

Modified D2 Gastrectomy operation in Gastric Cancer Patients and Outcome

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ABSTRACT

Gastric cancer remains the fifth most commonly diagnosed cancer and the third leading cause of cancer-related deaths worldwide. In 2018, there were an estimated 1,033,701 newly diagnosed cases and 782,685 related deaths. The aim of this study was to evaluate outcome of modified D2 gastrectomy operation in gastric cancer patients with or without comorbidities. This prospective observational study was conducted at the Department of Surgical Oncology, National Institute of Cancer Research and Hospital, Mohakhali, Dhaka, from July 2019 to March 2021. A total of 53 patients were included in the study. The outcome of the surgery was assessed by monitoring postoperative complications for a period of 30 days. Statistical analysis was performed using SPSS (Statistical Package for the Social Sciences) version 28. Prior to the commencement of the study, the research protocol was approved by the Research Review Committee of the Department of Surgical Oncology and the Ethical Committee of the National Institute of Cancer Research and Hospital, Dhaka. There was no significant association observed between postoperative complications of modified D2 gastrectomy and patients' age, gender, or smoking status. Among the 53 patients, the highest proportion (92.45%) experienced anorexia, followed by vomiting (81.13%), and approximately 71.69% had dyspepsia. Among the patients, 52.83% had diabetes mellitus (DM) and 45.28% had hypertension (HTN). Patients with gastric cancer and DM were found to be more susceptible to developing wound infections. Based on the analysis of the study results, it can be concluded that modified D2 gastrectomy is a safe procedure that yields acceptable postoperative outcomes for the treatment of gastric cancer in a tertiary care center.

Keywords: Gastric cancer, gastrectomy, infection, diabetes mellitus.

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INTRODUCTION

Gastric cancer remains the fifth most common cancer and the third leading cause of cancer-related deaths worldwide. In 2018, an estimated 1,033,701 new cases and 782,685 related deaths were reported globally.¹ The highest incidence rates are found in Eastern Asia, particularly in Mongolia, the Republic of Korea, and

Japan.² The first successful gastrectomy was performed by Bill Roth in 1881^[3]. Since then, radical gastrectomy, which involves the removal of the primary lesion with a satisfactory resection margin (R0), along with radical dissection of regional lymph nodes, has been the primary treatment for resectable gastric cancer.³ Surgeons have also explored more extensive surgeries, such as super-extended (D3) lymphadenectomy or standardized extended (D2) lymphadenectomy plus para-aortic nodal dissection (PAND), combined with prophylactic splenectomy or bursectomy.⁴ In Japan, radical gastrectomy with D2 dissection has been the standard procedure for locally advanced gastric cancer (LAGC) since 1961.⁵ This approach has also gained acceptance in Western

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countries, given the latest 15-year follow-up results of the Dutch D1D2 trial, which showed significant survival benefits of D2 over standardized limited (D1) lymphadenectomy.⁵ However, the United Kingdom Medical Research Council Gastric Cancer Surgical Trial (MRC, ST01) found no survival advantages of D2 over D1 dissection.⁶ Similarly, the Dutch D1D2 trial in the Netherlands showed that D2 dissection was associated with a higher risk of postoperative morbidity and mortality compared with D1 dissection, with no differences in overall survival rate after an 11-year follow-up period.⁷ Pancreatic resection often leads to complications such as pancreatic juice leakage, subphrenic abscess, and postoperative diabetes. To mitigate these risks, Maruyama et al. developed pancreas-preserving surgery in 1979.⁸ They found that gastric cancer tumors only invaded the pancreas directly, rather than metastasizing to the pancreas. Pancreas-preserving surgery proved superior to pancreas resection in terms of operative mortality, hospital mortality, surgical morbidity, and 5-year survival rate.⁹ Furukawa et al.'s randomized controlled trial (RCT) also supported the superiority of pancreas-preserving surgery over pancreas resection in terms of surgical risk and postoperative glucose tolerance.⁹

