Evaluation of diagnostics guidelines for hepatobiliary and pancreatic disease
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Diagnostic laparoscopy and laparoscopic ultrasound for the staging of patients with malignant proximal bile duct obstruction

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Abstract

Objective. To evaluate the diagnostic accuracy of diagnostic laparoscopy in patients with malignant proximal bile duct obstruction.

Introduction. Tumor staging in patients with a malignant obstruction of the proximal bile ducts is focused on selecting patients who could benefit from a resection. Diagnostic laparoscopy, which has proved its value in several gastrointestinal malignancies, has been used routinely in our hospital since 1993 in patients with a malignant proximal bile duct obstruction, although data in literature, regarding the additional value are conflicting. Therefore, the accuracy of diagnostic laparoscopy in patients with malignant proximal bile duct obstruction was evaluated.

Patients and Methods. From January 1993 to May 2000 diagnostic laparoscopy was performed in 110 patients (61 males and 49 females), with a mean age of 60 years (range 30-80 years) who had a suspected malignant proximal bile duct tumor and in whom ‘potential resectability’ was demonstrated by means of conventional radiological staging methods (Ultrasound combined with Doppler imaging, Computed Tomography, Endoscopic retrograde cholangiopancreatography and percutaneous transhepatic cholangiography).

Results. Laparoscopy revealed histologically proved incurable disease in 44 of the 110 patients (41%) (31 metastases and 13 extensive tumor ingrowth), laparoscopic ultrasound imaging, however, revealed histologically proven incurable disease in one patient (1%), thereby preventing explorative laparotomy in 45 patients because they had already been treated by palliative endoscopic endoprosthesis placement. The remaining 65 patients were staged as having a resectable tumor and underwent surgical exploration. Thirty patients had an unresectable tumor (distant metastases in five, tumor ingrowth in surrounding tissues in 24) or a benign disease (one patient). Sensitivity and negative predictive value of diagnostic laparoscopy for detecting unresectable disease were 60% and 52% respectively.

Conclusion. Diagnostic laparoscopy avoided unnecessary laparotomy in 41% of the patients with a malignant proximal bile duct obstruction considered resectable according to conventional imaging studies. The additional value of laparoscopic ultrasound imaging was limited. Therefore, diagnostic laparoscopy should be performed routinely in the workup of patients with a potentially resectable proximal bile duct tumor.
Diagnostic laparoscopy for malignant proximal bile duct obstruction

Introduction

A 'malignant' proximal bile duct obstruction can be caused by a proximal bile duct carcinoma or a gallbladder carcinoma infiltrating the liver hilus. In general a gall bladder carcinoma is easily recognized. However, in a small subgroup of patients differentiation between a cholangiocarcinoma and a gallbladder carcinoma with infiltration in the proximal bile ducts, metastasis from another tumor or even benign lesion is not always possible. Despite the evolution of radiological imaging techniques, such as ultrasonography combined with Doppler imaging, endoscopic retrograde cholangiopancreatography (ERCP) enhanced computer tomography (CT) and magnetic resonance imaging (MRI) in the selection of patients suitable for tumor resection, all imaging modalities have their limitations in detecting small superficial liver metastases and peritoneal tumor deposits or tumor ingrowth into the hepatoduodenal ligament and/or adjacent vascular structures. Therefore, the surgeon dealing with malignant proximal bile duct obstruction is often faced with significant discrepancy between the findings on preoperative investigations and those apparent at the time of laparotomy.\(^1\)\(^2\) Improvement in preoperative staging is mandatory to improve the assessment of tumor stage and to avoid an unnecessary laparotomy when palliation can be achieved by means of endoscopic or percutaneous placement of a biliary endoprosthesis.\(^3\)\(^4\) During the past decade non-surgical palliation was the procedure of choice in our institution whereas other favor a surgical approach.\(^5\)\(^6\)

