Original Article

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Oncology Section

Impact of Staging Laparoscopy on Treatment Intent in Non Metastatic Gastric Cancer: A Cross-sectional Study

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ABSTRACT

Introduction: Stomach cancer remains a leading cause of cancer-related mortality worldwide, with a poor prognosis primarily due to late-stage diagnosis. Despite advances in imaging modalities, the sensitivity in detecting peritoneal metastases is limited. Diagnostic Laparoscopy/Surgical Laparoscopy (SL) is a minimally invasive tool that enables direct visualisation of intra-abdominal disease, thereby improving staging accuracy and guiding treatment decisions.

Aim: To determine the proportion of patients with imaging-diagnosed non metastatic, resectable Gastric Cancer (GC) in whom SL alters the intended treatment plan.

Materials and Methods: This retrospective cross-sectional observational study was conducted in the Departments of Surgical Oncology and Surgical Gastroenterology at Government Medical College, Kottayam, Kerala, India, from February 1, 2019, to February 28, 2025. Data were analysed in March 2025. The study was designed as a surgical audit to assess the utility of staging laparoscopy (SL) in patients with biopsy-proven, resectable gastric cancer without evidence of metastasis on imaging. Register-based data were collected regarding SL findings and any modifications made to the treatment plan based on the SL results. Data were analysed using descriptive statistics and the Chi-square test for associations; results were presented as frequencies, percentages, means±Standard Deviation (SD), Odds Ratios (OR), and p-values.

Results: The mean age of the study participants was 59±9.76 years. Occult metastases were identified in 11 patients (40.7%); positive peritoneal cytology was present in 12 patients (44.4%). The presence of ascites was significantly associated with positive cytology (p=0.014), with an OR of 8. Furthermore, peritoneal deposits were present in 83.3% of cytology-positive cases, reinforcing the prognostic significance of SL. As a result, curative intent surgery was avoided in 11 (40.7%) of patients, redirecting them to palliative chemotherapy. No major complications were observed, and the mean hospital stay was one day.

Conclusion: Gastric cancer has a propensity for early peritoneal dissemination that may be missed on routine imaging. Therefore, patients planned for curative-intent therapy should undergo diagnostic laparoscopy to detect occult peritoneal disease that may alter treatment intent. The present study highlights that a significant number of patients experience a change in their treatment plans when SL is performed at the start of treatment.

Keywords: Adenocarcinoma stomach, Carcinoma stomach, Computed tomography, Hyperthermic intraperitoneal chemotherapy, Positron

INTRODUCTION

Stomach cancer is the fifth most common malignancy worldwide and a leading cause of cancer-related deaths [1]. Over 70% of cases occur in developing countries. In India, approximately 34,000 Gastric Cancer (GC) cases arise annually, with men being twice as likely to be affected. A recent survey ranks it as the second leading cause of cancer mortality in both men and women, with the highest incidence in the Northeast [2]. According to Global Cancer Observatory (GLOBOCAN) 2022, GC is the fifth most prevalent cancer (4.9%) and a major cause of cancer-related deaths globally [1]. By 2040, the incidence is expected to reach 1.8 million new cases, with 1.3 million deaths annually [3].

Advances in chemotherapy regimens, diagnostic technologies, surgical techniques, and multidisciplinary decision-making have significantly enhanced the management of advanced GC. These developments have enabled personalised treatment approaches, leading to improvements in overall survival and disease-free survival rates [4]. However, GC has a poor prognosis primarily because most patients are diagnosed at advanced stages, where the five-year survival rate is just 25% [5,6]. Peritoneal metastases occur in 15-30% of these cases, are challenging to manage, and are regarded as a terminal stage, with palliative systemic chemotherapy being the only treatment. Cytoreduction and Hyperthermic Intraperitoneal Chemotherapy (HIC) have emerged in recent years as potential solutions [7,8].

Despite advancements in imaging techniques like Computed Tomography (CT), Magnetic Resonance Imaging (MRI), and Positron Emission Tomography-CT (PET-CT), their ability to detect peritoneal metastases remains imperfect, with sensitivities of Contrast Enhanced CT or Contrast Enhanced Computed Tomography (CECT) and Fluorodeoxyglucose (FDG) PET being 75.6% and 35.3%, respectively [9,10].

