Safety and application of laparoscopic gastrectomy for benign gastric disease and gastric cancer

MK Zia, G Morris-Stiff, A Luhmann, R Jeffries, O Ehsan, A Hassn

Department of General Surgery, Princess of Wales Hospital, Bridgend, UK

ABSTRACT

INTRODUCTION Laparoscopic gastrectomy is rapidly expanding despite reservations by some surgeons regarding its safety and radicality. The aim of this study was to evaluate patients undergoing laparoscopic gastrectomy for both benign and malignant disease with particular emphasis on technical feasibility, safety, effectiveness and complications.

PATIENTS AND METHODS Review of prospectively collected data of patients who underwent laparoscopic gastrectomy from May 2005 to September 2009 under the care of one consultant surgeon.

RESULTS A total of 61 laparoscopic gastrectomies were performed (35 men and 26 women) with a median age of 68 years (range, 41–90 years). There were 39 distal gastrectomies (19 adenocarcinoma, 6 gastrointestinal stromal tumour [GIST], 4 benign gastric outlet obstruction, 4 high-grade dysplasia in gastric adenomas, 4 non-healing ulcers, 2 gastric antral vascular ectasia [GAVE]); 15 sub-total gastrectomies (13 adenocarcinomas, 2 GIST); and 7 total gastrectomies (5 adenocarcinomas, 1 GIST, 1 carcinoid). Median follow-up was for 48 months (range, 1–72 months). There was one death, two major and six minor complications. All patients with complications made a satisfactory recovery.

CONCLUSIONS Laparoscopic gastrectomy is associated with a low mortality (1.75%) and major morbidity (3.50%). Although technically demanding, especially when a D2 lymphadenectomy is performed, our results have shown that tailored laparoscopic resection based on tumour characteristics with either D1 or D2 lymphadenectomy results in good surgical and oncological outcomes.

KEYWORDS

Laparoscopic gastrectomy – Benign gastric disease – Gastric cancer – Audit

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CORRESPONDENCE TO

A Hassn, Consultant Upper Gastrointestinal and Laparoscopic Surgeon, Princess of Wales Hospital, Coity Road, Bridgend CF31 1RQ, UK
E: ahmed.hassn@bromor-tr.wales.nhs.uk

Gastric surgery, as other surgical disciplines, aims to achieve resection of the primary lesion and its draining lymph nodes (in cancers), with minimum complications and the best possible quality of life. Traditionally, it has been performed by open access and there is a general consensus regarding the satisfactory oncological safety of this approach. The role of laparoscopic gastric surgery has not yet been completely defined and doubts still remain about its ability to satisfy all the oncological criteria met during conventional open surgery.¹

Nevertheless, in the past decade, laparoscopic techniques have gained clinical acceptance as they offer significant advantages compared with open surgery: reduced surgical stress, less intra-operative blood loss, less postoperative pain and accelerated recovery, earlier return to normal bowel function with earlier resumption of oral intake, early discharge from hospital, and overall lower financial costs.^{2–5} The same advantages have been reported after laparoscopic-

ic subtotal or total gastrectomy for benign tumours as well as early gastric cancers.^{6–9}

Laparoscopic-assisted distal gastrectomy has been applied to the treatment of gastric cancer and there are now several publications regarding the safety and feasibility of this approach.^{10,11} However, both laparoscopic-assisted distal gastrectomy and laparoscopic-assisted subtotal gastrectomy for distal gastric cancer can only be justified and widely accepted as a safe alternative to open surgery if equal long-term results are obtained. This would include an equivalent radical oncological resection to open surgery. In contrast to laparoscopic-assisted distal gastrectomy, there have been few reports on laparoscopic-assisted total gastrectomy compared with open total gastrectomy.¹¹

The aim of the present study was to analyse the results of laparoscopic gastric surgery with intracorporeal anastomosis, for both benign and malignant conditions, performed in our institution by one laparoscopic oesophagogastric

surgeon and thereby evaluate its feasibility, safety and complications.

Patients and Methods

All patients who underwent laparoscopic gastrectomy under the care of a single laparoscopic upper gastrointestinal surgeon were identified from a prospectively maintained database. Data collected included: patient demographics; ASA status; pTNM stage; tumour histology; number of retrieved lymph nodes; type of gastrointestinal anastomosis; peri-operative outcome including blood loss, resumption of diet, morbidity and mortality; and overall and disease-free survival. Laparoscopic resectional surgery for oesophagogastric benign and malignant disease was approved by local governance committee in the trust and all operations were audited in local and regional meetings. Also, an early series was presented at an AUGIS (Association of Upper Gastrointestinal Surgery) meeting in 2006. The learning curve was included in this series. In the early part of the series, cases were carefully selected, *i.e.* early tumours, distal resections and slim patients. As experience advanced, procedures included subtotal and total gastrectomies at all operable stages. In the last 2.5 years, laparoscopic gastrectomy was offered to all patients regardless of stage, site of lesion and body mass index status.

