Surg Endosc (1998) 12: 921–925

Surgical Endoscopy
Ultrasound and
Interventional Techniques

The role of staging laparoscopy for multimodal therapy of gastrointestinal cancer

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Received: 3 April 1997/Accepted: 26 September 1997

Abstract

Background: This prospective study was conducted to evaluate the accuracy and the therapeutic relevance of staging laparoscopy.

Methods: Between June 1993 and February 1997 staging laparoscopy was performed in 389 patients with various neoplasms. Additionally, 144 selected patients of this group were examined with laparoscopic ultrasound using a semiflexible ultrasound probe (7.5 MHz).

Results: Compared to conventional imaging methods, laparoscopy and laparoscopic ultrasound improved the accuracy of staging in 158 of 389 patients (41%). Statistical subgroup analysis of 131 patients with gastric cancer showed that the accuracy of staging laparoscopy in the detection of distant metastases (68%) was significantly higher ($p < 0.01$) than that of ultrasound (63%) or computed tomography (58%). In the whole group, laparoscopy alone disclosed intraabdominal tumor dissemination or nonresectable disease in 111 patients. Laparoscopic ultrasound displayed additional metastases—i.e., liver metastases (n = 9), M1 lymph nodes (n = 15), or nonresectable tumors (n = 6) in 30 patients. Although metastastic disease was suggested by preoperative imaging, benign lesions were found in five patients with laparoscopy and in a further 12 patients with ultrasonography. The findings of staging laparoscopy changed the treatment strategy in 45% of the patients. Conversion to open surgery was necessary in 5% of the cases, and complications related to laparoscopy occured in 4% of the patients.

Conclusions: Laparoscopy with laparoscopic ultrasound improves the staging of gastrointestinal tumors and has a significant impact on a stage-adapted surgical therapy.

Key words: Laparoscopy — Staging — Gastrointestinal tumors — Multimodal therapy

A wide variety of multimodal treatment approaches are available for the treatment of advanced primary tumors and metastatic disease [7, 19]. Sensitive staging procedures are required to provide a rational basis for stage-adapted therapy of gastrointestinal tumors. One of the major goals of staging in surgical oncology is to identify patients with nonresectable or disseminated disease in whom curative surgery is not feasible.

Generally, imaging methods such as transcutaneous ultrasonography (US), computed tomography (CT), and magnetic resonance imaging (MRI) have been used for the evaluation of abdominal tumors. Accuracy rates of ~60–90% in the detection of intraabdominal metastases have been achieved with these methods [5, 17]. However, the sensitivity of imaging modalities is significantly lower in the detection of smaller lesions. In a study involving 75 patients with 95 lesions, comparative sensitivities of US, CT, and MRI for all lesions were 53%, 68%, and 63%, respectively [18]. In contrast, sensitivity for tumors <1 cm was 20%, 49%, and 31%, respectively. Recent reports indicate that helical CT and gadolinium-enhanced MRI may be more accurate than conventional examinations [16].

Because of the unsatisfactory sensitivity of various imaging methods in the detection of small metastases in the abdominal cavity, laparoscopy has been used more often for staging of gastrointestinal cancers. The purpose of this prospective study was to assess the value of laparoscopy and laparoscopic ultrasound in the staging of abdominal tumors. The results of staging laparoscopy in 389 patients were compared to conventional staging.

Methods

Between June 1993 and February 1997, staging laparoscopy was performed in 389 patients with various abdominal tumors. The patients included 202 men and 187 women with a mean age of 58 years (range, 18–88 years). Most patients underwent laparoscopy for the evaluation of gastrointestinal tumors (69%); other indications were relatively rare (Table 1). Patients with early esophageal or gastric cancer (uT1) were excluded from the study, because the prevalence of distant metastases is extremely low in these patients. All patients were examined with standard staging proce-

Presented at the annual meeting of the Society of American Gastrointestinal Endoscopic Surgeons (SAGES), San Diego, California, USA, 19–22 March 1997

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Table 1. Indications for staging laparoscopy

	No. of patients	Percent of patients
Gastric carcinoma	131	34%
Pancreatic cancer	54	14%
Esophageal cancer	45	11%
Liver tumors	35	9%
Breast cancer	22	6%
Miscellaneous	102	26%
Total	389	100%

Table 2. Results of staging laparoscopy

Finding	No. of patients
Liver metastasis	66[a]
Peritoneal spread	52[a]
M1 lymph nodes	4
Nonresectable disease	13
Benign lesions	5
Total	116

[a] Twenty-four patients were found to have both liver metastases and peritoneal seeding.

dures, including endosonography (Pentax FG 32 UA, Ecoscan, Kreuzberger Ring 21, 65205 Wiesbaden, Germany) abdominal US (Toshiba, Alt Moabit 96B, 10559 Berlin, Germany), CT (Somatom Plus, Siemens, Magnetom Expert, Siemens, Salzufer 6-8, 10587 Berlin, Germany) or MRI (Magnetom Expert, 1.0 Tesla, Siemens). Spiral CT was applied to selected patients. Contrast agents were used for both CT and MRI.

