

Review Article

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Role of laparoscopy in hepatobiliary malignancies

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The many benefits of laparoscopy, including smaller incision, reduced length of hospital stay and more rapid return to normal function, have seen its popularity grow in recent years. With concurrent improvements in non-surgical cancer management the importance of accurate staging is becoming increasingly important. There are two main applications of laparoscopic surgery in managing hepatopancreatico-biliary (HPB) malignancy: accurate staging of disease and resection. We aim to summarize the use of laparoscopy in these contexts. The role of staging laparoscopy has become routine in certain cancers, in particular T2 staged, locally advanced gastric cancer, hilar cholangiocarcinoma and non-Hodgkin's lymphoma. For other cancers, in particular colorectal, laparoscopy has now become the gold standard management for resection such that there is no role for stand-alone staging laparoscopy. In HPB cancers, although staging laparoscopy may play a role, with ever improving radiology, its role remains controversial.

Key words Cholangiocarcinoma - colorectal - gallbladder cancer - hepatobiliary malignancies - laparoscopy - perioperative morbidity - ultrasound

Introduction

Since Kurt Semm, pioneer in laparoscopic appendectomy performed the first laparoscopic cholecystectomy almost 30 years ago¹, minimally invasive surgery heralded the promise of less pain, shorter hospital stays, fewer complications and smaller scars as compared to open surgical procedures, most likely due to reduced tissue trauma and inflammatory response². The benefits of laparoscopic approach vary

according to the type of procedure, as some procedures show advantages over open surgery, and others only moderate improvements. As techniques and equipment have improved, minimally invasive surgery (MIS) has played an increasing role in the management of some gastrointestinal malignancies³. Initial concerns over the use of laparoscopic surgery in gastrointestinal malignancy surrounded the extent of laparoscopic oncological resection, adequate lymph node staging and the possibility of peritoneal tumour seeding.

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Each surgical speciality began prospective randomized trials to compare laparoscopic assisted and open surgery for curable cancer. The completion of the Clinical Outcomes of Surgical Therapy (COST)⁴ trial that randomized 872 patients with colonic adenocarcinoma to open versus laparoscopically assisted colectomy demonstrated that there was no significant difference in terms of local recurrence and overall survival at three years⁴. This study, along with multiple other landmark studies⁵ has led the way for consideration of the utility of MIS surgery for cancer.

Multiple large scale retrospective reviews have confirmed initial promise of laparoscopic surgery, demonstrating reductions in peri-operative morbidity^{3,5}, length of hospital stay⁶ and pain, and improvement in quality of life⁷. Apart from smaller incisions, laparoscopic surgery is also associated with reduced wound infections⁸⁻¹⁰ and incidence of incisional hernia¹¹. Costs of laparoscopic procedures are higher than those of open procedures, requiring specialist and, often, disposable equipment; however, the reduced length of hospital stay reduces the overall cost of laparoscopic surgery¹².

Laparoscopy has recently become the gold standard management in certain gastrointestinal conditions⁹. It enables direct inspection of intra-abdominal organs to facilitate biopsy, cultures and aspirates, and allows the use of intra-operative ultrasound to make therapeutic interventions.

In patients with suspected abdominal malignancy if preoperative oncological assessment is unable to identify metastatic disease, laparoscopy could help to correctly stage the disease and prevent unnecessary laparotomy in these patients. Clements *et al*¹³ identified metastatic disease by laparoscopy which was not seen on preoperative imaging in 37 per cent patients with oesophagogastric carcinoma. Preventing unnecessary laparotomy with laparoscopy was associated with decreased hospital stay and early administration of systemic chemotherapy¹⁴. The aim of this review is to define the role of laparoscopy in the management of hepato-pancreatico-biliary (HPB) cancers, aiming to distinguish the use as a diagnostic tool and as an approach for curative resection.

