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## Original Article

# Value of Staging Laparoscopy in Gastrointestinal Tumors

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## ABSTRACT

**Background:** Many patients with gastrointestinal (GIT) cancer have locally advanced or metastatic disease. Staging laparoscopy can support more accurate staging of gastrointestinal cancer by guiding the most appropriate treatment and avoiding morbidity associated with non-therapeutic laparotomy.

**Aim of the Work:** The aim of the current study was to investigate the value of staging laparoscopy by assessing the avoidable surgery rate in gastrointestinal cancer patients who underwent surgery with curative intent.

**Patients and Methods:** A randomized prospective study included patients, whom had gastro-intestinal tumor already diagnosed either by tissue histopathology or radiological study. Staging laparoscopy was done, and operable tumors compared to non-operable ones.

**Results:** This study was conducted on 28 patents with GIT tumors who were underwent staging laparoscopy, most of them were males (89.3%) with the mean age 52±8 years and mean of their weight is 56±6 kg. About 42.9% of tumors involved in our study had local invasion, 25% had multiple LN, 7.14% had malignant ascites, 10.7% had peritoneal deposit, 25% had stage N1-3 and 17.8% had M1 stage by staging laparoscopy. There is no statistically significant difference between operable and non-operable cases as regards location of the tumor and the imaging done.

**Conclusion:** Laparoscopic staging may help with more precise staging of digestive malignancies, providing recommendations for the best course of treatment and preventing the morbidity linked to unnecessary laparotomies. The process makes it possible to examine intra-abdominal organs up close and provides a way to collect biopsy samples and aspiration cytology data.

**Keywords:** Laparoscopy; Tumor; Stomach; Intestine.

## INTRODUCTION

Gastrointestinal tract (GIT) cancers are counted as a major global health problem worldwide [1]. Several researches have revealed that completing adjunctive chemotherapy increases survival [2-4]. These tumors involve the GIT and its accessories such as the bile duct, pancreas and anus [5].

Cancer can arise from any part of the digestive tract. Adenocarcinomas generally begin from glandular cells that underline most of the GIT. Alternatively, squamous cell carcinoma can arise from the upper part of the esophagus and the lower border of the anus. Finally, neuroendocrine tumors may originate from cells that have similar functions with nerve cells, or hormone-making (endocrine) cells [6].

Laparoscopy has several benefits over laparotomy that improve patient wellbeing, such as avoiding a wider incision, excessive tissue manipulation, and retraction [7].

Laparoscopy was originally exclusively used for diagnostic purposes, but it quickly gained popularity around the globe for examining and diagnosing a variety of intra-abdominal pathologies [8].

Upon exploration, most of the gastro-intestinal cancers were discovered to be irresectable or un-operable. It is crucial to know the stage of the cancer so that each patient can receive the essential care with the least amount of morbidity [9].

Pre-operative imaging studies are noticeably less reliable in staging despite the advances in radiology techniques. Despite technological advancements, radiographic examination has limited accuracy in detecting hepatic metastases and peritoneal illness in GIT cancers [10]

Laparoscopy has been used for years for the staging of different GIT cancers including gastric [11], pancreatic [12] and esophageal [13] cancers. However, few studies evaluated staging laparoscopy in multiple GIT cancers in the developing countries.

The aim of the current study was to investigate the value of staging laparoscopy by assessing the avoidable surgery rate in gastrointestinal cancer patients who underwent surgery with curative intent.

## PATIENTS AND METHODS

A prospective study included 28 patients, whom had gastro-intestinal tumor already diagnosed either by tissue histopathology or radiological study. It was conducted at the Department of Surgery, Al-Azhar University Hospital, New Damietta. All patients with malignant gastro-intestinal tumors demonstrated to be operable and resectable by preoperative radiological investigations were included.

Exclusion criteria were patients unfit for surgery and patients with laparoscopic contraindication (re-operative abdomen, intraperitoneal mesh, peritonitis, mechanical bowel obstruction, hemorrhage, shock, ventriculoperitoneal shunt, coagulation disorders and pregnancy)

### Ethical considerations

A written informed consent was obtained from all patients before the operation after describing and explaining the operative and post-operative details and complications of each approach. The approval of ethical committee of Damietta Faculty of medicine, Al-Azhar University was obtained before initiating this study.