Laparoscopy was performed under general anesthesia using standard equipment. A Veress needle was inserted through the linea alba superior to the umbilicus. The abdomen was insufflated with carbon dioxide until a pressure of 13–15 mm Hg was reached. After removal of the needle, a 1-cm incision was made to insert a 10-mm disposable trocar (Versaport, Autosuture, Tempelsweg 12, 47918 Tönisvorst, Germany) for the laparoscope. Where additional ports were required for further instruments, they were introduced under visual control. The abdominal cavity was examined carefully with a 45° side-viewing laparoscope. Special attention was paid to the detection of liver metastases, peritoneal seeding, and ascites. Wherever necessary, surgical procedures, such as lymph node dissection or lesser sac exploration, were carried out. Lesser sac exploration was approached by incision of the gastrocolic ligament. In women, the ovaries were examined for metastatic spread. Ascites was withdrawn and collected for cytologic analysis.

Laparoscopic ultrasound was performed in selected patients (n = 144) where there was no evidence of metastatic spread in laparoscopy. For intraoperative ultrasonography, we used a laparoscopic ultrasound probe (B&K Medical, Sandtoften 9, 2820 Gentofte, Denmark) with a flexible tip. The 7.5-MHz curved array linear transducer of the probe also allowed color-coded Doppler imaging for the assessment of vascular infiltration. The instrument has a diameter of 9 mm and was easily passed through a 10-mm trocar in the left or right upper quadrant. The liver was scanned systematically by moving the probe slowly over all segments. The number, the size, and the localization of hepatic lesions were all documented. Moreover, we attempted to detect enlarged lymph nodes in the porta hepatis and along the major intraabdominal vessels. The duration of the examination usually ranged between 10 and 20 min. Biopsies of suspicious lesions were done under direct laparoscopic vision or ultrasound guidance.

Generally, the surgical treatment was not performed directly after staging laparoscopy. The interval between both procedures was usually 3–4 days, because this time was necessary for a definitive histological diagnosis, including immunohistochemistry. Palliative laparoscopic procedures were done immediately based on the unequivocal laparoscopic findings and frozen sections. In a subgroup analysis of patients with gastric cancer, the comparative accuracies of laparoscopy, abdominal ultrasonography, and computed tomography in the detection of metastastic spread were evaluated statistically. Statistical analysis was performed using the chi square test.

Table 3. Results of laparoscopic ultrasound

Finding	No. of patients
Liver metastasis	9
M1 lymph nodes	15
Nonresectable disease	6
Benign lesions	12
Total	42

Table 4. Comparison of laparoscopy, ultrasound, and computed tomography in the detection of intraabdominal metastatic disease in gastric cancer

	Accuracy	Sensitivity	Specificity
Staging laparoscopy (n = 131)	92%	82%	100%
Abdominal ultrasound (n = 131)	63%	25%	90%
Computed tomography (n = 68)	58%	45%	71%

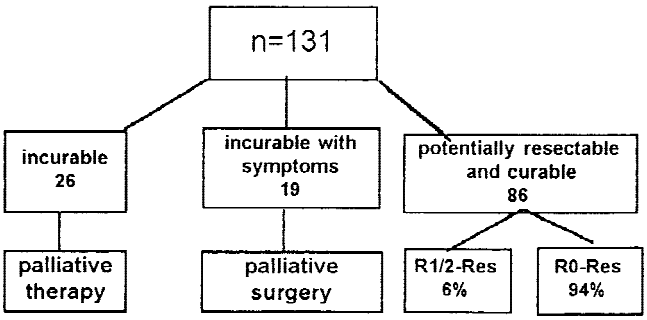

Fig. 1. Therapeutic consequences of staging laparoscopy in patients with gastric cancer.

Results

Compared to conventional imaging, laparoscopy and laparoscopic ultrasound improved staging in 158 of 389 patients (41%). A combination of both methods enabled detection of incurable disease because of tumor dissemination or nonresectable tumors in 122 and 19 patients, respectively. In 17 patients staging laparoscopy showed benign lesions of the liver—i.e., liver hemagioma and focal nodular hyperplasia (FNH)—although conventional staging suggested metastatic spread to the liver.