The SL is a minimally invasive diagnostic technique used to stage gastrointestinal and gynecological tumours, including advanced GC. It involves a detailed visual examination of the abdominal cavity to identify any occult peritoneal metastases that may not have been detected through preoperative imaging [4].

The SL offers a direct, real-time assessment of intra-abdominal disease, uncovering occult metastases that imaging alone might miss [11,12]. By preventing unnecessary laparotomies and altering treatment plans in a significant number of cases, SL ensures that patients receive the most appropriate therapy without delay. Moreover, the detection of free intraperitoneal tumour cells, an ominous prognostic marker, further underscores its role [13,14]. Given its high diagnostic yield and ability to personalise treatment strategies, major international guidelines, including those from the European Society

for Medical Oncology (ESMO), National Comprehensive Cancer Network (NCCN), and National Cancer Grid (NCG), advocate for its routine use in staging advanced GC [15-18].

MATERIALS AND METHODS

This retrospective cross-sectional observational study (surgical audit) was conducted in the Departments of Surgical Oncology and Surgical Gastroenterology at Government Medical College, Kottayam, Kerala, India. The cohort consisted of patients who presented between February 1, 2019, and February 28, 2025. The study was approved by the Surgical Oncology Scientific Research Committee, and ethical clearance was obtained from the Institutional Review Board (IRB No. 5/2025) prior to data collection. Data were compiled and analysed in March 2025.

Inclusion and Exclusion criteria: Patients with histologically confirmed carcinoma of the stomach or Gastro-oesophageal (GE) junction, diagnosed through endoscopic biopsy, and without evidence of distant metastases on preoperative imaging (CT, MRI, or PET-CT), were included in the study. Patients who had already received chemotherapy prior to SL or were deemed medically unfit for surgery were excluded.

Study Procedure

Data were collected retrospectively from hospital records using a structured proforma. The recorded variables included demographic details (age, gender, co-morbidities), tumour characteristics (location, histology), imaging findings, SL findings, intraoperative and postoperative complications, mean hospital stay and any changes in the intended treatment plan following SL. All patients underwent standard preoperative evaluation, preanaesthesia clearance, and provided informed written consent prior to the procedure. Biopsy specimens and peritoneal fluid or washings collected during laparoscopy were sent for histopathological and cytological examination.

All cases were performed under general anaesthesia. The standard procedure involves creating a pneumoperitoneum using the open Hasson method followed by inserting a 10 mm trocar in the umbilical region for introducing a 30° laparoscopic camera. A 5 mm trocar is placed in the right upper quadrant, and, if required, another 5 mm port is placed in the left flank. The presence or absence of ascites is documented. The pelvis is examined in the Trendelenburg position, while the upper abdomen is assessed with the patient in a reverse Trendelenburg position. If ascites is present, fluid is collected for cytological analysis. If there is no ascites, a peritoneal wash cytology is taken. The examination includes the pelvic cavity, hepatic surface, gastrohepatic and gastrocolic omenta, right and left paracolic gutters, all peritoneal surfaces and mesentery along with bilateral adnexa in females. When assessment of local resectability was required, an additional port was placed in the left flank to facilitate evaluation of posterior gastric and tumour relations. Any suspicious lesions in the liver, omentum, or peritoneum are biopsied and sent for histopathological examination.

The primary outcome was the detection of occult metastatic disease, including peritoneal deposits and/or positive peritoneal cytology. Secondary outcomes included the incidence of procedure-related complications, the proportion of patients whose treatment plan was altered after SL and mean hospital stay.

