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ORIGINAL ARTICLE

Laparoscopy in surgical management of gastric cancer: A single center experience

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ABSTRACT

Background: Gastric cancer is the fourth most common cancer worldwide. Laparoscopic Gastrectomy is technically demanding surgery and its adequacy for lymph node clearance is controversial. The present work aims to evaluate feasibility and effectiveness of the laparoscopic method in treating gastric cancer.
Methods: A total sample of 15 patients presenting with non-metastatic cancer stomach were included in the study. Ages less than 15 years or older than 70 were excluded. Laparoscopic total gastrectomy and esophagojejunostomy was performed for proximal types of cancer, while laparoscopic subtotal gastrectomy with gastrojejunostomy and entero-enterostomy was done for distal stomach cancer.
Results: Mean age was 55.87+7.37 with male predominance (80%) and 26.7% were diabetics. Distal stomach cancer was the most prevalent type (73.3%). Total gastrectomy was done in 3 patients, subtotal gastrectomy in 11 patients, partial gastrectomy in 1 patient of Gist tumor. The mean operative time was 251.87+24.14 while average blood loss ranged from 150 to 310ml. Chest infection occurred in 2 patients, while wound infection and anastomotic leakage occurred in 1 patient each. Surgical margins were clear in 100% of patients (14.8+2.42 lymph node dissected). Adenocarcinoma was the commonest pathological type (60%). Mean hospital stay was 6.53 days while time to start oral feeding ranged from 2 to 5 days.
Conclusion: Total laparoscopic gastrectomy is safe and effective, and offers some advantages as low intra-operative blood loss and overall complication rates; few wound-related complications; quick recovery of gastrointestinal motility and a short hospital stay, but with a long operating time.
Keywords: Laparoscopic, gastrectomy, cancer, stomach

INTRODUCTION

Gastric cancer is one of the most common cancers worldwide. However, the worldwide incidence of gastric cancer has declined rapidly over the recent few decades. Globally, gastric cancer accounts for 989,600 new cases and 738,000 deaths annually[1].
Although the etiology of gastric cancer is multifactorial, more than 80% of cases have been attributed to *H. pylori* infection. In addition, diet, lifestyle, genetic, socioeconomic and other factors contribute to gastric carcinogenesis[2].
The symptoms of gastric cancer are generally nonspecific and contribute to its frequently advanced stage at the time of diagnosis. Symptoms include epigastric pain, early satiety, and weight loss. These symptoms are frequently mistaken for more common benign causes of dyspepsia including peptic ulcer disease (PUD) and gastritis[3]. The goal of any preoperative workup is twofold. The first is to gain information on prognosis to counsel the patient and family effectively. The second is to determine the extent of disease to determine the most appropriate course of therapy. The three main treatment paths are resection (with or without subsequent adjuvant therapy), neoadjuvant therapy followed by resection, or treatment of systemic disease without resection The main modalities for staging gastric adenocarcinoma and guiding therapy are endoscopy; EUS; cross-sectional imaging such as computed tomography (CT), magnetic resonance imaging (MRI), or positron emission tomography (PET); and diagnostic laparoscopy[3].

Complete surgical removal of a gastric cancer with resection of adjacent lymph nodes represents the best chance for long-term survival. The only widely accepted criteria of unresectability for gastric cancer are the presence of distant metastases, invasion of a major vascular structure, such as the aorta, or disease encasement or occlusion of the hepatic artery or celiac axis/proximal splenic artery[4].

Open gastrectomy remains the preferred surgical treatment for gastric cancer worldwide. In high-volume, experienced centers, however, laparoscopic gastric resection provides an alternative that offers patients a faster recovery and fewer complications while recovering a similar number of lymph nodes compared with open surgery[5].

The best contemporary evidence for the short-term advantages of laparoscopic, as compared with open, gastric surgery in prospective randomized trials includes the following: Laparoscopic gastrectomy is most commonly performed for early gastric cancers in patients who are not candidates for endoscopic resection[6].