### Preoperative preparations

Routine preoperative laboratory tests included complete Blood Count, bleeding profile, serum creatinine, liver enzymes, serum albumin, serum electrolytes, ECG and Echo-cardiogram for known cardiac patients and hypertensive patients over 50 year and above 60 year. To weed out cases that weren't eligible, pulmonary function tests were done on patients with persistent chest diseases and esophageal tumors. Patients with stomach, small bowel, and colon tumors underwent CT abdomen; those with rectosigmoid tumors underwent MRI abdomen/pelvis; those with lower third esophageal tumors underwent CT chest; and those with worrisome hepatic lesions underwent triphasic CT of the liver.

### Operative technique

Under general anesthesia, all patients received diagnostic laparoscopies, and a single dose of prophylactic antibiotic was received. The patient was lying on his back, then 12–14 mm Hg insufflation pressures and a 30-degree

camera were employed. The trocars were placed in accordance with the location of the tumor: one 10 mm supra or infra umbilical for the camera, and one or two 5 mm trocars for dissecting and retracting equipment. Patients who had previous abdominal surgery were treated using the open Hasson approach and the first trocar.

Before performing any manipulations, the peritoneal surfaces were examined to look for any peritoneal malignant nodules; if any were found, ascites was drained and referred for histologic analysis. For liver metastases, the liver was examined. The ligament of Treitz, the paracolic gutters, the bowel surface, the lesser sac, the colon, the mesocolon, the root of the mesentery, the supra-hepatic and infra-hepatic spaces, and the pelvis were all examined. When necessary, the lesser sac was opened. In order to explore the hiatus for lower esophageal malignancies, the esophago-cardial peritoneal fold was cut, and the stomach was pulled either to the right or left. Any worrisome abdominal lesions and lymph nodes had biopsies obtained for histological analysis.

**Laparoscopic operability**

Depending on the extent and stage of the tumor, as well as the presence of liver metastases, peritoneal nodules, malignant ascites, or localized invasion of other organs, the decision was made to either proceed with laparoscopic or open surgery, or to refer the patients to another plan of treatment without surgery, such as chemotherapy and radiation therapy.