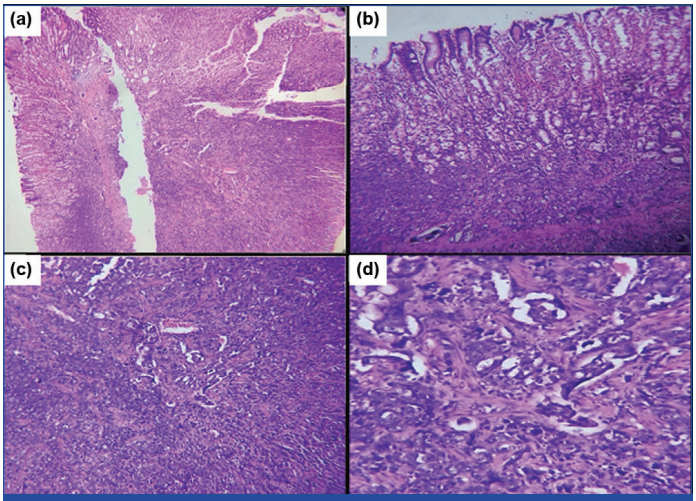
STATISTICAL ANALYSIS

Data were analysed using IBM Statistical Package for the Social Sciences (SPSS) version 20.0. Continuous variables were summarised as mean±SD, and categorical variables were expressed as frequencies and percentages. Associations between categorical variables were analysed using the Chi-square test, and OR with 95% confidence intervals were calculated where appropriate. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 27 patients who underwent surgical intervention for carcinoma of the stomach and gastroesophageal junction met the inclusion criteria, with a mean age of 59±9.76 years. On initial endoscopic biopsy, 14 patients (51.9%) were diagnosed with poorly differentiated adenocarcinoma[Table/Fig-1], while 11 patients (40.7%) had moderately differentiated adenocarcinoma [Table/Fig-2]. Two patients (7.4%) were diagnosed with squamous cell carcinoma of the lower oesophagus or gastro-oesophageal junction. Staging laparoscopy detected occult metastatic disease in 11 patients (40.7%), while 16 patients (59.3%) had no evidence of metastasis. Positive peritoneal cytology was observed in 12 patients (44.4%).

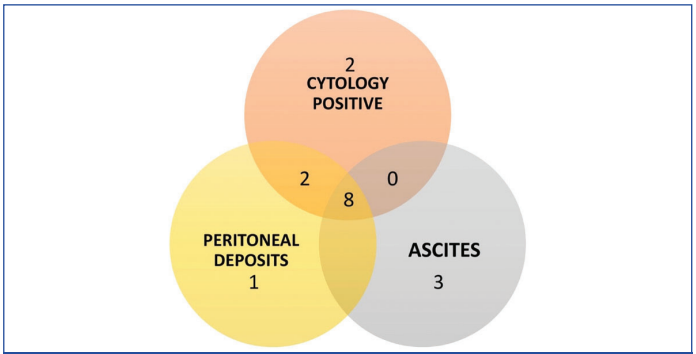
Ascites was present in 11 (40.7%) patients, of whom 8 (72.7%) had positive cytology [Table/Fig-3]. This association was statistically significant, with a p-value of 0.014. Patients with ascites had an eightfold increased risk of having positive peritoneal cytology (odds ratio=8). In addition, peritoneal deposits were identified in 83.3% of cytology-positive cases, demonstrating a strong correlation between cytology positivity and macroscopic peritoneal disease. Among cases with positive cytology, 8 (72.7%) had poorly differentiated adenocarcinoma compared to 5 (27.3%) with negative cytology. Ascites was present in 11 (42.3%) cases, of which 8 (72.7%) had peritoneal deposits, with a p-value of 0.005. The Chi-square test



[Table/Fig-1]: Histopathology: a) Gastric mucosa showing dysplasia with infiltration in poorly differentiated adenocarcinoma (4x); b) 20x magnification of a; c) Poorly differentiated adenocarcinoma– with poorly cohesive cells arranged in small nests and vague glandular formation (20x); d) 40x magnification of image c {Haematoxylin and Eosin (H&E)}.

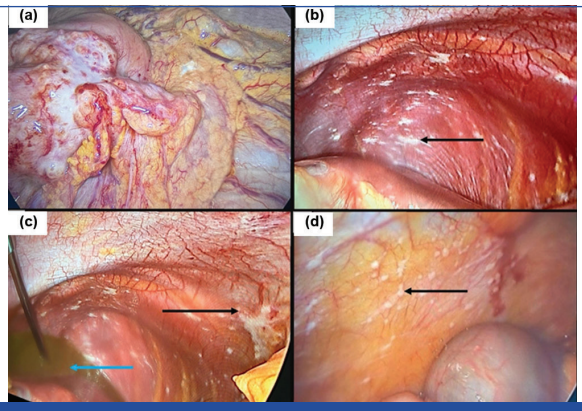
Pathology(WHO ICD-O)	n (%)
Adenocarcinoma (poorly Differentiated)	14 (51.9%)
Adenocarcinoma (moderately Differentiated)*	11 (40.7%)
Squamous cell carcinoma	2 (7.4%)

[Table/Fig-2]: Showing the pathologic distribution of patients.
*No well differentiated adenocarcinoma cases. WHO; World health organisation; ICD-O: International classification of diseases for oncology).