Surgical procedures consisted of total gastrectomy with a Roux-en-Y oesophagojejunostomy for proximal and middle gastric cancers, subtotal/distal gastrectomy with a Roux-en-Y gastrojejunostomy for distal gastric cancers and antral/prepyloric lesions. The port site placements are shown in Figure 1. The first part of duodenum was divided with 60 mm vascular stapler and all gastrojejunostomies were constructed side-to-side intracorporeally using 60 mm vascular cartilage. After anastomosis, the remaining stapler entry site in the bowel wall was closed with a single layer 3/0 vicryl intracorporeal continuous suture. For oesophagojejunostomy, an Orvil (Covidien) 25 mm stapling gun was used constructing an end-to-side anastomosis. In addition, a D2 *en-bloc* lymphadenectomy was performed for carcinomas and a D1 *en-bloc* lymphadenectomy for patients with severe dysplasia. For benign lesions, a tailored gastric resection was devised which would adequately excise the ulcer or tumour bearing area. All operations were performed laparoscopically with intracorporeal anastomosis and the specimen was extracted through the umbilical port in an Endo Catch.

Results

A total of 61 patients underwent laparoscopic gastrectomy during the study period between May 2005 and Sept 2009. There were 35 men and 26 women with a median age of 68

Figure 1 Configuration of port site placements.

years (range, 41–90 years). The median follow-up was for 48 months (range, 1–72 months). The median ASA grade was 3 (range, 1–4).

The indications and the operations performed are summarised in Figure 2. Thirty-nine patients underwent distal gastrectomy, 15 sub-total gastrectomy and seven total gastrectomy. Fifty-nine gastrectomies were successfully completed laparoscopically and two were converted to open operation. Among these conversions, one was a very large GIST in the proximal stomach with the dissection hampered by a larger left lobe of liver, and the other was a total gastrectomy converted due to instrument failure.

The median operating time was 2 h 40 min (range, 1 h 20 min to 6 h) and the estimated median blood loss was 45 ml (range, 30–74 ml). One patient required transfusion for a postoperative haemorrhage. The median time to resumption of food intake was 3 days (range, 2–5 days) with a median length of hospital stay of 12 days (range, 2–29 days).

Histological examination revealed 38 cancers, 14 benign lesions and nine low-grade GISTs (Table 1). Among the cancers, 37 were adenocarcinomas and one carcinoid. All proximal and distal resection margins were clear; however, the circumferential resection margin (CRM) was involved in two patients with advanced cancer. D1 lymphadenectomy was performed in 15 patients for early stage gastric cancer and D2 lymphadenectomy in 23 patients for high-risk cancers. A median of 17 lymph nodes were retrieved (range, 8–46). The pTNM showed 14 stage I, 13 stage II, 11 stage III and no stage IV lesions. Two patients with advanced cancer who had involved CRM developed tumour recurrence during follow-up, one at 5 months and the other after 14 months.

Complications

There was one death and two patients developed major

complications (Table 2). The patient who died suffered a myocardial infarct on the 8th postoperative day following a sub-total gastrectomy. Among the two patients with major complications, one suffered a duodenal stump blow out which was managed by open repair and the other had a postoperative haemorrhage which was managed by re-laparoscopy, drainage and blood transfusion. There were six minor complications. All patients developing complications made a satisfactory recovery.

Discussion

Gastric cancer is the seventh most common cancer in the UK and has an incidence of about 8000 new cases per

Table 1 Tumour characteristics

Location of lesion	Oesophagogastric junction ($n = 0$); upper third ($n = 7$); middle third ($n = 12$); lower third ($n = 42$)
Total cancers	$n = 38$
D1 lymphadenectomy	For early stage cancers ($n = 15$)
D2 lymphadenectomy	For high-risk cancers ($n = 23$)
No of retrieved lymph nodes	Median 17, range (8–46)
Tumour histology	37 adenocarcinoma; 1 carcinoid
Margins	Clear except 2 patients with locally advanced but resectable disease
pTNM	I ($n = 14$) II ($n = 13$) III ($n = 11$) IV ($n = 0$)

Table 2 Complications

Complication	Number	Outcome
Myocardial infarction	1	Died
Blow out of duodenal stump	1	Patient. survived after open repair
Postoperative haemorrhage	1	Patient survived after re-laparoscopy, drainage and blood transfusion
Peri-umbilical laparoscopic port site infection	2	Treated with antibiotics
Chest infection	1	Treated with antibiotics
Renal failure	1	Renal impairment present before surgery. Renal function returned to baseline following surgery
Ascites	1	Patient with alcoholic cirrhosis
Exacerbation of psychosis	1	Treated with antipsychotics

annum. Men are affected at least twice as often as women and gastric cancer remains among the top ten causes of cancer-related deaths in either sex.¹²