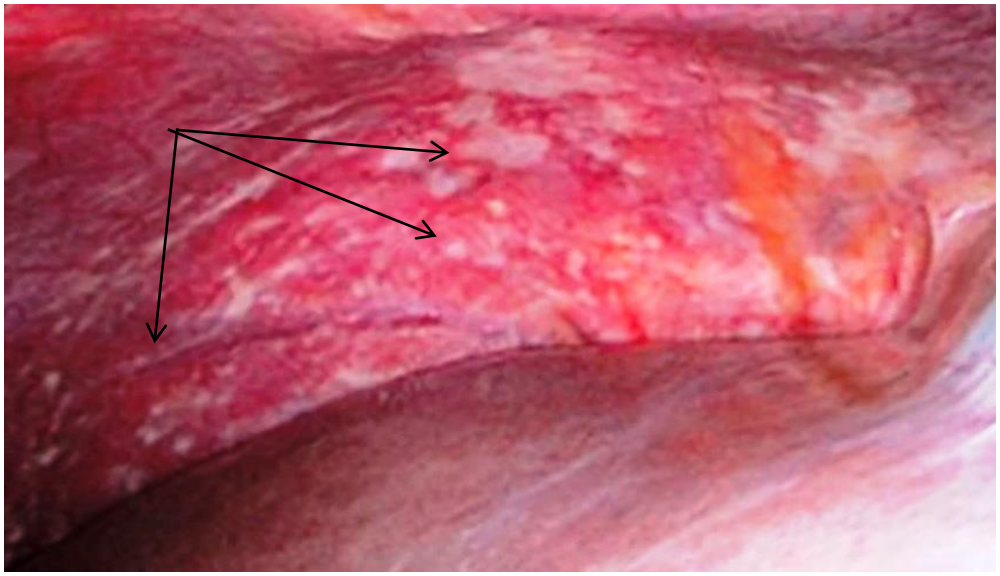

**Figure (1):** Right diaphragmatic peritoneal malignant deposits

**Statistical analysis**

Statistical Package for Social Sciences was used to computerize and statistically analyze the gathered data (SPSS 24 Inc. Chicago, IL, USA). Using the Shapiro Walk test, the distribution of the data was examined for normality. Frequencies and relative percentages were used to depict qualitative data. The difference between the qualitative variables was calculated using the chi square test (2) and Fisher exact, as shown. Quantitative information was presented as mean SD (Standard deviation). To calculate the difference between the quantitative variables, an independent t test was utilized. Between two diagnostic techniques, the Kappa test was employed to assess agreement. P-values 0.05 were used in all two-tailed statistical comparisons to denote significance.

## RESULTS

In the current study, most of patients were males (89.3%) with the mean age 52±8 years and mean of their weight is 56±6 kg. 42.9% of tumors involved in our study had local invasion, 25% had multiple LN, 7.14% had malignant ascites, 10.7% had peritoneal deposit, 25% had stage N1-3 and 17.8% had M1 stage by staging laparoscopy.

Table (2) shows detailed description of tumors data based on anatomical location. Gastric cancers were the most frequent type [9 cases], followed by colonic and lower esophageal [4 cases for each].

There was no statistically significant difference between operable and non-operable cases as regards location of the tumor, and the imaging done (table 3).

Regarding the relation between operability and presenting manifestations, it was found that operable cases outlined significant increased history of abdominal pain (P=0.031). Regarding laboratory data, there was no statistically significant difference between operable and non-operable cases regarding laboratory results except for serum albumin (P=0.005) being lower with non-operable cases (table 4).

There is statistically significant increased local invasion (P=0.001) and multiple LN (P=0.008) among non-operable cases detected by staging laparoscopy. Also, there was a statistically significant increased need for LN biopsy among non-operable GIT tumors compared to operable cases (table 5).

Table (6) showed Kappa agreement between operability by diagnostic laparoscopy and radiological imaging. There was slight agreement (kappa=0.117) between both modalities (P=0.483).

**Table (1):** General feature of studied cases

| Variables | | Total (n=28) |
|---|---|---|
| **Sex** | Females | 3 (10.7%) |
| | Males | 25 (89.3%) |
| **Age (years)** | | 52±8 |
| **Weight (Kg)** | | 56±6 |
| **Results of staging laparoscopy** | Local invasion | 12 (42.9%) |
| | Multiple LN | 7 (25%) |
| | Malignant ascites | 2 (7.14%) |
| | Peritoneal deposit | 3 (10.7%) |
| | N1-3 | 7 (25%) |
| | M1 | 5 (17.8%) |

**Table (2):** Details of tumors based on anatomical location

| | | Location Of Tumor | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Biliary** | **Cecum** | **Colon** | **Gastric** | **Hepatic** | **Lower Esophagus** | **Mesenteric** | **Pancreases** | **Rectosigmoid** | **Spleen** |
| **Total number of cases (28)** | | 1 | 1 | 4 | 9 | 3 | 4 | 1 | 2 | 1 | 2 |
| **Imaging** | CT abdomen | 0 | 0 | 4 | 9 | 0 | 0 | 0 | 1 | 0 | 0 |
| | CT chest | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 |
| | MRI abdomen | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| | Triphasic CT | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 2 |
| **Operability by radiological imaging** | No | 0 | 0 | 2 | 2 | 0 | 3 | 0 | 2 | 0 | 0 |
| | Yes | 1 | 1 | 2 | 7 | 3 | 1 | 1 | 0 | 1 | 2 |
| **N1-3** | No | 0 | 1 | 3 | 6 | 3 | 2 | 1 | 2 | 1 | 2 |
| | Yes | 1 | 0 | 1 | 3 | 0 | 2 | 0 | 0 | 0 | 0 |
| **M1** | No | 1 | 1 | 4 | 6 | 3 | 3 | 1 | 1 | 1 | 2 |
| | Yes | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 1 | 0 | 0 |
| **Operability by diagnostic laparoscopy** | No | 1 | 0 | 1 | 6 | 3 | 3 | 0 | 2 | 0 | 0 |
| | Yes | 0 | 1 | 3 | 3 | 0 | 1 | 1 | 0 | 1 | 2 |
| **Neo-adjuvant therapy** | No | 1 | 1 | 3 | 5 | 3 | 2 | 1 | 2 | 1 | 2 |
| | Yes | 0 | 0 | 1 | 4 | 0 | 2 | 0 | 0 | 0 | 0 |
| **Complications** | No | 1 | 1 | 3 | 8 | 2 | 3 | 1 | 2 | 1 | 2 |
| | Yes | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |

**Table (3):** Comparison of tumor location and imaging between operable and non-operable group

| | | Operability by diagnostic laparoscopy | | | | $X^2$ Test | P |
|---|---|---|---|---|---|---|---|
| | | No [n=16] | | Yes [n=12] | | | |
| | | No. | % | N | % | | |
| **Location of tumor** | Biliary | 1 | 6.3% | 0 | 0.0% | 13.48 | 0.142 |
| | Cecum | 0 | 0.0% | 1 | 8.3% | | |
| | Colon | 1 | 8.3% | 3 | 18.8% | | |
| | Gastric | 6 | 43.8% | 3 | 16.7% | | |
| | Hepatic | 3 | 25.0% | 0 | 0.0% | | |
| | Lower Esophagus | 3 | 25.0% | 1 | 6.3% | | |
| | Mesenteric | 0 | 0.0% | 1 | 8.3% | | |
| | Pancreases | 2 | 12.5% | 0 | 0.0% | | |
| | Rectosigmoid | 0 | 6.3% | 1 | 6.3% | | |
| | Spleen | 0 | 6.3% | 2 | 25.0% | | |
| **Imaging** | CT abdomen | 11 | 68.8% | 3 | 25.0% | 5.59 | 0.133 |
| | CT chest | 1 | 6.3% | 3 | 25.0% | | |
| | MRI abdomen | 1 | 6.3% | 2 | 16.7% | | |
| | Triphasic CT | 3 | 18.8% | 4 | 33.3% | | |

**Table (4):** Comparison of presenting manifestations and investigations between operable and non-operable patients

| | Operability by diagnostic laparoscopy | | Test | P |
|---|---|---|---|---|
| | No (n=16) | Yes (n=12) | | |
| **loss of weight** | 7 (43.8%) | 4 (33.3%) | 0.31 | 0.576 |
| **Hematemesis** | 1 (6.3%) | 1 (8.3%) | 0.04 | 0.832 |
| **Abdominal pain** | 3 (18.8%) | 7 (58.3%) | 4.68 | **0.031** |
| **Constipation** | 4 (25.0%) | 2 (16.7%) | 0.28 | 0.595 |
| **Bleeding per rectum** | 1 (6.3%) | 1 (8.3%) | 0.04 | 0.832 |
| **Dyspepsia** | 6 (37.5%) | 1 (8.3%) | 3.11 | 0.078 |
| **Hemoglobin** | 12.5±0.8 | 12.4±1.6 | -0.36 | 0.720 |
| **WBCs** | 8.5±1.5 | 9.0±1.6 | 0.69 | 0.499 |
| **Serum albumin** | 3.0±0.2 | 3.3±0.4 | 3.10 | **0.005** |