METHODS

This prospective observational study was conducted at the Department of Surgical Oncology, National Institute of Cancer Research and Hospital, Mohakhali, Dhaka, Bangladesh, from July 2019 to March 2021. The study aimed to evaluate outcome of modified D2 gastrectomy operation in gastric cancer patients with or without comorbidities. A total of 53 patients who met the inclusion criteria were enrolled in the study. The inclusion criteria consisted of patients with biopsy-proven and operable

adenocarcinoma of the stomach. Patients with stage IV diseases, previous gastric surgery, individuals unfit for surgery, and those unwilling to participate in the study were excluded. Preoperative evaluations were performed, including basic laboratory tests such as complete blood count (CBC), random blood sugar (RBS), serum creatinine, serum electrolytes, serum albumin, liver function tests, electrocardiogram (ECG), chest x-ray, ultrasound of the whole abdomen, contrast-enhanced computed tomography (CT) scan of the abdomen, and serum carcinoembryonic antigen (CEA) levels. Patients were selected for the surgical procedure based on proper staging evaluation. The surgery was performed as per standard guidelines, and modifications to the extent of lymph node dissection were implemented based on the procedure. Postoperative complications were monitored for a duration of 30 days to assess the outcome of surgery.

Statistical analysis was conducted to analyze the data using SPSS (Statistical Package for the Social Sciences) version 28. The available statistical analysis focused on determining the significance of the association between diabetes mellitus and wound infection. A single table presenting the p-value for this association was generated. No other tables, such as those displaying confidence intervals or odds ratios, were included in this study.

The study was approved by the Ethical Review Committee of National Institute of Cancer Research and Hospital, Mohakhali, Dhaka, Bangladesh,

RESULTS

Postoperative complications in this study were categorized as major complications including anastomotic leak and duodenal blow out and minor complications including wound infection, wound dehiscence, pulmonary infection, and paralytic ileus.

Table I: Association of different demographic parameters, and postoperative complication in gastric cancer (n=53)

Parameters	Complications			P value
	no	minor	major	
Age				
<45	9(32.1%)	3(14.3%)	1(25.0)	0.356a
≤45	19(67.9)	18(85.7)	3(75)	
Sex				
Male	21(75)	17(81)	3(75)	0.88b
Female	7(25)	4 (19)	1(25)	
Smoking				
Yes	18(64.3)	15(71.4)	3 (75)	0.827c
No	10(35.7)	6(28.6)	1(25)	

a.X²= 2.068 df=2, b.X²= .256 df=2 c.X²= .380 df=2

The study analyzed the association of demographic parameters with postoperative complications in gastric cancer patients. Age was categorized into two groups: below 45, 45 and above. In case of patients with major complications 25% patients were below 45yrs and 75% were 45 and above. Among minor complications group 14.3% patients were below 45 and 85.7% were 45 and above. Among patients with no complications, 32.1% were below 45 and 67.9% were 45 and above. However, the association between age and postoperative complications was not statistically significant ($p=0.356$, chi-square test, $df=2$). The study also examined the association between sex and postoperative complications. In case of patients with major complications 75% patients were male and 25% were female. Among minor complications group 81% patients were male and 19% were female. Among patients with no complications, 75% were male and 25% were female. The association between sex and postoperative complications was not statistically significant ($p=0.88$, chi-square test, $df=2$). Similarly, the association between smoking status and postoperative complications was investigated. In case of patients with major complications 75% patients were smoker and 25% were non-smokers. Among minor complications group 71.4% patients were smokers and 28.6% were non-smokers. Among patients with no complications, 64.3% were smokers and 35.7% were non-smokers. The association between smoking status and postoperative complications was not statistically significant ($p=0.827$, chi-square test, $df=2$). Although the associations did not reach statistical significance, it is noteworthy that chi-square values and degrees of freedom were reported for each association: age ($X^2=2.068$, $df=2$), sex ($X^2=0.256$, $df=2$), and smoking status ($X^2=0.380$, $df=2$). These values provide insights into the strength and significance of the associations in this analysis.