The additional value of diagnostic laparoscopy in the preoperative staging of gastrointestinal malignancies has previously been reported.\(^7\)\(^-\)\(^11\) Small superficial liver metastases and peritoneal tumor deposits or local ingrowth can be detected and biopsies done under direct vision.\(^7\)\(^,\)\(^12\)\(^,\)\(^13\) Laparoscopic ultrasound allows inspection of local tumor invasion in patients with vascular and regional nodal involvement and distant metastatic spread to the liver. But the histological confirmation of these findings could be difficult to obtain.\(^14\)\(^,\)\(^15\)

Information on the additional value of diagnostic laparoscopy for malignant proximal bile duct obstruction is limited. In a pilot study from our institution incurable disease was diagnosed in 40% of the patients by means diagnostic laparoscopy.\(^16\) Because data in the literature are conflicting, we decided to evaluate the use of diagnostic laparoscopy and laparoscopic ultrasound in predicting resectability in 110 consecutive patients with a malignant proximal bile duct obstruction who were judged to have resectable disease after standard radiological staging. The accuracy of the laparoscopic staging for detection of unresectable disease and the prevention of unnecessary surgical staging exploration were studied.
Patients and methods

Between January 1993 and May 2000 diagnostic laparoscopy was performed in 110 consecutive patients at the Academic Medical Center, Amsterdam, The Netherlands who were found to have obstructive jaundice due to a proximal bile duct obstruction after radiological staging demonstrated a suspected bile duct malignancy without distant metastases. The diagnostic work-up consisted of transabdominal ultrasonography combined with Doppler imaging. ERCP was performed in most patients with obstructive jaundice, and at least one endoprosthesis was placed if possible. Before 1995 conventional CT scanning was performed, and after 1995 spiral CT scanning. Magnetic resonance cholangiography (MRCP) and endoscopic ultrasound (EUS) were only performed in a selected group of patients in whom controversy remained regarding the intrahepatic segmental tumor growth after radiological staging, because the value of these investigations in predicting the resectability of these tumors has not been proven. Patients were classified according to the Bismuth-Corlette classification into type I-IV.

Diagnostic laparoscopy was performed under general anesthesia as previously described. In short, a CO₂ pneumoperitoneum was induced and, with the use of three 10- to 11- mm trocars (umbilical, left and right subcostal), the abdominal cavity was explored to determine the type of tumor (i.e., cancer of the gall bladder or cholangiocarcinoma) and assess each patient for the presence of peritoneal or for hepatic deposits and for extensive malignant infiltration of the hepatoduodenal ligament. Dissection of the hepatoduodenal ligament and elevation of the hilar plate were not performed. If no histology proven distant metastases or tumor ingrowth in the hepatoduodenal ligament was found, laparoscopic ultrasound imaging was performed. A 7.5-Mhz linear array US-probe (UST5522-7.5; Aloka Co, Tokyo, Japan) was used to examine the liver for intrahepatic metastases, to evaluate the portal vein and to investigate the celiac axis for lymph node metastases. Biopsy samples of suspected metastatic lesions were obtained under direct laparoscopic vision or by laparoscopic ultrasound guidance using biopsy forceps or True cut (Travenol; Baxter Healthcare Corporation, Deerfield, Illionois) and Rostex (Ursus Konsult AB; Stockholm, Sweden) biopsy needles. All tumors were restaged after laparoscopy. A tumor was considered unresectable if metastatic disease or extra hepatic tumor ingrowth, detected during laparoscopy was proven histologically. In all patients with a tumor judged to be resectable or in patients in which metastatic disease, loco regional tumor ingrowth or local extensive gall bladder tumor shown at laparoscopy could not be proven histologically, an explorative laparotomy was performed preferably within 4 weeks after laparoscopy. Preoperatively external irradiation therapy (3 x 3.5 Gy) was
administered to devitalize detached tumor cells in the bile, to prevent implantation of seeding metastases as described previously.\textsuperscript{19,20} Patients with an unresectable tumor at laparoscopy or laparotomy underwent non-surgical palliation that included placement of biliary endoprosthesis or Wallstent (Schneider Europe AG, Bulack Switzerland). In two of these patients with a high risk of gastric outlet obstruction that was missed at conventional CT (before 1997), but discovered at laparoscopy, a gastroenterostomy was performed. When curative resection was possible, a hilar resection was performed with or without (extended) hemihepatectomy almost always including resection of the caudate lobe.