**Table (5):** Comparison of tumor and staging laparoscopy related data between both operable and non-operable patients

| | Operability by diagnostic laparoscopy | | | | $X^2$ Test | P |
|---|---|---|---|---|---|---|
| | No (n=16) | | Yes (n=12) | | | |
| | No. | % | No. | % | | |
| **Locally invasion** | 11 | 68.8% | 1 | 8.3% | 10.22 | **0.001** |
| **Multiple LN** | 7 | 43.8% | 0 | 0.0% | 7.00 | **0.008** |
| **Malignant ascites** | 2 | 12.5% | 0 | 0.0% | 1.6 | 0.204 |
| **Peritoneal deposit** | 3 | 18.8% | 0 | 0.0% | 2.52 | 0.112 |
| **Hepatic biopsy** | 8 | 50.0% | 6 | 50.0% | 0.001 | >0.999 |
| **Peritoneal biopsy** | 7 | 43.8% | 5 | 41.7% | 0.01 | 0.912 |
| **M1 (on frozen section)** | 6 | 37.5% | 6 | 50.0% | 0.44 | 0.508 |
| **LN biopsy** | 8 | 50.0% | 1 | 8.3% | 5.46 | **0.019** |
| **N1-3 (non-frozen sections)** | 5 | 31.3% | 2 | 16.7% | 0.78 | 0.378 |
| **Positive peritoneal cytology** | 7 | 43.8% | 3 | 25.0% | 1.05 | 0.306 |
| **Primary tumor resectable** | 9 | 56.3% | 9 | 75.0% | 1.05 | 0.306 |
| **Resectable metastasis (colorectal cancer); n=14** | 1 | 6.3% | 3 | 25.0% | 2.11 | 0.349 |
| **Laparoscopy palliative surgery** | 3 | 18.8% | 2 | 16.7% | 0.02 | 0.887 |
| **Complications** | 2 | 12.5% | 2 | 16.7% | 0.10 | 0.755 |
| **Need for Neoadjuvant therapy** | 3 | 18.8% | 4 | 33.3% | 0.78 | 0.378 |

**Table (6):** Kappa agreement and comparison of tumor operability by diagnostic laparoscopy and radiological imaging

| | | Operability by Laparoscopy | | | | Total (n=28) | | Kappa test | $X^2$ Test | P |
|---|---|---|---|---|---|---|---|---|---|---|
| | | No (n=16) | | Yes (n=12) | | | | | | |
| **Operability by radiological imaging** | No | 6 | 37.5% | 3 | 25.0% | 9 | 32.1% | 0.117 | 0.49 | 0.483 |
| | Yes | 10 | 62.5% | 9 | 75.0% | 19 | 67.9% | | | |

## DISCUSSION

Since a significant portion of patients with gastro-intestinal cancers present with locally advanced or metastatic disease, correct staging aids in the selection of the best treatment for either cure or palliation. Many patients are discovered to have undetected, incurable disease at exploration even after sophisticated pre-operative imaging screening (trans-abdominal and endoscopic ultrasound, CT scan, MRI, and PET scan). Laparoscopic staging of digestive malignancies may help achieve more precise staging, provide recommendations for the best course of treatment, and prevent the morbidity of unnecessary laparotomies [10-14].

Our study included 28 patients with GIT tumors (16 inoperable and 12 operable) by diagnostic laparoscopy. Twelve (42.9%) of the involved tumors had local invasion, seven (25%) had multiple LN, two patients (7.14%) had malignant ascites, three patients (10.7%) had peritoneal deposit, seventeen (25%) patients had stage N1-3 and twenty (17.8%) patients had M1 stage by staging laparoscopy**.**

The presence of peritoneal disease has a significant impact on prognosis in multiple GIT and gynecological malignancies which even include death. Several theories can explain peritoneal spread from gastrointestinal cancers including; spontaneous or iatrogenic perforation of the primary tumor, or spillage of tumor cells from transected lymphatic channels or blood vessels at the time of surgical resection. Other theories include cancer cell spread via lymphatic or hematogenous routes [15].

For esophageal cancer, preoperative imaging may predict resectable disease, although a significant percentage (20-65%) of esophageal cancers was found to be un-resectable at the time of exploration [16]**.**

**El-Tokhy** [17] reported that out of 3 patients with lower third esophageal cancer which they are operable preoperative by imaging, 2 of them (66.7%) found to be inoperable after diagnostic laparoscopy.

In our current, study there is 4 patients with lower esophageal tumors which proved to be operable preoperative by imaging. one patient (8.3%) of all operable 12 cases found to be operable after diagnostic laparoscopy **.**

For gastric tumors, previous study reported that diagnostic laparoscopy has an accuracy of 89-100% for staging, identifying occult metastasis or unresectable disease, and avoids nontherapeutic laparotomy in 13-57% of gastric patients although of negative preoperative imaging workup [18, 19].