Laparoscopy proved to be a sensitive method for the detection of superficial metastatic lesions in the abdominal cavity (Table 2). Laparoscopy showed liver metastases in 42 patients and peritoneal seeding in 28 patients; both conditions were found in 24 patients. M1 lymph nodes were excised in four cases. Because laparoscopic instruments do not allow for tactile sensitivity, laparoscopic ultrasound was usually required to detect these lymph nodes. Laparoscopic ultrasound was also applied in all patients in whom visual assessment of the abdominal cavity provided no further information. This technique allowed high-resolution imaging of nonsuperficial lesions (Fig. 2). Ultrasonography provided additional information on intraabdominal tumor spread in 42 of 144 patients (29%). Intraparenchymal liver metastases and M1 lymph nodes, which were not seen laparoscopically, were displayed in nine and 15 patients, respectively (Table

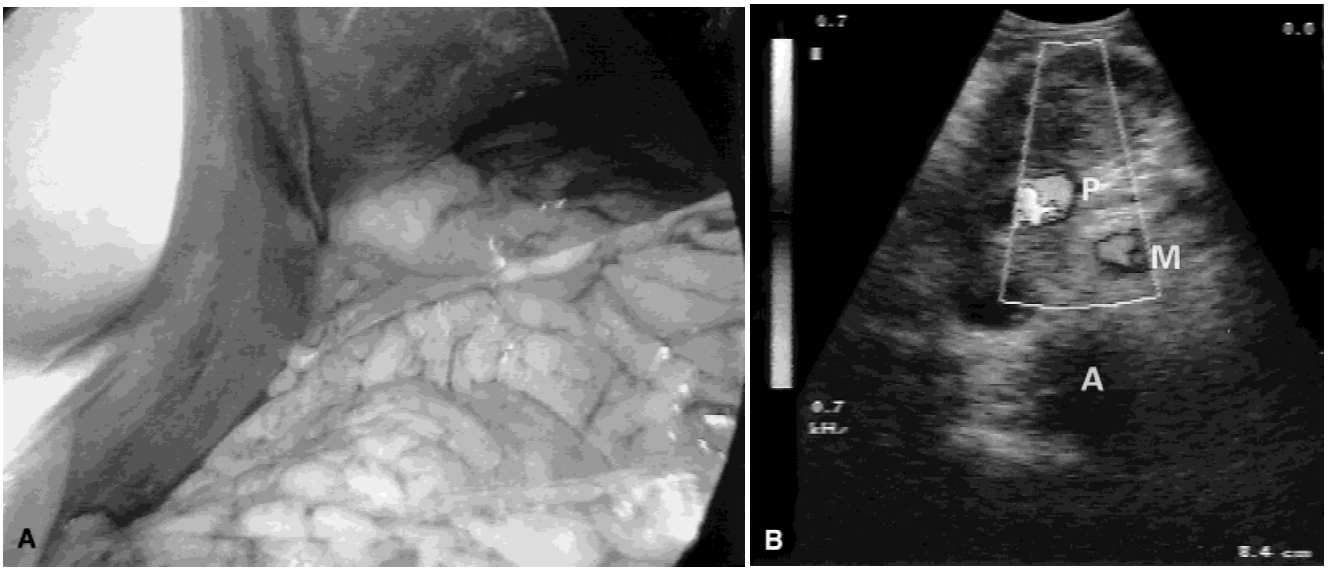

Fig. 2. A Laparoscopic view. Lesser sac exploration via the omentum minus in a patient with pancreatic cancer. **B** Laparoscopic color Doppler ultrasonography reveals entrapment of the portal vein (P). (A, aorta; M, arteria mesenterica superior.)

3). Tumor involvement was verified by biopsy and histological workup.

The efficacy of laparoscopy in the staging and treatment of gastrointestinal tumors was analyzed in 131 consecutive patients with gastric cancer. Statistical analysis showed a significantly better accuracy ($p < 0.01$) of laparoscopy in the detection of distant metastases (92%) than ultrasound (63%) or computed tomography (58%). The detailed analysis is shown in Table 4. Incurable disease was identified in 45 patients (36%). Consequently, palliative chemotherapy or symptomatic therapy was initiated in 26 patients. Palliative operations were performed in 19 patients, five of whom received a laparoscopic gastroenteroanastomosis. Radical resection was considered feasible in 86 patients on the basis of staging laparoscopy. The R0 resection rate in this group was 94% (Fig 1). False negative results were obtained in five cases because of minimal peritoneal seeding(n = 2), M1 lymph nodes (n = 1), and nonresectable disease (n = 2).