Cholangiocarcinoma

Cholangiocarcinoma often presents late with local or metastatic disease meaning that curative surgical resection is not an option. Up to 45 per cent of patients thought to have resectable disease on preoperative

radiological imaging are found to have locally advanced or metastatic disease at the time of surgery¹⁵⁻¹⁷. Patients with locally advanced hilar cholangiocarcinoma are most likely to require open resection¹⁸. These patients, therefore, may be spared unnecessary laparotomy if staging laparoscopy is carried out to detect those with inoperable disease prior to laparotomy. In addition, an analysis of 175 patients with suspected hilar cholangiocarcinoma diagnoses over ten years found the increasing accuracy and reliability of radiological imaging. This has reduced the requirement of laparoscopy in identifying unresectable disease in recent years^{18,19}.

Although laparoscopic resection of intrahepatic cholangiocarcinoma has been performed, there are limited case reports²⁰⁻²². These only describe laparoscopic surgery in patients who have solitary intrahepatic lesions. There are no randomized controlled trials or large meta-analyses considering laparoscopic versus open resection for intrahepatic cholangiocarcinoma.

Hepatocellular carcinoma/colorectal liver metastasis (HCC/ CRLM)

The use of staging laparoscopy has been shown to reduce the number of futile laparotomies carried out for patients with liver metastases, particularly in selected high-risk patients²³⁻²⁵. The nature of any previous surgery and related complications must be considered; a colorectal resection complicated with post-operative sepsis may lead to an obliterated abdominal cavity precluding laparoscopy^{24,26}. These risks, as well as overall patient fitness should be considered when selecting patients for staging laparoscopy. However, with increasing accuracy and availability of positron emission tomography (PET), computed tomography (CT) and magnetic resonance imaging (MRI) the role of staging laparoscopy in hepatic tumours may be diminishing^{26,27}.

The International Position on Laparoscopic Surgery - The Louisville Statement published in 2008²⁸ divided liver resections into three categories; (i) biopsies and small wedge resections, (ii) resection of the left liver, segments IVb, V and VI, and (iii) hemihepatectomies and resections of segments IVa, VII and VIII; type (iv) resections are considered to be major resections. The consensus was that all types of laparoscopic resection are feasible and safe when carried out by experienced surgeons in specialist centres. Moreover, laparoscopic surgery should be considered the preferred treatment

for all solitary liver lesions under 5 cm in diameter and situated in the left lateral segments²⁸. Furthermore, the long-term outcome of laparoscopic resection is comparable with open resection both in terms of overall survival and disease free survival²⁹. Hand assisted laparoscopic liver resection may reduce the need for conversion to full open surgery and help to control haemorrhage^{28,30}.

Gallbladder cancer

Patients without evidence of nodal or distant metastases on the basis of preoperative investigations should be considered suitable for surgical resection for gallbladder cancer. The extent of the planned surgery is dependent on this staging process³¹. However, this is an uncommon clinical scenario, usually only applicable to those who have had a diagnosis of gallbladder cancer, as an incidental finding at cholecystectomy.

When considering incidental gallbladder cancer diagnosed at the time of cholecystectomy, patients with T1 disease can be considered fully treated with simple cholecystectomy alone provided the cystic duct margin is negative. Those found to have a positive cystic duct margin should be re-explored and undergo bile duct excision, lymphadenectomy and biliary enteric anastomosis. T2 or above primary tumour is most likely to require resection of the gallbladder bed^{32,33}. Laparoscopic liver resection in those cases that do not also require bile duct excision has been shown to be a feasible and safe procedure with low rates of local recurrence and acceptable R0 resection rates compared with open surgery^{32,34}. However, there is no randomized controlled trial to date for the use of laparoscopic liver resection for completion surgery for gallbladder cancer compared with open surgery. There had been no large case series using the laparoscopic approach to treat patients requiring common bile duct excision.

Gallbladder cancer is rare and has insidious symptoms. It is, therefore, often diagnosed late and carries poor prognosis. There has been an increase in the diagnosis of incidental gallbladder cancer in recent years as a result of the increasing number of elective cholecystectomies done in the UK^{31,35}. In patients with high clinical suspicion of gallbladder cancer on the basis of CT and PET imaging, staging laparoscopy has been shown to be of benefit in completing the staging process and as with other cancers preventing unnecessary invasive surgery^{34,35}.

