Current status of laparoscopic surgery in gastrointestinal malignancies

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Abstract Laparoscopy has become a significant tool in a surgeon's armamentarium since the first laparoscopic cholecystectomy in 1989. Oncological surgeons have been slow in adopting laparoscopy for fear of inadequate cancer operation and occurrence of port site metastasis. Neither of these concerns have stood the test of time. Laparoscopy is being used increasingly in oncological surgery both for staging and respective surgery. This article outlines the present use of laparoscopy in GI cancer surgery.

Keywords GI malignancy · Laparoscopic resections · Diagnostic laparoscopy

Introduction

Laparoscopy, one of the most significant advances in surgery in the latter half of the twentieth century, only blossomed over the last 20 years. Yet, its birth can be dated over 100 years ago when George Kelling from Dresden introduced a cystoscope into the peritoneal cavity of a living dog and insufflated air to enhance the view [1]. German surgeon Eric Muhe performed the first laparoscopic cholecystectomy in 1985 [2], and with the advent of the computer chip television camera Philippe Mouret introduced the first video-laparoscopic cholecystectomy in 1987 [3]. The explosion had started with laparoscopy finding itself in all areas of the peritoneal and retroperitoneal cavity.

The application of laparoscopy in the field of surgical oncology was halted by the seemingly overwhelming reports of port-site metastasis, with some studies quoting its incidence at 14–32% post-laparoscopic cholecystectomies for unsuspected gallbladder carcinomas [4]. In support of these studies, many theories explaining the mechanism were postulated ranging from tissue handling with inadvertent spillage to the implantation of aerosolized tumour cells circulating within the pneumoperitoneum. Since then, numerous large studies conducted at high-volume laparoscopic surgical oncology centres have revealed a port-site recurrence rate on average of up to 0.62% which is comparable to the laparotomy rate of 0.6% [5]. Also, immunologic benefit of laparoscopic surgery was investigated and studies confirmed that laparoscopic surgery was less stressful than open surgery as evidenced by higher levels of interleukin-6 (IL-6) and C-reactive protein (CRP) in the latter [6]. Although the clinical significance of this is uncertain, we could hope that improved immunologic status of the patient may improve outcomes from laparoscopic surgery in oncology.

In this paper, we discuss the current role of laparoscopic surgery in gastric, pancreatic, hepatobiliary and colorectal carcinoma.

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Gastric cancer

Although laparoscopy was initially introduced by Abaev in 1965 to assist with disease staging [7], it can now be used for curative as well as for palliative purposes.

Burke et al [8] published their study of 110 gastric cancer patients who underwent laparoscopy which enabled them to exclude 22% (24/110) of these patients for further surgical intervention due to identification of occult metastasis. Thus, staging laparoscopy could be performed during the same anaesthesia for curative resection, if deemed resectable, or as a separate procedure. Staging laparoscopy can range from simply inspecting the liver and peritoneum to extensive dissection which may include lesser sac exploration and the use of laparoscopic ultrasound. Laparoscopic ultrasound defines the depth of tumour penetration, nodal involvement and occult liver metastasis. Certainly, greater information could be gathered with extensive exploration. In females, the pelvis must be inspected for a Krukenberg tumour.

Laparoscopic gastrectomy is well established in early gastric cancer which is defined as cancer involving the gastric mucosa or submucosa. In Japan, screening with endoscopic US enables accurate diagnosis and staging of early gastric cancers in 20% of the patients [9]. These neoplasms could be managed by either endoscopic mucosal resection (EMR) or laparoscopic gastrectomy without extended lymph node dissection. Laparoscopic surgery with curative intent remains controversial. However, Huscher et al [10] with their series of 100 patients that underwent totally laparoscopic gastrectomies with extended lymph node dissections revealed comparable long-term survival rates as with open surgery. The advantage of laparoscopic surgery in reducing morbidity and hospital stay is particularly attractive to patients with a limited life span. If occult metastasis is identified at staging laparoscopy, laparoscopic bypass can be performed for symptomatic patients.

As per current guidelines, staging laparoscopy should be performed in gastric cancer patients without evidence of metastasis [11]. Curative resection is recommended if T1 lesion is identified; neoadjuvant chemotherapy followed by surgery is recommended if $\geq$ T2 disease exists, provided it is resectable; and palliative chemotherapy is advised if disease is unresectable.

Pancreatic cancer

Resectability of pancreatic cancers can be accurately evaluated with multi-detector computed tomography (MDCT) with a sensitivity and specificity of 94% and 89%, respectively [12]. However, borderline resectable cases require further evaluation that is made possible with laparoscopy. In 109 cases of pancreatic cancers, Reddy et al [13] found high predictive values with staging laparoscopy employed to evaluate hepatic, peritoneal or mesenteric metastasis,

thus suggesting that laparoscopy must be performed in all pancreatic cancer patients prior to curative surgery.

