbidity and mortality rates were 20.1% and 1.0% respectively and the grade III and above grade complications occurred in 6.6% patients, which was also statistically significant as comparable to our study. In accordance with our study, Lee *et al.*, (2014) [37], reported that 22.4% patients developed complications, which had 28.8% events of clinical manifestations and the overall complication rate was significantly ($p < 0.05$) more common in grade IIIa or over and systemic complication ($p < 0.001$). In a similar study, Jiang *et al.*, (2014) [38], stated that complication grade may be an independent prognostic factor for gastric cancer following curative resection and the

treatment of complications can improve the long-term outcome of gastric cancer patients. Wang SL *et al.*, (2016) [34], found that patients who experienced more than one complication were classified as higher-grade complication. In the present study, regarding the association between tumor size with severities of complications, it was observed that tumor size more than 6 cm was found in 3 cases. All cases had developed complication (33.3% major and 66.7% minor complication). Tumor size belonged to 3 - 6 cm was found in 34 cases. Among them 11.8% had developed major complication, 81.4% minor complication and 5.9% had no complication. Tumor size 3 cm or more was significantly ($p < 0.05$) associated with severities of complications. Im *et al.*, (2012) [39], reported that tumor size has been continuously pointed out as one of the critical factors determining the prognosis in gastric cancer and tumor size can be determined quite easily in the preoperative exam and the accuracy of information is fairly reliable. Regarding the complication developed, Zeybek *et al.*, (2013) [40], found that 26.32% patient's tumor size was ≤ 3 cm followed by 22.22% was ≤ 6 cm and > 6 cm, which associated with complication. In a study, Zhao *et al.*, (2015) [41], reported that tumor size is significantly correlated with gastric cancer progression, which can be regarded as a reliable prognostic factor and the TsNM stage system may improve the prognostic prediction accuracy in gastric cancer patients. On a similar note, Im *et al.*, (2012) [39], observed in univariate analysis, tumor size is a significant prognostic factor in advanced gastric cancer, but not in early gastric cancer. It has been reported by some authors that the tumor size, tumor grade, distant metastasis was outstanding independent prognostic factor that can affect mortality and morbidity rates besides the surgical procedures [12]. Moreover, lymphnode metastasis and distant metastasis was considered to be the most important prognostic factor for gastric cancer patients [13]. It is noteworthy that studies on the impact of clinicopathological factor on postoperative outcome after GI tumor resection are not adequate, though this information is essential for preoperative risk stratification and optimal preoperative, perioperative, and postoperative management of gastric cancer [14]. In our study, according to grade of complications it was observed that 60.9% of patients had Grade-I, 6.5% grade-II, 2.2% grade-IIIa, 4.3% grade-IIIb, 4.3% grade-IVa, none found grade-IVb and grade-V. In a similar study, Yuan *et al.*, (2019) [19], observed that postoperative complication and mortality rates were 24.7 and 0.8%, respectively. The severity of complications was graded in accordance with the Clavien–Dindo classification [8]. The incidence of minor complications (grades I-II) and major complications (grades III–V) was found as 9.2 and 15.5%, respectively. Their data also showed that the most frequent complication was anastomotic leakage (18/239, 7.5%), followed by gastric stasis (10/239, 4.2%) and abdominal bleeding (6/239, 2.5%). In another study, Jeong *et al.*, (2018) showed the \geq grade 3 complications occurred in

20 (6.6%) patients which are almost comparable with the present study.

LIMITATION OF THE STUDY

- The study population was selected from one selected hospital in Dhaka city, so that the results of the study may not reflect the exact picture of the country.
- The present study was conducted at a very short period of time.
- Demographic and operative factors were not analyzed which might appear as confounding variables in this analysis.

CONCLUSION AND RECOMMENDATIONS

Tumor located in fundus and corpus of the stomach, adenocarcinoma (signet ring, mucinous), grade III lesion, tumor size 3 cm or more were significantly associated with complications. Further studies can be undertaken by including large number of patients. By knowing this association assists in clinical decision-making regarding patient stratification, timing of surgery and taking appropriate measure in perioperative period to decrease postoperative complications.

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