\section*{Results}

Diagnostic laparoscopy was performed in 110 patients (male: 61, female: 49 median age 60 years (range30-80)). Laparoscopic ultrasound imaging was performed in 74 patients. In the other 36 patients the procedure was judged to be superfluous because of evidence of unresectability diagnosed by laparoscopy alone.

Diagnostic laparoscopy alone demonstrated histology proved unresectable disease in 44 patients (40%): metastases in 31 patients, loco regional tumor ingrowth in 10 patients and unresectable gallbladder carcinoma in three patients (table 1). Metastases were localized at the surface of the liver in 10 patients, on the peritoneum in 10 patients, on the diaphragm in eight patients and in the omentum in three patients. In three patients laparoscopic inspection was incomplete due to massive adhesions; they went on for exploration.

Laparoscopic ultrasound was performed in 74 patients,12 of whom already had histologically proved metastases detected at laparoscopy alone. Of the other 62 patients metastasis were suspected in 11 patients and locally extensive disease in eight, but histological proof could only be obtained in one patient. Mean and median operating time for diagnostic laparoscopy was 60 minutes, range from 15 to 145 minutes, about half of the time was used for laparoscopic ultrasound imaging.

The morbidity was low (3%), in two patients a postoperative bleeding occurred, requiring a re-laparotomy (2%) and one patient (1%) had an allergic reaction to iodine. No deaths occurred. The median hospital stay for the laparoscopic procedure was 2 days, with a range of 1 to 11 days.
Table 1 Laparoscopic identification and histological proof of unresectable disease

<table>
<thead>
<tr>
<th>Metastases</th>
<th>n=110</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver</td>
<td>10</td>
</tr>
<tr>
<td>Peritoneum</td>
<td>10</td>
</tr>
<tr>
<td>Diaphragm</td>
<td>8</td>
</tr>
<tr>
<td>Omentum</td>
<td>3</td>
</tr>
<tr>
<td>Loco regional tumor ingrowth</td>
<td>13</td>
</tr>
<tr>
<td><strong>Total (avoided laparotomy)</strong></td>
<td><strong>44 (40%)</strong></td>
</tr>
</tbody>
</table>

Patients with tumors considered potentially resectable after diagnostic laparoscopy and laparoscopic ultrasound imaging (65) underwent exploration. Unfortunately, in 31 of these patients (46%) the tumor was not resected because of metastases (5), loco regional tumor ingrowth (21) and locally unresectable gallbladder carcinoma (3), and in one patient the resection was not completed because of benign disease (sclerosing cholangitis). Distant metastases were found in the liver in three patients and in distant lymph nodes in two (Table 2). In Figure 1 a flow chart is presented outlining the results of laparoscopic staging of 110 patients with a proximal bile duct obstruction is shown.

Table 2 Peroperative identification of unresectable disease

<table>
<thead>
<tr>
<th>Metastases</th>
<th>n=65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver</td>
<td>3</td>
</tr>
<tr>
<td>Lymph nodes</td>
<td>2</td>
</tr>
<tr>
<td>Local extensive gallbladder tumor</td>
<td>3</td>
</tr>
<tr>
<td>Loco regional tumor ingrowth</td>
<td>21</td>
</tr>
<tr>
<td>Benign disease</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total unresectable</strong></td>
<td><strong>30 (46%)</strong></td>
</tr>
</tbody>
</table>
Figure 1 Laparoscopic staging of 110 patients with a proximal bile duct obstruction

Eighteen patients with suspicion of (but not histologically proved) unresectable disease detected at laparoscopic ultrasound imaging underwent an exploration and in 7 patients (39%) a resection was performed that was in 61% microscopically radical.

Of the 30 patients with unresectable disease at laparotomy, a gastroenterostomy was performed in two patients and a hepatico-jejunostomy in combination with a gastroenterostomy in one. Of the 35 patients who underwent a resection, in 15 patients a local hilar resection and 20 patients hilar resection with hemihepatectomy was performed. In 22 patients (59%) the resection was microscopically radical.