In a recent meta-analysis[5], that included mostly retrospective studies comparing outcomes among patients who underwent laparoscopic or open gastric cancer surgery for resectable gastric cancer of all stages, five-year rates of overall survival, recurrence-free survival, and disease-specific survival were not significantly different with laparoscopic as compared with open surgery.

The aim of this work is to evaluate the feasibility and effectiveness of the laparoscopic method in treating gastric cancer in the era of minimal invasive surgeries and applying it as a routine practice in our hospital.

PATIENTS AND METHODS

After approval of the Ethical Committee, the study was conducted on patients presented with gastric cancer to the outpatient clinic of Zagazig University Hospitals. The study was prospectively conducted during the period from August, 2017 to August, 2019 and included a comprehensive sample of 15 patients all admitted on elective basis. The inclusion criteria included patients proved to have gastric cancer and age 15 to 70 years. While patients with distant metastasis (stage IV), patients presenting to the emergency department with complications and patients converted to open surgery were excluded from the study.

All patients were subjected to history taking, general examination, abdominal examination including PR and PV. Routine Laboratory investigations were done including Complete blood count, Kidney function tests, Liver function tests, Random Blood glucose level, Prothrombin time and concentration and INR. Special Laboratory investigations included Serum carcinoembryonic antigen (CEA). Moreover, Chest x-ray, pelvi-abdominal ultrasound and CT scan of the abdomen and pelvis with IV& oral contrast were done for all patients. Gastroscopic examination (Fig. 1) and biopsy was done as a routine diagnostic test.

Patients were admitted to oncosurgery unit for preoperative preparation which included deep venous thrombosis (DVT) prophylaxis (Enoxaparin 0.5mg/kg) 12 hours preoperatively and continued till full mobilization and 1gm 3rd generation cephalosporin and metronidazole 1 hour preoperatively.

Written informed consent was obtained from all participants. The work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Operative Technique

After informed consent was obtained, general anesthesia was administered; Foley's catheter and nasogastric tube were inserted. Patient was positioned in a supine-reversed trendelenburg position. The abdomen was prepped and draped. The main surgeon stood on the patient's left side, the assistant is on the right side, and the camera operator is between the patient's legs, while during dissection of the splenic hilar lymph nodes (LNs), the surgeon stood between the patient's legs, with the assistant and camera operator both on the patient's right. A 10-mm trocar is inserted 1 cm below the umbilicus as a visual port. Another 12-mm trocar is

introduced in the left preaxillary line 2 cm below the costal margin as a major hand port. A 5-mm trocar is then inserted in the left midclavicular line 2 cm above the umbilicus as a tractive port. Two 5-mm trocars were placed in the right midclavicular line 2 cm above the umbilicus and in the right preaxillary line 2 cm below the costal margin as two accessory ports (Fig. 2).

After establishment of pneumoperitoneum, the dissection began with omentectomy (either partial or total). Dissection is then continued around the pylorus while the assistant retracts the stomach anteriorly and the right gastro-epiploic vein is clipped in flush to its trunk. Dissection along the avascular plane between the pancreas and mesocolon is carried out until the second part of duodenum is reached. Identification of the anterosuperior pancreatico-duodenal vein and removal of all soft tissue proximally to the vein resulted in complete dissection of lymph node station 6. The right gastroepiploic artery is clipped and cut at its origin from gastrodoudenal artery just above the pancreatic head. The pyloric vessels are then sectioned, the pylorus is freed (Fig. 4), and infrapyloric tiers (station 4 & 6) lymph node basins are resected together. Dissection around the right gastric artery should be as complete as possible to ease identification and complete dissection of lymph nodes around the hepatic artery.

Small suprapyloric branches or right gastric artery are meticulously dissected using an ultrasonic device as they easily produce bleeding, the lesser sac is then opened. After the lesser omentum of the upper duodenum was resected, the right gastric vessels were identified from the hepatic artery and ligated at the root. Then, the duodenum was transected 1-2 cm distal to the pyloric ring using a laparoscopic linear stapler (cutter). The gastrohepatic ligament is dissected to open the lesser sac up to the gastro-esophageal junction area and particularly opening the right side of the hiatus.