In our study, nine (32.1%) of all patients had gastric tumor, three patients (25%) were operable and 7 (43.8%) patients of gastric tumor were inoperable by DL**.** Laparoscopic surgery for colon cancer has significantly increased during the past ten years. This rise has been influenced by numerous variables. The surgical treatment can successfully stop the spread and implantation of cancer cells at the port site. Additionally, numerous studies have reported on the short- and long-term follow-up outcomes of open and laparoscopic surgery, and those outcomes have repeatedly demonstrated the superior oncological outcome of open surgery. This is the main factor contributing to laparoscopic surgery's current reputation for safety. Additionally, improvements in surgical methods and the creation of numerous laparoscopic surgical devices are other factors contributing to the rise in laparoscopic surgery [20].

In the current study, of 4 patients with colonic tumors, only 3 (75%) were operable. However, another study by **El-Tokhy** [17] reported that 25% of colon cancer was operable.

In our study there is statistically significant increased local invasion and multiple LN among

non-operable cases detected by staging laparoscopy with p-value =0.001, and 0.008 respectively. This goes in run with **El-Tokhy** [17] study in which staging laparoscopy had statistically significant increased local invasion, multiple LN, and peritoneal deposits among non-operable cases with p-value =0.000, 0.000, and 0.003 respectively.

According to reports, lympho-vascular invasion, the cancer's stage, histologic grade, and adjuvant treatment are all factors that affect a patient's chance of surviving colon cancer. Advanced digestive malignancies with peritoneal and hepatic metastases are the main indications for staging laparoscopy. Neoadjuvant treatment increases quality of life and survival in a large number of patients with distant metastases [21].

Diagnostic laparoscopy is rarely beneficial for patients with primary colorectal cancer who do not have evidence of systemic metastasis, partly due to its limited yield in detecting occult or subclinical metastasis but also because the majority of patients have a colectomy [21].

When staging laparoscopy was performed for recognition of the quantity and site of hepatic metastasis along with to exclude peritoneal or extra hepatic disease, a non-therapeutic laparotomy can be evaded in 25-45% of patients [22].

This study shows that the agreement was slight (0.117) between diagnostic laparoscopy and radiological imaging [P=0.483]. **El-Tokhy** [17] reported that sensitivity of radiological imaging for staging was 62% after comparing to staging laparoscopy.

Another study by **Kakroo et al.** [23] reported that laparoscopy had 53% sensitivity and 91% specificity for staging of gastric carcinoma. Also, **Burbidge et al.** [24] study was conducted to compare both CT and staging laparoscopy in staging of gastric cancer and revealed that although of CT being highly specific, laparoscopy was more sensitive in staging of gastric cancer. Triphasic CT scan was less sensitive than laparoscopic ultrasound for detecting hepatic tumors, and its sensitivity was highly correlated with tumor size, with detection rates of 71% for tumors measuring 0–1 cm, 84% for tumors measuring 1-2 cm, 96% for tumors measuring 2-3 cm, and 100% for tumors measuring more than 3 cm [25].

The current study found a statistically significant increased need for LN biopsy among non-operable GIT tumors compared to operable cases [p-value =0.019]; this can be explained by advanced stage of non-operable cases. Another study by **Orsenigo et al.** [26] revealed that staging laparoscopy staining of LN mapping had accuracy 100% for early gastric cancer.

Laparoscopic staging may help with more precise staging of digestive malignancies, providing recommendations for the best course of treatment and preventing the morbidity linked to unnecessary laparotomies. The process makes it possible to examine intra-abdominal organs up close and provides a way to collect biopsy samples and aspiration cytology data.

The main limitation of the study is the small sample size, and the lack of specific GIT cancers, which restrict the generality of our results.

**Conclusion:** Laparoscopy is a more sensitive noninvasive tool, which can help in appropriate staging of gastrointestinal tumors and in turn prevents unneeded laparotomy for some cases, by appropriate detection of peritoneal deposits and lymph node involvement and distal metastasis especially the liver. Further longitudinal studies with large sample size are needed for further estimation of the diagnostic effect and staging by laparoscopy in gastrointestinal tumors. Staging laparoscopy should be put in mind as an easy noninvasive tool which can prevent overuse of laparotomy and open surgery in some cases.

**Conflict of Interest and Financial Disclosure:** None.

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