The median interval between laparoscopy and laparotomy was 36 days (range 17-84). The sensitivity and negative predictive value of diagnostic laparoscopy for detection of unresectable disease were 60% and 52%, respectively.

Discussion

In this series of 110 consecutive patients, diagnostic laparoscopy increased the yield of radiological assessment of distant metastases and loco regional ingrowth in 41% of the patients. As a result an unnecessary explorative laparotomy could be avoided in these patients because almost all of them were palliated by nonsurgical means.
Laparoscopic ultrasound imaging was of limited additional value in this study. The suspicion of unresectability mainly because of local ingrowth could only be proved by histologic examination in one of the 19 patients. The fact that 7 of the 18 remaining patients could undergo a resection underlines the need of histological proof in case of metastases or local unresectable disease. Furthermore the inability to obtain histological proof of (vascular) ingrowth potentially accounts for the limited additional value of laparoscopic ultrasound imaging.\textsuperscript{21,22}

Diagnostic laparoscopy is only useful in patients who could benefit from non-surgical palliation because in these patients it makes sense to avoid an explorative laparotomy. In our institute surgical palliation is performed only in selected patients and there were three patients in the present series. Others favor non-surgical palliation although this is associated with considerable procedure related morbidity and mortality and late complications as obstruction or cholangitis.\textsuperscript{5} There is currently insufficient evidence to support the use of one palliative procedure over the other and the choice seems to be dependent on the experience within a particular center.

Some studies show that endoscopic endoprosthesis placement is associated with a high failure rate compared to percutaneous endoprosthesis placement.\textsuperscript{23} On the other hand percutaneous endoprosthesis placement can be associated with more complications and therefore the endoscopic route is our first choice for non-surgical biliary drainage.

In forty-six percent of the patients in the present series diagnostic laparoscopy had not detected metastasis or extensive tumor ingrowth that was found during exploratory laparotomy. Patients had unresectable disease mainly due to lymph node metastases and vascular involvement or extensive biliary involvement as has been reported by others.\textsuperscript{6,24} More extensive dissection at laparoscopy could have detected one or two of these findings, probably at the cost of a longer procedure and a higher overall risk. However some improvement in the yield of laparoscopy can be obtained, as 5% of the unresectable tumors were due to metastases that could have possibly been detected at laparoscopy.

In recent years, preoperative radiological staging has improved substantially with introduction of the spiral CT with 3-mm slides, and endoscopic ultrasonography has also shown improvement. These diagnostic improvements could have led to higher detection rate of metastases that were missed in our series. Consequently a reduction in the additional value of diagnostic laparoscopy in staging proximal bile duct malignancies can be expected in the future, similar to what has been shown for distal bile duct obstruction caused by periampullary tumors. Differentiation between gallbladder and proximal bile duct carcinoma on radiological assessment is sometimes difficult. In the present study, before laparoscopy there was doubt about the localization of the tumor in at least 20% of the patients.
Diagnostic laparoscopy for malignant proximal bile duct obstruction

Because biopsies taken during diagnostic laparoscopy often show false negative benign disease and it increase the change of seeding metastases, in the present series no biopsies were taken from tumors presumed to be resectable.

Resection was performed in 13 patients who turned out to have benign disease after histopathologic examination of the resection specimen. In a previous study of 132 resection for presumed proximal bile duct tumor a 15% false positive rate of malignancies was reported in patients with a presumed malignant proximal bile duct obstruction.

At our institution diagnostic laparoscopy and a laparotomy in general are not performed in one session for logistic reasons. One additional consequence of not performing diagnostic laparoscopy and laparotomy in one session is that the total hospital stay for those patients who underwent a laparotomy was longer because they were admitted a second time for the resection. Therefore the potential financial benefit was not as great as would be possible when diagnostic laparoscopy and laparotomy were performed in one session.

In summary, diagnostic laparoscopy without laparoscopic ultrasound imaging is useful in staging patients with a proximal bile duct tumor because in a considerable number of patients an unnecessary laparotomy can be avoided since non surgical palliation is available.

References