The supra-pancreatic area lymph node dissection is started from the common hepatic toward the splenic artery or from central area around left gastric artery then in right and left direction. Lymphadenectomy of this area includes station 7 (left gastric a.) in D1 dissection, station 8 (common hepatic a.), station 9 (celiac axis) for a D1+ dissection, station 11(proximal splenic a.) and station 12 (proper hepatic a.) for D2 dissection. Then the left gastric vein is identified and ligated with clips and the left gastric artery is cleared at its base and ligated with 2 clips. Dissection is continued to free the posterior wall of cardia and dissect lymph node station 1(righ paracardial). Proximal transection sites on the stomach are selected according to the location of the tumour, and transaction is done using multiple 45- or 60-mm endoscopic linear stapler with blue cartridge (3.5 mm staple load). In case of total gastrectomy, we continue mobilization of the fundus and intra-abdominal part of the esophagus. The short gastric vessels, posterior attachments of lesser curve and phreno-esophageal ligament are divided using ultrasonic coagulating shears, and the distal esophagus is mobilized well into the mediastinum.

Roux-en-Y reconstruction was done in both subtotal and total gastrectomy cases (Fig. 5). A 5 cm Pfannenstiel incision is then made. The specimen is then exteriorized (Fig. 6). After closure of this incision, pneumoperitoneum was recreated and hemostasis was done and a drain was inserted at gastro or osophago-jejunal anastmosis another was inserted at jejunojejunal anastmosis.

Patients were followed-up in the post-operative period and data was collected regarding operation time, blood loss and transfusion requirements or any intraoperative events. Post-operative data included intensive care admission, time of return of bowel function, time until resumption of full oral intake, length of hospital stay and complications and mortality. Detailed pathological data including histopathology, grade of differentiation, tumor size, safety margins, TNM stage, and the number of lymph nodes harvested were also recorded. Six months follow up for recurrence, port site and distant metastasis were documented.

The collected data were analyzed by computer using Statistical Package of Social Services

version 24 (SPSS). Data were represented in tables and graphs, Continuous Quantitative variables e.g. age were expressed as the mean ± SD & median (range), and categorical qualitative variables were expressed as absolute frequencies (number)& relative frequencies (percentage).

RESULTS

The study included 15 patients (12 males and 3 females). Most of the studied group were males (80%), Their ages ranged from 38 to 67 years old, with a mean of 55.87 ± 7.37 years old, 2/3 of them (66.7%) aged from 50-60 years (Table 1). About 75% of the studied cancer patients had cancer at the distal part of stomach, only 6.7% had tumor at the proximal part of the stomach (Table 2).

D2 subtotal gastrectomy was done in 11 patients, D2 total gastrectomy was done in 3 cases, partial gastrectomy for GIST tuomr was done in only one case of the studied patients. Mean operation time was 251.87± 24.14 minutes, operation time ranged from 180 min till 280 minutes, regarding amount of blood loss, it ranged from 150 to 310 ml with a mean of 238 ± 40.08 ml.

Post-operative complications, wound infection and leak occurred only in 6.7% of the studied cases, while chest infection was complicated in 13.3% of the studied patients. 73.3% of the operated cases need ICU, post-operative embolism occurred only in 6.7% of the studied cases, while all the operated cancer patients survived (Table 3).

Resection of affected segment with adequate safety margins occurred in 100% of the studied cases and median of draining lymph nodes number was 15, and it ranged from 8 to 19 lymph node. Adenocarcinoma was the most common type on histopathological examination in 60% of cases, followed by Mucinous adenocarcinoma among 26.7% of them, Signet ring adenocarcinoma and GIST was found in only 6.7% of the studied patients.

Mean Length of hospital stays was 6.53 ± 3.7 days, it ranged from 4 till 20 days, regarding time of start oral feeding, it ranged from 2 to 5 days with a mean of 3.53 ± 0.74 days (Table 4).

Short term follow-up for six months was done for all cases, no recurrence was detected.

Table (1): Demographic data of the studied stomach cancer cases.