[Table/Fig-3]: Venn diagram showing relations of peritoneal deposits, ascites and cytology positivity.

indicated that patients presenting with ascites had an 11.5 times higher risk of having peritoneal deposits [Table/Fig-4].



[Table/Fig-4]: a) Intraoperative images showing locally advanced disease; b) Peritoneal deposit (black arrow); c) Showing ascites (blue arrow) and peritoneal deposits (black arrow); d) Showing multiple peritoneal deposits (black arrow).

Based on staging laparoscopy findings, curative-intent surgery was avoided in 11 patients (40.7%), and these patients were redirected to palliative chemotherapy. The planned treatment strategy remained unchanged in 16 patients (59.3%). No major procedure-related complications were observed. The mean postoperative hospital stay was one day.

DISCUSSION

Gastric Cancer (GC) is a highly aggressive disease, with poor outcomes largely attributed to its frequent diagnosis at advanced stages. Peritoneal dissemination is particularly common, affecting 20-30% of patients at the time of diagnosis [8,19]. Even after curative gastrectomy, 40-60% of patients experience peritoneal relapse as the sole site of recurrence, highlighting the challenges in long-term disease control [5,8,20].

Beyond tumour-specific factors such as pTN stage, differentiation, perineural invasion, and the presence of signet-ring cells, two key prognostic indicators for patients with GC and Peritoneal Metastases (GC-PM) are the extent of peritoneal disease, assessed by the Peritoneal Cancer Index (PCI), and the feasibility of achieving complete cytoreduction, measured by the Completeness of Cytoreduction Score (CC-0) [20-22].

Gastric cancer with peritoneal metastasis has a very poor prognosis, with survival dropping to 2.8 to 9 months [23]. Ikeguchi M et al., from Japan reported that patients with positive peritoneal cytology have a five-year survival of 15.4%, compared to 49.3% of those who do not have free cancer cells in the peritoneal cavity [23].

Historically, patients with peritoneal metastasis were considered for palliative chemotherapy or best supportive care. However, newer modalities such as Hyperthermic Intraperitoneal Chemotherapy (HIPEC) and cytoreductive surgery have emerged, especially in patients with a low peritoneal cancer burden [24]. Current NCCN guidelines (accessed in March 2025) suggest a cut-off of 10 for PCI, below which, if a multidisciplinary team agrees that complete cytoreduction is possible, cytoreductive surgery with HIPEC is an option [25].

Comprehensive staging, including a CECT scan and possibly endoscopic ultrasonography, is crucial in determining treatment pathways. All cases should involve a multidisciplinary tumour board discussion. In study Institute, authors follow the guidelines set by the National Cancer Grid of India [18]. According to these guidelines, patients with early, localised gastric cancer (T1-2, N0) are primarily treated with D2 gastrectomy.

For loco-regionally advanced cancer (T3-4, N+), perioperative chemotherapy with regimens like Fluorouracil + Leucovorin (folinic acid) + Oxaliplatin + Taxoter (FLOT), Epirubicin + Oxaliplatin + Xeloda (EOX), or Folinic acid (Leucovorin) + Fluorouracil + Oxaliplatin (FOLFOX)//Capecitabine + Oxaliplatin (CAPOX) is preferred, with surgery in between. The Medical Research Council (MRC) Adjuvant Gastric Infusional Chemotherapy (MAGIC) trial, published in 2006 [26], established a regimen of three preoperative and three postoperative cycles of ECF/ECX (Epirubicin, Cisplatin, and Fluorouracil or Capecitabine), which remained the standard therapy for non metastatic disease for over a decade. However, the 2019 publication of the FLOT4 trial redefined this standard, demonstrating superior outcomes with the FLOT regimen (Fluorouracil, Leucovorin, Oxaliplatin, and Docetaxel). Currently, FLOT—administered as four preoperative and four postoperative cycles—is preferred for locally advanced tumours [27]. Regular follow-up, nutritional support, and surveillance are also key aspects of post-treatment care.

