

# Staging Laparoscopy for Assessing Inoperability in Gastrointestinal Malignancies: Is it Useful?

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## INTRODUCTION

Abdominal malignancy is one of the most common malignancies affecting humans. Despite the availability of modern diagnostic staging modalities, preoperative assessment of inoperability in intra-abdominal malignancy is often inadequate, especially in patients being considered for potential curative resection, resulting in many unnecessary laparotomies.<sup>[1]</sup> Modern staging modalities such as ultrasonography, computerized tomography (CT), magnetic resonance imaging (MRI), and positron emission tomography, though may exclude patients

with metastatic (M1) disease pre-operatively, have their recognized limitations in identifying small secondary tumor deposits on the peritoneal surfaces.<sup>[1]</sup>

Laparoscopic surgery has gained popularity even in a developing nation like India because of early patient recovery, less scarring, reduction in pain, and early

**ABSTRACT** **Background:** Despite the availability of modern cross-sectional diagnostic staging modalities, preoperative assessment of operability in intra-abdominal malignancy is often inadequate, especially in patients being considered for potential curative resection, resulting in many unnecessary laparotomies. Staging laparoscopy (SL) is usually undertaken in tertiary care centers, but the same has not been widely studied in India. The aim of the present study was to find out the possibility of diagnosing inoperability on SL and to study whether SL can prevent unnecessary laparotomy in cases of clinically diagnosed potentially resectable abdominal malignancies. **Methods:** This prospective diagnostics study was conducted in consecutive patients with gastrointestinal malignancies. All eligible patients were subjected to a thorough SL to look for inoperability before a therapeutic laparotomy. Statistical analysis of SL as a diagnostic modality was performed and the results were noted. **Results:** A total of 88 such patients were studied. The SL demonstrated inoperability in 24 out of the 88 (27.3%) patients. However, it failed to predict inoperability in 11 (12.5%) patients, yielding a sensitivity of 68.57% and specificity of 100%. The positive predictive value (PPV) of SL was 100%, whereas the negative predictive value (NPV) was 82.81% with efficacy of 87.5%. **Conclusions:** The specificity, PPV, NPV, and accuracy of SL to rule out inoperability in clinically diagnosed potentially resectable intra-abdominal gastrointestinal malignancies are noteworthy. The sensitivity of SL for the same purpose, though relatively low, may be augmented with practices such as liberal use of frozen section biopsy and intraoperative ultrasound. However, SL still fails to demonstrate unresectability due to locoregional advancement and aortocaval lymph node mets.

**KEYWORDS:** Intra-abdominal gastrointestinal malignancies, Staging laparoscopy, Inoperability

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return to normal activity. It also facilitates obtaining biopsy specimens and aspiration cytology, so that palliative alternate treatment modalities can be offered. In some patients, the intended therapeutic intervention can be performed through the same laparoscopic approach. Furthermore, staging laparoscopy (SL) has not been associated with peritoneal disease progression.<sup>[2]</sup>

Although SL is a standard of care in tertiary care oncologic centers worldwide, the correlation of postlaparoscopy M staging with prelaparoscopy M staging has not been widely studied in the Indian subcontinent so far, barring a single study involving 36 patients.<sup>[3]</sup>

Thus, a study was designed to find out the possibility of diagnosing inoperability on SL and to study whether SL can prevent unnecessary laparotomy in cases of clinically diagnosed potentially resectable abdominal malignancies.

## METHODS

This diagnostic study was carried out in a metropolitan tertiary care teaching hospital. The proposal of the study was submitted to the institutional ethical committee and work began after approval of the same on July 4, 2011.

### Inclusion criteria

This prospective study was conducted in consecutive patients who had reported to a tertiary care center over a year with symptoms suggestive of gastrointestinal (GI) malignancies and were subsequently diagnosed as having resectable abdominal malignancy based on clinical, radiological, and laboratory findings.

### Exclusion criteria

- Patients with M1 disease on preoperative workup
- Patients with non-GI cancers (gynecologic cancers, genitourinary cancers, retroperitoneal sarcoma, and abdominal metastasis of non-GI cancers)
- Patients with intestinal obstruction where laparoscopy was deemed hazardous due to distended bowel loops
- Patients unfit for laparotomy due to coexisting medical illness or poor performance status.

## Detailed methodology

### Clinical

Detailed history, laying emphasis on symptoms suggestive of malignant processes, was obtained. These symptoms varied depending on the organ involved and the stage of the disease. Symptoms included nausea, vomiting, upper abdominal discomfort, post prandial fullness, and recent onset of jaundice. Any significant anorexia, dysphagia with recent significant loss of weight, manifestation of abdominal lump, distension, altered bowel habits, and bleeding from the rectum were noted.