Demographic data	Studied cases *(n=15)*	
	No.	**%**
Age (years)		
Mean ± SD	55.87 ± 7.37	
Median (Range)	56 (38 - 67)	
Age group		
Less than 40	1	6.7
40	1	6.7
50-	10	66.7
≥60	3	20.0
Sex		
Male	12	80.0
Female	3	20.0
DM		
Absent	11	73.3
Present	4	26.7

Table (2): Tumor site among the studied cancer stomach cases.

Item	Studied cases *(n=15)*	
	No.	**%**
Tumor site		
Proximal	1	6.7
Mid body	3	20.0
Distal	11	73.3

Table (3): Intra and post-operative events among the studied stomach cancer cases.

Item	Studied cases *(n=15)*	
Operation time (min)		
Mean ± SD	251.87 ± 24.14	
Median (Range)	256 (180 - 280)	
Amount of blood loss (ml)		
Mean ± SD	238 ± 40.08	
Median (Range)	235 (150 - 310)	
Wound infection		
Absent	14	93.3
Present	1	6.7
Leak		
Absent	14	93.3
Present	1	6.7
Chest infection		
Absent	13	86.7
Present	2	13.3
Need for ICU		
Absent	4	26.7
Present	11	73.3
Post-operative embolism		
Absent	14	93.3
Present	1	6.7
Mortality		
Died	0	0.0
Survived	15	100.0

Table (4): Length of hospital stays post-operative among the studied stomach cancer cases.

Item	Studied cases *(n=15)*
Length of hospital stays *(days)*	
Mean ± SD	6.53 ± 3.7
Median (Range)	6 (4 - 20)
Time of start oral feeding *(days)*	
Mean ± SD	3.53 ± 0.74
Median (Range)	4 (2 - 5)

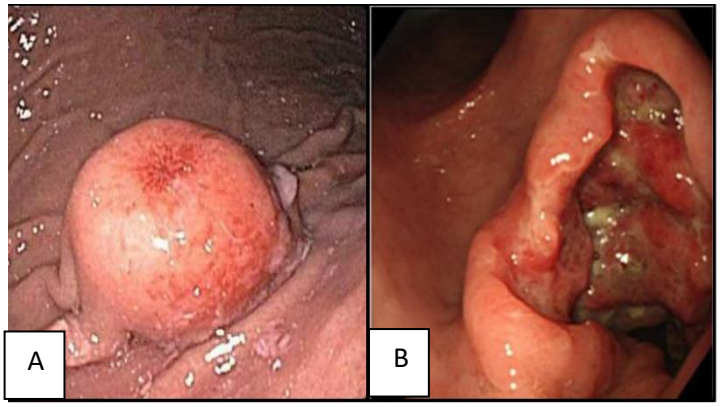

Fig. (1): preoperative endoscopic veiw of 2 cases of cancer stomach one of them (A) proved to be a malignant GIST and other was adenocarcinoma (B)

Fig. (2): Trocar placement and insertion sites.

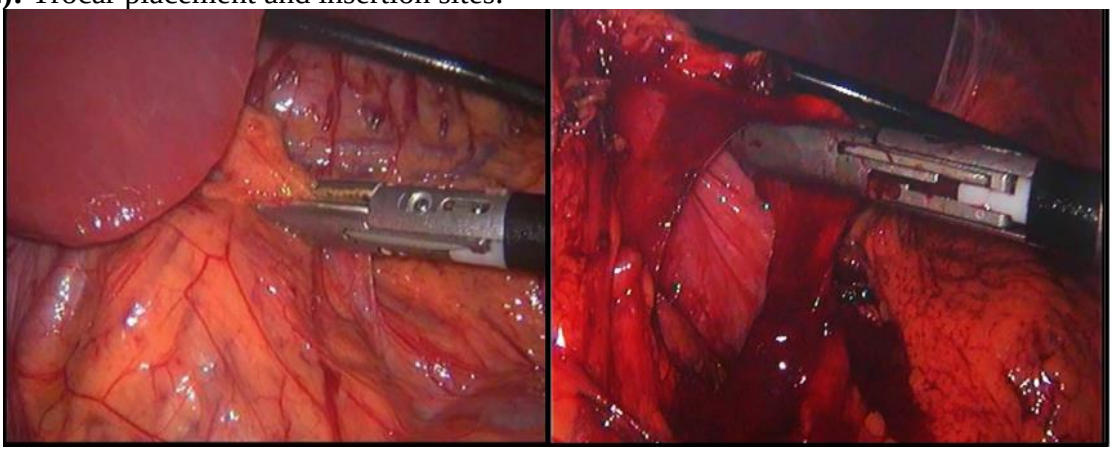

Fig. (3): omentectomy and opening lesser sac.