The SL is a minimally invasive technique performed to evaluate the extent of intra-abdominal disease. It is indicated in patients with gastric cancer when distant metastases are not detected through advanced preoperative imaging [11]. Gastric cancer carries a poor prognosis, with a high mortality-to-incidence ratio globally. This is largely due to late-stage diagnosis, where only about 50% of patients are eligible for curative treatment at the time of detection. Various imaging techniques are utilised for staging gastric cancer. However, a recent meta-analysis revealed that while CT demonstrates good accuracy in staging, its sensitivity (76.5%) and specificity (35.3%) in detecting peritoneal metastases remain low [9,10,28].

Recent advancements in immunotherapy and targeted therapy have introduced new treatment paradigms for advanced gastric cancer, emphasising the importance of precise staging to tailor therapy effectively. The role of immune checkpoint inhibitors, such as Programmed Death (PD)-1/PD-Ligand (L)1 inhibitors, has been increasingly explored in gastric cancer, with studies suggesting improved survival outcomes in selected patients [29,30]. However, the efficacy of these treatments depends on accurate workup to identify candidates who may benefit from immunotherapy.

A systematic review by Ramos RF et al., reported that SL altered treatment plans in a significant proportion of cases by identifying occult metastases, thereby preventing futile surgeries [31]. This aligns with present findings, where 40.3% of patients were spared from non-beneficial curative-intent surgery, further highlighting the impact of this technique in optimising treatment strategies.

Beyond its role in staging, SL, if it finds peritoneal disease, can be utilised as a tool for Peritoneal Cancer Index (PCI) calculation for future intraperitoneal chemotherapy administration, particularly in patients with positive peritoneal cytology or minimal peritoneal disease [32,33]. The use of laparoscopic HIPEC and Pressurised Intraperitoneal Aerosol Chemotherapy (PIPAC) has shown promising results in controlling peritoneal spread and improving survival rates in selected patients with gastric cancer [34,35].

Yoshikawa K et al., demonstrated that SL plays a crucial role in evaluating the extent of peritoneal dissemination, aiding in patient selection for these novel therapeutic approaches [36]. Furthermore, a Canadian study by Nostedt JJ et al., reinforced the importance of routine SL in detecting peritoneal disease, which was undetectable on preoperative imaging, leading to significant modifications in treatment plans [37]. Collectively, these findings underscore the evolving role of SL, serving as a critical tool for guiding personalised treatment approaches in advanced gastric cancer.

In present study, staging laparoscopy detected occult metastases in 11 (40.7%) of patients, significantly altering treatment plans for these individuals. These findings highlight the limitations of preoperative imaging and underscore the utility of laparoscopy in staging gastric carcinoma. Leake PA et al., report that SL demonstrated moderate reliability in assessing T and N stages compared to final histology [12]. However, for M staging, laparoscopy consistently showed high accuracy, sensitivity, and specificity, with reported ranges of 85%

to 98.9%, 64.3% to 94%, and 80% to 100%, respectively, across studies included in their meta-analysis.

Additionally, SL impacted treatment decisions in 8.5% to 59.6% of patients, with 8.5% to 43.8% of cases subsequently avoiding laparotomy [12]. This finding is consistent with present study, where we observed that 40.7% of patients had changes in management plans based on present SL findings. SL allows surgeons to detect Intraperitoneal Free Cancer Cells (IFCC) through ascitic fluid aspiration or peritoneal lavage. While the presence of IFCC is a poor prognostic marker, its impact on treatment—such as halting surgical resection or initiating intraperitoneal chemotherapy—remains uncertain [13, 14]. Nath J et al., reported that peritoneal lavage altered management in 7% of patients by identifying microscopic metastases in cases without overt peritoneal deposits or locally advanced tumours [38]. Positive peritoneal cytology was detected in 12 patients (44%), comprising 10 (83.3%) with peritoneal deposits ($p<0.001$). Among 11 cases with ascites, 8 (72.7%) had positive cytology, with a statistically significant p-value of 0.014. The Dutch and European gastric cancer guidelines recommend SL for patients with advanced gastric cancer [15,16].

Limitation(s)

The present study on SL in gastric carcinoma is limited by the small sample size, which reduces the statistical power of present analyses.

CONCLUSION(S)

The SL is a safe and highly accurate diagnostic tool in the staging of gastric cancer. It has low morbidity and a short hospital stay; in present series, it altered the management of a significant number of patients. SL should be considered a standard modality in the clinical staging of non metastatic gastric carcinoma patients who are planned for perioperative chemotherapy.

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