Pancreatic cancer

Staging laparoscopy in pancreatic cancer remains under debate. In the age of high resolution CT, Schnelldorfer *et al*³⁶ investigated the role of staging laparoscopy at identifying radiographic occult metastases. They noted two per cent of cases where radiographic localized disease had distant metastases. However, comparing these rates with laparotomy, an additional nine per cent of cases were noted to have metastases. Many of these metastases were located to the posterior surface of the liver, paraduodenal areas, proximal jejunal mesentery and lesser sac. Their conclusion was to offer all patients with radiographic localized disease a staging laparoscopy, but to extend it to include assessment and visualization of the lesser sac, proximal jejunal mesentery, mobilisation of duodenum and posterior surface of the liver³⁶.

Laparoscopic distal pancreatectomy has been shown in several meta-analyses to be safe and to provide similar oncological outcomes as open surgery³⁷⁻³⁹. All of these studies found reduced length of hospital stay and less blood loss with laparoscopic compared with open surgery. In one meta-analysis of 1,935 patients there was also no difference in resection margins between patients undergoing laparoscopic or open distal pancreatectomy³⁸.

The first laparoscopic pancreaticoduodenectomy was reported in 1994⁴⁰ but due to the complexity of the procedure uptake has been much slower than with other laparoscopic procedures. There have been no meta-analyses of laparoscopic pancreaticoduodenectomy but there are several case series. Large case series have shown that completely laparoscopic pancreaticoduodenectomy can be carried out safely and with acceptable morbidity and mortality compared with open surgery⁴¹⁻⁴³. Pancreatic fistula rates ranged between 1 and 18 per cent in cases series and overall mortality of 1 to 6 per cent. Negative resection margins were reported in 97-100 per cent of cases^{42,43}.

Conclusion

Staging laparoscopy is an invaluable part of the final assessment of patients with certain HPB malignancies (Table) being considered for curative resection, since non-invasive imaging may be unable to detect small liver or peritoneal metastasis. Laparoscopic assessment provides a magnified view along with the ability to use laparoscopic ultrasound. Surgeons are, therefore, able to visualize occult liver metastases or local tumour

Table. The utility of laparoscopy

Malignancy	Staging modality	Routine laparoscopic resection	Role for staging laparoscopy
Liver	PET CT/ MRI	Yes	Diminishing role ²⁸
Gastric	OGD/ CT	Yes	Potentially in T2 stage patients, with potentially nodal disease less than 1cm ⁴⁴
Cholangiocarcinoma	ERCP CT	No	For hilar cholangiocarcinoma ²¹
Gall bladder	CT/ PET Incidental finding	Routinely performed laparoscopically, but no large data series to compare open vs laparoscopic	No ²¹
Pancreatic	CT	Performed, but not universally accepted	Limited role ³⁷
Colorectal	Colonoscopy CT/ MRI	Gold standard	No ⁴⁵
Lymphoma	CT Tissue biopsy	Has role in elective splenectomy. Potentially for tissue diagnosis	For tissue diagnosis ⁴⁶

OGD, oesophago-gastro duodenoscopy; CT, computed tomography; MRI, magnetic resonance imaging; ERCP, endoscopic retrograde cholangio-pancreatography; PET, positron emission tomography. Numerals in superscripts are references

invasion into major vessels that would prevent curative resection. By performing the procedure, a surgeon may spare the patient a futile laparotomy that comes with increased surgical risk, pain and longer hospital stay. Undergoing such a laparotomy may also delay any subsequent oncological treatment until the patient is fully recovered. The role of staging laparoscopy has become routine in certain cancers, in particular T2 staged, locally advanced gastric cancer, hilar cholangiocarcinoma and non-Hodgkin's lymphoma.

In many cancers laparoscopic resection is now the standard management strategy. In these conditions, therefore, a separate staging laparoscopy would be of no value and would only expose the patient to additional risk. Furthermore, there has been great advancement in the accuracy of radiological staging across the board which has reduced the value of staging laparoscopy in the management of colorectal cancer in particular which is staged only using CT, MRI and PET scanning. In assessment of liver tumours its role remains uncertain and for assessment of liver metastases it has been suggested that staging laparoscopy has been superseded by high quality CT, MRI and PET scanning.

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Conflicts of Interest: None.

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