Curative laparoscopic pancreatectomy although successful is limited only to a few, high-volume, experienced centres. Pugliese et al [14] published a retrospective review of their laparoscopic Whipple's with oncological principles, lymphadenectomies and resection margins comparable to those of conventional surgery. Similarly, feasibility and safety of laparoscopic distal pancreatectomies has also been documented [15–16].

As per current guidelines, staging laparoscopy should be selectively offered to pancreatic cancer patients with borderline resectability or poor prognostic factors (high CA19-9, large tumours, tumours of the body or tail) with a view of offering neoadjuvant chemoradiation if no radiological evidence of metastasis exists [17].

Hepatobiliary cancers

Significance of laparoscopy in management of hepatocellular carcinoma is evolving. Laparoscopy and laparoscopic ultrasound are both able to evaluate disease resectability, thus aid in selection of patients who would benefit from either laparoscopic resection, or local ablative therapy, or formal hepatectomy [18–19].

Hepatic metastatectomy for colorectal carcinoma improves 5-year survival from 5–10% to up to 45% in selected patients. However, not all patients with hepatic metastasis are candidates for curative hepatic resection. Laparoscopy identifies patients with occult metastasis which precludes curative resection, but it is not required in all patients with potentially resectable disease. Grobmyer et al [20] have suggested a clinical risk score (CRS) calculated on the basis of disease-related factors such as lymph node positivity, duration of disease-free interval, number of hepatic tumours, hepatic tumour size, and carcinoembryonic antigen levels. The CRS correlates with the likelihood of identifying occult unresectable disease, and therefore predicts the benefit of staging laparoscopy.

Laparoscopic resections of both primary and secondary hepatic tumours are readily performed. Small tumours located in the left lateral hepatic lobe are ideal for laparoscopic resection, however Vibert et al [21] have reported the feasibility of major hepatectomies performed laparoscopically.

Similar to its application in malignancies of the liver, laparoscopy plays a critical role in staging gallbladder cancers. Recently, we at Tata Memorial Hospital devised and published a new scoring system, Tata Memorial Hospital Staging System (TMHSS), for gallbladder cancer based on disease factors such as serum bilirubin and CA19-9 levels, and specific CT findings [22]. Again, the score correlates with disease status, and hence predicts the benefit of staging laparoscopy.

Once the diagnosis of gallbladder is suspected, either due to a gallbladder mass on ultrasound or high serum CA19-9 levels, or is confirmed on fine needle aspiration cytology (FNAC), open exploration must be performed with the intent of a radical cholecystectomy with wedge resection of the liver and lymphadenectomy [23]. Laparoscopy plays no role in the definitive treatment of gallbladder cancer except if a T1a (invading the lamina propria) lesion with negative margins is recognised following laparoscopic cholecystectomy [24]. Lesions that are >T1a or have positive tumour margins require a revision cholecystectomy with wedge resection of the liver bed and lymphadenectomy [25].

Colorectal cancers

Laparoscopic colectomy, in experienced hands, is now considered a feasible approach to the surgical management of colon cancer. This advancement has been facilitated by the development of laparoscopic staplers and the harmonic scalpel. However, its benefits are compromised by factors such as the need for advanced laparoscopic operating skills, restrictions on early discharge due to presence of an anastomosis, and the concern of adherence to adequate oncological principles. Multiple studies including that of Melotti et al [26] and a meta-analysis by Korolija et al [27] have confirmed that adequate tumour margins can be achieved and appropriate number of lymph nodes harvested laparoscopically. Both the MRC CLASICC [28] and COST [29] studies have concluded that the overall survival and disease free survival were comparable for laparoscopic and open surgery. A sub-analysis from the COLOR Trial [30] did indicate that these favorable results occurred when laparoscopic surgery was performed in high-volume centres. There are, however impaired short-term outcomes including positive circumferential margins (CRM) post-laparoscopic anterior resection in the MRC CLASICC Trial [30].

As per current guidelines, laparoscopic surgery is recommended for colorectal cancer in the absence of intra-abdominal adhesions, advanced local or metastatic disease, or bowel perforation or obstruction [31]. Laparoscopic surgery for rectal cancer is yet to demonstrate any benefit over conventional procedure and is not recommended outside of a clinical trial.

Conclusion

Laparoscopy surgery is increasingly being applied to gastrointestinal oncology. Though its main purpose still lies with staging of malignancies, the application of laparoscopy in therapeutic management currently applies to cancer of the colon at present time. With further innovations in laparoscopic instruments and modes of micro-visualisation, we are hopeful that laparoscopic surgery will become a

vital component of the therapeutic armamentarium for other gastrointestinal malignancies.

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