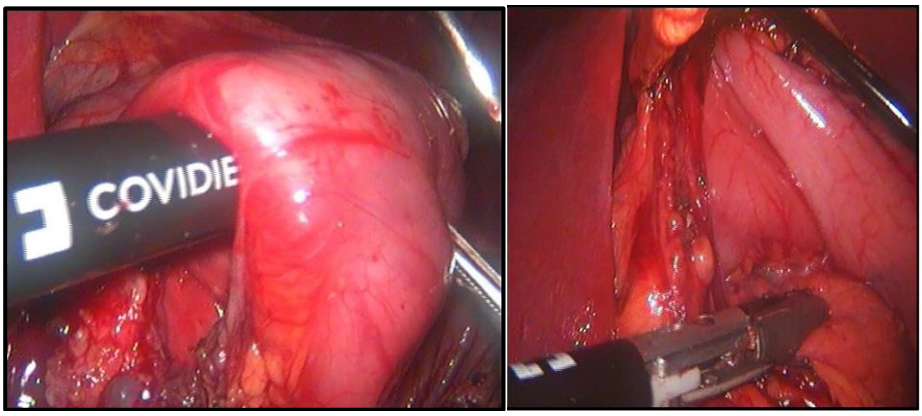

Fig. (4): infrapyloric dissection and mobilization.

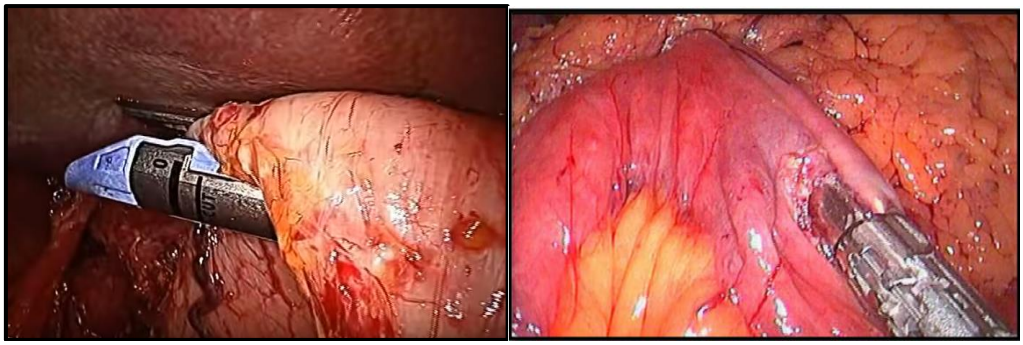

Fig. (5): Gastric transection and anastomosis performed.