Detailed clinical examination of all the patients was done to detect the malignancy and stage it clinically. On examination, pallor, icterus, abdominal distension, any palpable abdominal lump, left supraclavicular lymphadenopathy, periumbilical nodule, skin nodule, any bony tenderness, or ascites were specially noted. The patients were examined per rectally/per vaginally to rule out any suspicious mass.

### Investigations

Investigations were divided into two groups, i.e., for preanesthetic checkup and for diagnosis and/or staging of malignancy.

Diagnostic and/or staging investigations included contrast studies to study the luminal pathology, USG, 256-slide contrast-enhanced CT (CECT), and MRI abdomen to diagnose and stage the malignancies. Chest X-ray was done to look for lung metastases, supplemented by CECT chest in case of any suspicious finding on X-ray. Fine-needle aspiration cytology was done as needed. Upper GI examination with end-viewing or side-viewing endoscopies and lower GI examination endoscopies were done where indicated and biopsies taken if needed.

The patients, thus, diagnosed with abdominal malignancy and seemed to be otherwise resectable underwent a thorough SL by experienced surgical gastroenterologists or surgical oncologists.

### Method of staging laparoscopy

SL was done under general anesthesia. A proper operation table that allowed the patient to be placed in multiple dynamic positions including Trendelenburg, reverse Trendelenburg, split leg, or modified lithotomy positions during SL was used. The entire abdomen was prepped and draped as for open laparotomy, after positioning and padding the patient. Pneumoperitoneum was created using carbon dioxide at 10–12 mm Hg. SL was begun through a 1 cm periumbilical port using a 10-mm 30° laparoscope. The entire abdominal cavity, pelvis, both paracolic gutters, and lesser sac were evaluated. The peritoneal surfaces of the right and left lobes of the liver were inspected. Liver was also looked for any obvious cirrhotic changes. The peritoneal under surface of the diaphragm was scrutinized for evidence of metastatic disease. The omentum was inspected on both anterior and posterior surfaces. The primary was assessed for resectability. Wherever indicated clinically, sampling of aortocaval lymph nodes was attempted. Additional trocars were deployed for exposure and dissection if deemed necessary. Laparoscopic USG, however, was not used due to unavailability at our center.

Biopsies were performed using cupped forceps or biopsy needles cleanly without undue crushing or burning the tissue. In addition, fluid was aspirated for cytological

investigations in the presence of ascites. Liberal use of 'frozen' biopsy was done in suspicious circumstances in addition to routine biopsies.

Formal laparotomy was undertaken only if SL did not demonstrate inoperable disease and therapeutic or palliative procedures were not possible laparoscopically. Formal laparotomy was not done solely for diagnostic purpose only, i.e., for the purpose of confirmation of inoperability detected on SL, as this practice can never be ethical. Patients in whom unresectable or inoperable disease was found at following laparotomy with operability on initial SL were considered failures of SL. Figure 1 depicts the flowchart of participants according to the STARD 2015 guidelines.

Statistical analysis of SL was performed using

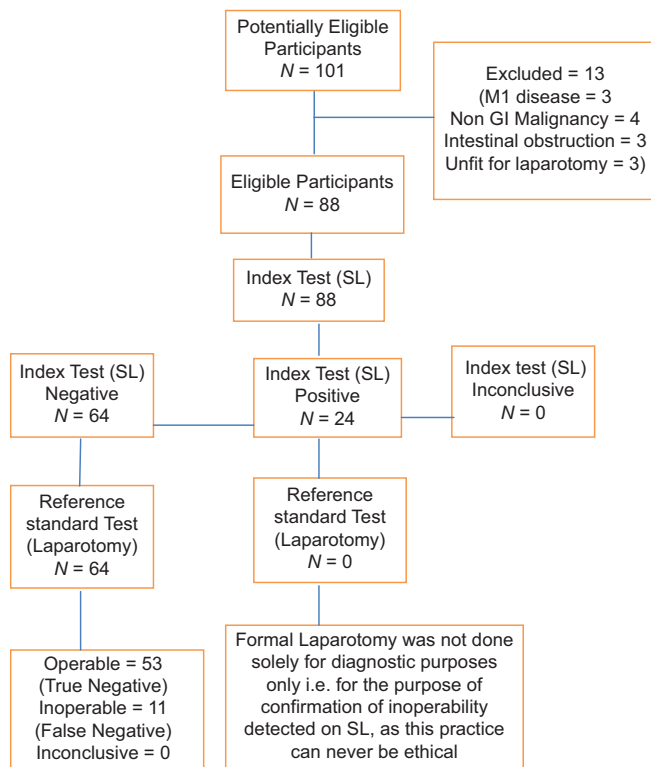


Figure 1: Flow chart of participants according to STARD 2015 guidelines

parameters such as sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy or efficacy.