Conversion of staging laparoscopy to open surgery was necessary in 18 of 389 patients (5%). The reasons for conversion included massive adhesions (n = 8), hemorrhage (n = 4), intestinal perforation (n = 2), and technical problems (n = 4). Serious postoperative complications—i.e., wound infection (n = 8), intestinal perforation (n = 2), lung embolism (n = 1), and myocardial infarction (n = 1)—were observed in only 4% of the patients. Trocar metastases developed in two patients with advanced pancreatic cancer 1 and 4 months after laparoscopy, respectively.

Discussion

Generally, radical resection is the only curative treatment approach for gastrointestinal malignancies. However, at the time of diagnosis, ~20–40% of the patients with esophageal, gastric, and pancreatic cancer present with incurable disease. Because of the poor prognosis of these patients, primary surgery should be abandoned; palliative treatment or multimodal therapy may be more appropriate.

Some authors claim that resection of gastric cancer is the best palliation even in patients with advanced disease and a very poor life expectancy. However, despite all the advances in preoperative imaging, 20–30% of the patients with gastric cancer undergo exploratory laparotomy without resection of the malignancy because preoperative imaging fails to detect nonresectable disease. Exploratory laparotomy is associated with a high morbidity (15–20%) and a mortality rate of ~10% [3]. Some studies indicate that preoperative chemotherapy may increase the rate of resectability and improve survival in patients with advanced gastric cancers [1, 2, 20]. Plukker et al. reported an increase in the rate of curative resections from 30% to 70% by the application of preoperative chemotherapy in node-positive T3 and T4 tumors [14]. The median survival in the chemotherapy group was more than twice as long as in the control group. These data demonstrate the need for sensitive staging procedures that allow precise preoperative evaluation of intraabdominal tumor spread. Recently, laparoscopy has been used with increasing frequency for the staging of gastrointestinal tumors [9–11]. The purpose of this prospective study was to evaluate the role of laparoscopy and laparoscopic ultrasound in the staging of malignancy. Furthermore, we analyzed the impact of the findings on therapeutic decisions.

Laparoscopy and laparoscopic ultrasound proved to be sensitive techniques for the detection of intraabdominal tumor spread. Compared to standard imaging, a combination of both methods allowed for more accurate staging in 41% of the patients. Subgroup analysis of patients with gastric cancer showed that laparoscopy was significantly more accurate in the diagnosis of intraabdominal metastases than ultrasound and computed tomography ($p < 0.01$). The accuracy of laparoscopy in the detection of distant metastases was superior to ultrasound and CT (92% versus 63% and 58%). This superiority was mainly due to the inability of

both imaging modalities to detect peritoneal seeding in the absence of ascites. Laparoscopy allows visual assessment of the viscera and the peritoneal surface as well as the detection of extremely small lesions. Biopsy of all suspicous lesions is mandatory to confirm the diagnosis histologically. Although frozen sections should be performed routinely, a definitive therapeutic decision should be based on conventional histopathology. In our experience, the preliminary diagnosis of the frozen section was subsequently changed in some cases. Therefore it seems reasonable to delay surgical treatment until a definitive diagnosis is available. In this study, laparoscopy alone identified intraabdominal metastases in 25% and nonresectable disease in 3% of the patients. Laparascopy was considerably more sensitive than conventional imaging in the detection of small liver metastases and peritoneal metastases.

In a recent study, O'Brien et al. compared laparoscopy with conventional staging in 110 patients with cancer of the esophagogastric region [13]. The sensitivity of combined imaging for the detection of intraabdominal metastatic disease was significantly lower (38%) than with laparoscopy (77%). Laparoscopy was extremely useful for identification of peritoneal seeding (sensitivity 96%), which was often not visualized with imaging methods (sensitivity 21%). The sensitivity of both methods in the detection of metastatic spread to the liver were 60% and 47%, respectively.