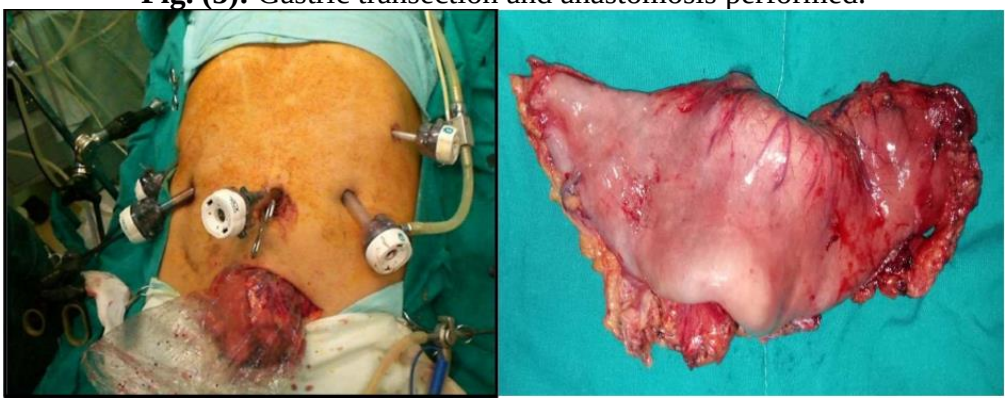

Fig (6): specimen extraction

DISCUSSION

Laparoscopic surgery, and more specifically laparoscopic distal gastrectomy, has been used widely in the far East to treat early gastric cancers and is associated with many advantages over open surgery. On the other hand, laparoscopic total gastrectomy with lymph node dissection, is associated with a high risk of bleeding and a technically demanding anastomosis, all within a narrow operating field. However, with technical advances and improved instrumentation, it is now being used increasingly to treat gastric cancer[7].

Okada et al.[8]in a study of the epidemiology of gastric cancer, they found that patients with gastric cancer were more likely to be male (73.2%) of the cases, the age range of diagnosing gastric cancer was 60-69 years, this is in line with our results.

Initial criticism of laparoscopic gastrectomy focused on the longer operative time required for these procedures. This fact neglected the beneficial economic advantage of shorter hospital stay observed inpatients who

underwent laparoscopic gastrectomy. With improvement of the instrumentation & refinement of technique, operative time has decreased[9].

Our analyses indicated that the mean operative time was similar to previous studies[10-12], yet longer than others[6,13]. The long operative time in our study is the due our early experience in laparoscopic gastrectomy. *Zhang and Tanigawa*[14]reported on the learning curve of laparoscopic surgery for gastric cancer and concluded that 60~90 cases of experience were required to complete the learning curve.

Our results showed that the amount of intraoperative blood loss was (238± 40.08ml), this is low amount in comparison with studies[12] compared open and laparoscopic gastric cancer management which reported less intraoperative loss in laparoscopic group. This be caused by usual using of modern energy devices during laparoscopic surgery as minor oozing compromise the laparoscopic view.

Xiong et al.[7]compared open and laparoscopic gastrectomy indicated that the overall complication rate was significantly lower in the laparoscopic total gastrectomy (LTG) group compared with the open total gastrectomy (OTG) group (OR= 0.73, 95%CI: 0.57-0.92, *P* = 0.009). In our study the post-operative complications include one case of wound infection (6.7 %) in a patient with poor controlled DM. Also there is a one case (6.7%) of leakage post-operative which was managed conservatively and close spontaneously. ***Kim et al.***[6]reported 3 cases (1.45%) of leakage in open group and zero in laparoscopic group. ***Kim et al.***[6]explained that by the continuous advances in laparoscopic stapling systems and by the less traction applied on gastric and esophageal remnant during laparoscopy avoiding affection of vascularity.

Xiong et al.[7]reported the duration of hospital stay indicated that laparoscopic gastrectomy was associated with a significantly shorter postoperative hospital stay compared with open gastrectomy. In our study the length of hospital stay was (6.53± 3.7) days, range (4-20) days. The longest hospital stay was 20 days for the case of leakage, this is in line with ***Kim et al.***[6] results as hospital stay in their study in laparoscopic group was 7 days. Surgical resection is the treatment of choice for gastric cancer, but the extents of resection and lymphadenectomy during gastrectomy remain controversial. However, a recent randomized trial confirmed the survival benefit of D2 lymph node dissection while controlling for the morbidity of lymph node dissection[15].

The mean of lymph nodes harvested in our study was (14.8 ± 2.42) lymph nodes, the median is (8 - 19) lymph nodes. The resection margins were free in all our cases, there is no recurrence in the period of short term follow up (6 months) in our study. This indicate the oncological safety of laparoscopic gastrectomy. But this results need to be confirmed by large randomized trial with long term follow up.

CONCLUSION

Total laparoscopic gastrectomy is safe and effective, and may offer some advantages in the treatment of gastric cancer as low intra-operative blood loss and overall complication rates; few wound-related complications; quick recovery of gastrointestinal motility and a short hospital stay, but with a long operating time.

Conflict of Interest: None.
Financial Disclosures: Nothing to disclose.

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