## RESULTS

This prospective study was conducted on a total of 88 consecutive patients who had reported to a tertiary care center over a year with the mentioned inclusion and exclusion criteria. Figure 1 depicts the flowchart of patients according to the STARD 2015 guidelines. Demographics of the patients is summarized in Table 1.

These patients underwent a thorough SL, which demonstrated inoperability in 24 (27.3%) out of the 88 patients. However, SL failed to predict inoperability in 11 (12.5%) patients, yielding a sensitivity of 68.57% and specificity of 100%. The PPV of SL was 100%, while the NPV was 82.81%. The overall Accuracy or Efficacy of SL was 87.5% [Table 2].

The sub distribution of results of SL according to the site of malignancy is summarised. Anyhow, as the numbers of cases of individual organ specific malignancy are very small, interpretations cannot be drawn [Table 3].

The reasons for inoperability at SL with those at following laparotomy were studied. The findings precluding curative resection were present either singly or in combination including ascites, peritoneal and/or omental metastases, liver metastases, aortic nodal mets or loco-regionally advanced disease [Table 4].

## DISCUSSION

Despite the availability of modern day cross sectional diagnostic staging modalities, preoperative assessment of inoperability in intra-abdominal malignancy is often inadequate, especially in patients being considered for potential curative resection, resulting in many unnecessary laparotomies.<sup>[1]</sup>

SL scores well because of early patient recovery, less scarring, reduction in pain and early return to normal activity. It also facilitates obtaining biopsy specimens and

Table 1: Demographics of patients

GI malignancy	Number of patients	Male	Female	Mean age (years)
Gastric and gastroesophageal junction	25	16	9	59.6
Hepatocellular	2	1	1	68.5
Gallbladder	18	4	14	55.11
Hilar cholangiocarcinoma	2	1	1	57.5
Pancreatic	13	6	7	55.62
Duodenal, lower end CBD and ampullary	9	8	1	59
Colorectal	19	9	10	54.79
Total	88	45	43	57.15

CBD: Common bile duct, GI: Gastrointestinal

aspiration cytology, so that palliative alternate treatment modalities can be offered. In some patients, the intended therapeutic intervention can be performed through the same laparoscopic approach with oncological safety. Though SL is a standard of care in tertiary care oncologic centres in the developed nations, the statistical parameters of SL as a diagnostic test are studied in only a single study so far in India involving a cohort of 36 patients.<sup>[3]</sup>

Our study demonstrated that SL forms a good screening test to rule out inoperability in otherwise resectable abdominal GI malignancies with acceptable sensitivity (68.57%), specificity (100%), PPV (100%), NPV (82.81%) and accuracy values (87.5%).

Very few studies have studied abdominal malignancies as a patient cohort, rather than individual organ malignancies. Muntean *et al.* in 2009 have given

sensitivity figures ranging from 66% to 100% for different organs, specificity of 100% and accuracy figures ranging from 87% to 100%, which closely match our study.<sup>[4]</sup>

Nair in 2012 studied the role of SL in assessing operability in borderline resectable GI cancers. The importance of this study lies in the fact that this is the only such study from India, according to the best of our knowledge. Out of 36 patients with malignant diagnosis, after DL, 22 patients (61.1%) were inoperable, 11 patients (30.6%) were operable, and three (8.3%) patients were of equivocal operability. Sensitivity, specificity, PPV, and NPV of laparoscopy in detecting operability were 100%, 91.7%, 81.8%, and 100%, respectively.<sup>[3]</sup>

Velanovich further demonstrated that the median number of days from surgery to postoperative cancer treatment was 13 days (range 5–41 days) for the SL group and 35 days (range 16–89 days) for the exploratory laparotomy i.e., EL group ( $P = 0.0004$ ), thus concluding that patients with unresectable intra-abdominal malignancies discovered by SL were more likely to receive postoperative chemotherapy and/or radiotherapy than patients surgically evaluated by EL.<sup>[2]</sup>

### Gastroesophageal junction and gastric carcinoma

The role of SL in case of gastroesophageal junction and gastric carcinoma has been studied well so far. Coburn *et al.* recommends SL in patients at risk for stage IV disease.<sup>[5]</sup>

**Table 2: Statistical parameters of staging laparoscopy to diagnose inoperability**

SL operable (64)		SL inoperable (24)	
Operable	Inoperable	Operable	Inoperable
53 (TN)	11 (FN)	0 (FP)	24 (TP)
Sensitivity of SL = $TP/(TP + FN) = 24/35 = 68.57\%$			
Specificity of SL = $TN/(TN + FP) = 53/53 = 100\%$			
PPV of SL = $TP/(TP + FP) = 24/24 = 100\%$			
NPV of SL = $TN/(TN + FN) = 53/64 = 82.81\%$			
Accuracy or efficacy of SL = $(TP + TN)/(TP + TN + FP + FN) = 77/88 = 87.5\%$			