Table II : *Distribution of patients according to clinical presentation (n=53)*

Clinical presentation	Frequency (%)
Anorexia	49(92.45%)
Dyspepsia	38(71.69%)
Vomiting	43(81.13%)
Epigastric pain	19(35.84%)
Abdominal lump	11(20.75%)
Hematemesis	3(5.67%)
Melena	5(9.43%)
Weight loss	12(22.64%)

Table II provides the distribution of patients according to their clinical presentation in a cohort of 53 individuals. The clinical presentations evaluated in this study include anorexia, dyspepsia, vomiting, epigastric pain, abdominal lump, hematemesis, melena, and weight loss. Among the patients, 49 (92.45%) reported experiencing anorexia, indicating a loss of appetite. Dyspepsia, characterized by recurrent or persistent discomfort or pain in the upper abdomen, was reported by 38 individuals (71.69%). Vomiting, defined as the forceful expulsion of stomach contents, was observed in 43 patients (81.13%). Epigastric pain, felt in the upper central part of the abdomen, was reported by 19 individuals (35.84%). Furthermore, 11 patients (20.75%) presented with an abdominal lump, which refers to a localized swelling or mass in the abdominal region. Hematemesis, the vomiting of blood, was reported by 3 individuals (5.67%). Additionally, 5 patients (9.43%) presented with melena, which is the passage of dark, tarry stools containing blood. Weight loss, defined as a reduction in body weight, was observed in 12 individuals (22.64%).

Table III : *Distribution of patients according to postoperative findings (n=53)*

Postoperative findings	Frequency (%)
Postoperative wound infection	
Present	16. (30.19%)
Absent	37. (69.81%)
Wound dehiscence	
Present	2 (3.77%)
Absent	51 (96.23%)
Anastomotic leakage	
Present	2 (3.77%)
Absent	51 (96.23%)
Postoperative ileus (in days)	
>4	8 (15.09%)
≤4	45 (84.91%)
Duodenal blow out	
Present	2 (3.77%)
Absent	51 (96.23%)
Pulmonary infection	
Present	8 (15.09%)
Absent	45 (84.91%)

Regarding postoperative wound infection, 16 patients (30.19%) presented with this complication, while 37 patients (69.81%) did not. Similarly, for wound dehiscence, only 2 patients (3.77%) experienced this condition, while the majority, 51 patients (96.23%), did not exhibit wound dehiscence. The occurrence of anastomotic leakage was also low, with 2 patients (3.77%) demonstrating this complication, while 51 patients (96.23%) did not experience it. Postoperative ileus, defined as a disruption of normal bowel function after surgery, was observed in 8 patients (15.09%) for more than 4 days, while 45 patients (84.91%) had a postoperative ileus duration of 4 days or less. In terms of duodenal blowout, 2 patients (3.77%) presented with this complication, while 51 patients (96.23%) did not. Lastly, pulmonary infection was observed in 8 patients (15.09%), while 45 patients (84.91%) did not experience this postoperative complication.

Table IV: Distribution of patients according to co-morbidities (n=53)

Co-morbidities	Frequency (%)
Diabetes mellitus (DM)	17(32.07%)
Hypertension (HTN)	13(24.52%)
Both DM & HTN	11(20.75%)
No Co-Morbidities	12(22.66%)

Among the patients, 17 individuals (32.07%) had diabetes mellitus (DM). Additionally, 13 patients (24.52%) presented with hypertension (HTN). Moreover, 11 patients (20.75%) had both diabetes mellitus and hypertension (DM&HTN), indicating a co-occurrence of these two conditions. 12 patients (22.66%) had no co-morbidities.