One major limitation of laparoscopy is the lack of tactile sensitivity, which makes detection of nonsuperficial lesions difficult. However, it appears that the accuracy of laparoscopy in the assessment of intraparenchymal liver lesion and lymph node metastases can be increased by laparoscopic ultrasound. In our experience, laparoscopic ultrasound represents an ideal adjunct to laparoscopy because nonsuperficial lesions can be visualized. Visualization is of major importance for the assessment of occult liver metastases and lymph node involvement. Color-coded Doppler imaging was very valuable for the assessment of resectability in patients with pancreatic cancer (Fig. 2). With this technique, vascular entrapment can be seen clearly. Overall, laparoscopic ultrasound improved the staging of the disease in 29% of the cases. There is also evidence from other data that laparoscopic ultrasound improves the staging of cancer of the upper GI tract [6, 12]. Compared to standard laparoscopy, the combination of both techniques enhanced the efficiency in ~30–50% of the cases [4, 8].

The therapeutic relevance of staging laparoscopy was analyzed in 131 patients with gastric cancer who were judged to be eligible for curative resection. Staging laparoscopy identified incurable or nonresectable disease in 45 patients. As a consequence, 26 patients received primary pallative medical therapy. On the other hand, 19 patients with symptoms of obstruction underwent palliative surgery. A laparoscopic procedure (gastroenteroanastomosis) was feasible in five of the 19 patients. The remaining 86 patients underwent laparotomy for curative resection of the tumor. The R0 resection rate in this group was 94%. These data demonstrate that exploratory laparotomy can be avoided in ~25% of patients with gastric cancer if staging laparoscopy is performed. This rate may even increase if palliative laparoscopic procedures are applied more frequently [15].

Laparoscopy proved to be a very safe technique. Conversion to open surgery was necessary in only 5% of the patients. The postoperative morbidity was 4%, a rate that is comparable to other studies.

In conclusion, laparoscopy and laparoscopic ultrasound are feasible means of improving preoperative staging in patients with gastrointestinal tumors. These methods permit the identification of patients who are suitable for curative surgery. In contrast, exploratory laparotomy can be avoided in patients with incurable or nonresectable disease. Besides its use in staging, laparoscopy may be used more often for palliative procedures in selected patients with advanced cancer.

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Discussion

Dr. Easter: I enjoyed your paper very much, because it validates some of my own stock of biases. We collected material like this, but we also looked at the prelaparoscopic and the postlaparoscopic stage, and how that changed our preoperative plans. Can you tell me how many times you changed your preoperative plan after the diagnostic laparoscopy?

Dr. Hünerbein: The plan changed in approximately 30% of the patients, as I told you, in the group with the gastric cancer. We mainly detected disseminated disease, and these patients were assigned to groups receiving multimodal therapy or palliative therapy.

Dr. Easter: Then was your intent at laparoscopy to provide palliative therapy going in? I read your data a little differently as you presented it. I interpreted your presentation to imply that you did your laparoscopy with every intent to cure the patient, but then you changed your plans based on the laparoscopic findings. Is that a correct assumption?

Dr. Hünerbein: Preoperative staging suggested that the patients could undergo curative surgery; we excluded those patients, let's say 30%, who had disseminated or unresectable disease by laparoscopy. Among the patients who finally underwent resection there was a curative resection rate of 94%.

Dr. Scott-Conner: Other questions? I also enjoyed this paper because it agreed with some of our experience at the University of Mississippi, particularly with the use of laparoscopic staging and palliative laparoscopic procedures in patients who are found to be nonresectable.

Dr. Nagy: I also enjoyed your paper. Contrary to Dr. David Easter, I do understand what you're presenting. I'd like to point out that even before the video laparoscopic era the same kind of figures were obtainable with direct view laparoscopy and probes. It's very interesting to me that in ten years, despite the addition of ultrasound and video endoscopy and two-handed techniques, we still are basically achieving the same rates of resectability as you're showing today.

Dr. Hünerbein: There were a lot of papers in the 1980s dealing with laparoscopy. This was not surgical laparoscopy in our view, because if you do surgical laparoscopy you need at least three trocars and you may have to do some dissection, such as exploration, lymph node excision, and so on. You just can't use your impression; you have to have histopathologic confirmation, especially since the therapeutic consequences are so significant. If you say ''I won't operate on that patient,'' you can't just say it from your observations, you have to confirm it histologically.

Dr. Nagy: Yes, well, we used to confirm it before the video endoscopic area, too, with biopsies.

Dr. Hünerbein: I doubt if you could achieve dissection of an M1 lymph node or biopsy of an M1 lymph node at the hepatic artery, could you?

Dr. Scott-Conner: I have a practical question. I saw your slide of the pancreas exposed through the lesser sac, and I wonder if you could share with us your preferred method for exposing the pancreas in the lesser sac. Do you go through the lesser omentum, or do you take down the gastrocolic omentum?

Dr. Hünerbein: Usually we take the gastrocolic ligament.