SL: Staging laparoscopy, TN: True negative, FN: False negative, TP: True positive, FP: False positive, PPV: Positive predictive value, NPV: Negative predictive value

**Table 3: Sub distribution of results of staging laparoscopy according to the site of malignancy**

GI malignancy	SL performed	SL showed inoperability	SL failed to demonstrate inoperability	Overall benefit of SL (%)	Overall failure of SL (%)
Gastric and GE junction	25	6	3	24.0	12
Hepatocellular	2	1	1	50.0	50
Gallbladder	18	9	3	50.0	16.7
Hilar cholangiocarcinoma	2	1	0	50.0	0
Pancreatic	13	4	3	30.8	23.1
Duodenal, lower end CBD and ampullary	9	0	1	0	11.1
Colorectal	19	3	0	15.80	0
Total	88	24	11	27.3	12.5

GE: Gastroesophageal, CBD: Common bile duct, SL: Staging laparoscopy, GI: Gastrointestinal

**Table 4: Inoperability at staging laparoscopy and at following laparotomy**

	Inoperable at SL (n=24)	Inoperable at laparotomy (n=11)
Ascites	2	0
Peritoneal and/or omental deposits	14	0
Hepatic metastases	8	0
Aortocaval nodal mets	1	5
Loco-regionally advanced disease	3	5
Others	Cirrhosis 1	Retrovesical pouch mets <sup>[1]</sup>



Huang *et al.* in 2018 has recommended a systematic and painstaking inspection of the whole abdominal cavity, including routine entry into the bursa omentalis, is necessary for improving the yield of SL.<sup>[6]</sup>

NCCN guidelines dictate routine use of SL in cT3 or cN+ disease.<sup>[7]</sup>

### Hepatocellular carcinoma

Earlier studies by Babineau *et al.* and Dijkum *et al.* though showed that the yield of SL can be as high as 48%, recent studies like that by Hoekstra *et al.* demonstrate the yield to be as low as 7%.<sup>[8-10]</sup> This may reflect bettering of cross sectional imaging in this patient subset.

### Gall bladder and hilar cholangiocarcinoma

Gall bladder carcinoma and cholangiocarcinoma are lethal malignancies with very poor median survival for patients with unresectable disease. Unfortunately, even after extensive preoperative evaluation, occult unresectable disease is discovered at the time of exploratory laparotomy in many patients.

The meta-analysis by Tian *et al.* revealed that 32.4% of patients with hilar cholangiocarcinoma and 27.6% of patients with gall bladder carcinoma may avoid unnecessary laparotomy with the use of SL. It also highlights the use of intraoperative ultrasound in such patients.<sup>[11]</sup>

### Periampullary and pancreatic carcinoma

Patients with metastatic disease can benefit from minimally invasive percutaneous and endoscopic techniques which allow tissue sampling and treatment of malignant biliary obstruction, without the potential morbidity and recovery time characteristic of surgical approaches. Also with ever-evolving skills of laparoscopic surgeons, effective palliation can be achieved in the same laparoscopic setting.

The same has been documented well by Ashraf and by Suker *et al.* in 2019.<sup>[12,13]</sup>

### Colorectal carcinoma

Earlier studies dealing with colorectal liver metastases reported good outcomes of SL, with unresectable disease being detected in 46% patients by John *et al.* and in 38% patients by Rahusen *et al.*<sup>[14,15]</sup>

However, more recent studies have shown much lower benefit of SL. Jarnagin *et al.* reported it to be 13%.<sup>[16]</sup> Similarly, Rodgers *et al.* reported yield of laparoscopy in colorectal carcinoma to be as low as 6%.<sup>[17]</sup>

This difference in results may be due to improvement in imaging modalities particularly advanced CT scanning capabilities. It might be also due to evolving

surgical approach where disease previously considered inoperable is now being resected. So the majority of patients with potentially resectable colorectal metastases do not benefit from SL.

In our study, though the statistical parameters of SL fare well for intra-abdominal GI malignancies as a cohort, the same logic cannot be applied to individual organ malignancies due to very less number of individual organ specific malignancies studied.

## CONCLUSIONS

The specificity, positive and NPVs and accuracy of SL to rule out inoperable disease in clinically diagnosed potentially resectable intra-abdominal GI malignancies is noteworthy. The sensitivity of SL for the same purpose, though relatively low, may be augmented with practices like liberal use of frozen section biopsy and intra-Op ultrasound. However, SL still fails to demonstrate unresectability due to loco-regional advancement and aortocaval lymph node mets.

In our study, though the statistical parameters of SL fare well for intra-abdominal GI malignancies as a cohort, the same logic cannot be applied to individual organ malignancies due to very less number. This is a major drawback of our study.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

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