Table V: Association of DM with Wound infection in gastric cancer(n=53)

DM	Wound infection		P value
	No (n=37)	Yes (n=16)	
Non Diabetic (25)	23	2	<.001
Diabetic (28)	14	14	

Among the 25 patients without DM, 23 did not experience wound infection, while 2 had wound infections. In contrast, among the 28 patients with DM, 14 had wound infections, while the remaining

14 did not. The association between DM and wound infection was found to be statistically significant, with a p-value of less than 0.001.

DISCUSSION

In this study, the mean age was observed to be 48.9 ± 9.36 years, with the most common age group affected being 45-54 years (49%). These findings closely resemble those reported by Dr. Sahu et al., who observed a mean age of 49.10 ± 8.32 years.¹⁰ However, Galata et al., reported a higher mean age of 65 years in their study, which differs from the current study.¹¹ The proportion of females was considerably lower than males in this study, with 41 (77.35%) male patients and 12 (22.64%) female patients. The male-to-female ratio was 3:1. Similar findings were reported by Lam et al., who found a male-to-female ratio of 2:1, closely resembling the present study.¹² Galata et al. also observed a male predominance in their study.¹¹ The majority of the patients in this study were smokers, accounting for 36 (67.92%) cases. This finding aligns with the study by Crumley et al., which also found an association between smoking and gastric cancer.¹³ However, due to the small sample size, it was challenging to comment on the correlation between smoking and gastric cancer. No association was observed between smoking and postoperative complications in this study. The most commonly observed symptoms in the patients were anorexia (92.45%), vomiting (81.13%), dyspepsia (71.69%), epigastric pain (35.84%), weight loss (22.64%), and abdominal lump (20.75%). These clinical findings are consistent with those reported by Nafae et al., who also found anorexia, dyspepsia, abdominal pain, and weight loss as the most common symptoms.¹⁴ Postoperative complications in this study were categorized as major complications, including anastomotic leak and duodenal blow out, and minor complications, including wound infection, wound dehiscence, pulmonary infection, and paralytic ileus. Prolonged postoperative ileus, lasting more than 4 days, is a known complication following gastric cancer surgery.¹⁵ In this study, postoperative ileus duration was determined based on the patient’s appreciation of flatus and bowel sounds returning together, as bowel activity typically resumes within 3 days following abdominal surgery. However, in the context of this study’s perspective and open surgery, a cutoff of more than 4 days was arbitrarily chosen. The majority of cases had timely return of bowel activity, while 8 (15.09%) cases experienced

postoperative ileus lasting longer than 4 days. Among these cases, anastomotic leakage was a major complication observed in only 2 (3.77%) cases. Another major complication, duodenal blowout, was observed in 2 (3.77%) patients. The remaining 4 cases of postoperative ileus were considered idiopathic. Wound infection was present in 16 (30.19%) cases, which is higher compared to the 13% wound infection observed by Nafae et al., with a positive statistical significance associated with DM.¹⁴ Postoperative pulmonary infection was observed in 8 (15.09%) patients, and no association was found between pulmonary infection and smoking based on the statistical analysis. Only 2 (3.77%) patients developed wound dehiscence in this study. The majority of patients (29, 54.71%) did not experience any postoperative complications. The mortality rate in this study was only 1.08%, which aligns with findings from previous studies by Nafae et al. and Sahu et al.^{10,14}. The presence of preoperative comorbidities, particularly in oncologic patients, can contribute to the occurrence of postoperative complications. In this study, the most common comorbidity observed was DM in 28 (52.83%) patients, followed by hypertension in 24 (45.28%) patients, consistent with a previous Indian study by Dr. Sahu et al.^[10]. This study also found that gastric cancer patients with DM were more prone to developing wound infection, and a statistical association was observed between DM and postoperative wound infection.

CONCLUSION

Modified D2 gastrectomy is safe procedure and provide with acceptable postoperative outcomes in treatment of gastric cancer. Diabetes mellitus should be well controlled in gastric cancer patients before surgery for better postoperative outcome.

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