Most authorities agree that the treatment of operable distal gastric cancer is a radical resection of the distal four-fifths of the stomach with a tumour-free margin of at least 5 cm.^{15,14} The extent of draining lymph node dissection is still contentious. In Japan, where gastric cancer is six times more common than the West, an extended dissection with routine involvement of D2 and D3 lymph nodes is performed because of perceived improved long-term survival, despite the higher postoperative morbidity and mortality.¹⁵⁻¹⁸ In contrast, a more conservative lymphadenectomy (D1) is favoured in the West due to the higher complications associated with extended lymphadenectomy (D2, D3)¹⁹⁻²² and owing to a paucity of long-term survival data following extensive lymph node resections.²³⁻²⁵

Goh *et al.*²⁶ are credited with the first laparoscopic-assisted distal gastrectomy in 1992. It was performed for a peptic ulcer with a Billroth II gastrojejunostomy reconstruction. The first laparoscopic gastrectomy for cancer was performed in 1992 by Kitano *et al.*²⁷ Again, the reconstruction was performed by a Billroth II gastrojejunostomy. Following this, a number of publications have appeared reporting the important advantages of laparoscopic total, sub-total and distal gastrectomy.²⁸⁻³²

Goh *et al.*²⁸ reported early follow-up results of laparoscopic distal gastrectomies in 1997. A questionnaire was sent to surgeons in 12 countries regarding a total of 118 laparoscopic distal gastrectomies. Out of 16 respondents, 10 felt laparoscopic distal gastrectomy to be superior to open distal gastrectomy in terms of duration of recovery, pain and cosmesis. Another interesting study in 1999 by Shirasahi *et al.*²⁹ published a report of 40 laparoscopic-assisted gastrectomies for early gastric cancer. At a mean follow-up of 21 months, there was no morbidity, mortality or recurrence.

In 1999 and then 2000 Adachi *et al.*^{30,31} reported superior results of laparoscopic distal gastrectomy as compared with open distal gastrectomy with respect to weight loss, early dumping syndrome, heart burn, surgical trauma, return of gastrointestinal function and duration of hospital stay.

An interesting, prospective, randomised, controlled trial comparing laparoscopic and open gastrectomy for malignant disease was published in 2003 by Weber *et al.*³² They compared the 5-year results of a series of 12 gastric cancer patients treated by laparoscopic subtotal gastrectomy with 13 patients who underwent open gastrectomy and acted as controls. This study concluded that the laparoscopic approach did not compromise the oncological safety or the 5-year overall and disease-free survival rates.³²

In 2002, Kitano *et al.*¹⁰ published interim results of a randomised controlled trial comparing open distal gastrectomy with laparoscopy-assisted distal gastrectomy for early gas-

tric cancer. A total of 28 patients were included in the trial and the results showed an earlier recovery, reduced pain and less impairment of pulmonary function following laparoscopic-assisted distal gastrectomy.

In 2005, Huscher *et al.*¹ reported the results of a prospective, randomised, controlled trial with a total of 59 patients comparing laparoscopic ($n = 30$) versus open ($n = 29$) subtotal gastrectomy for distal gastric cancer. There was no difference in the mean number of resected lymph nodes at 33.4 ± 17.4 in the open group and 30.0 ± 14.9 in the laparoscopic group. Operative mortality was non-significantly higher at 6.7% (2 patients) in the open group compared to 3.3% (1 patient) in the laparoscopic group. Morbidity rates were also comparable at 27.6% and 26.7% in the open and laparoscopic groups, respectively (not significant). They concluded that laparoscopic subtotal gastrectomy for distal gastric cancer is feasible and safe with short- and long-term results similar to those obtained with an open approach. In addition, the laparoscopic group had less blood loss, shorter time to resumption of oral intake, earlier discharge from hospital and similar 5-year overall and disease-free survival. More recently, several other authors have found similar benefits from laparoscopic gastrectomy compared with open surgery.³³⁻⁴⁰

Our results have shown both low mortality (1.75%) and major morbidity (3.50%) rates for laparoscopic gastrectomy. This compares favourably with published literature regarding complications from open gastrectomy. The time to resumption of food intake was also favourable (median, 2 days; range, 1-4 days) with a median length of postoperative hospital stay of 12 days (range, 2-29 days). In this series, most of the patients who stayed in hospital for longer than 8 days did so due to social reasons and, again, a 12-day postoperative median stay compared favourably with open surgery. In addition, all proximal and distal resection margins were clear and the CRM was involved in only two patients who were known to have advanced, albeit resectable, cancer. Unfortunately, these two patients developed recurrence. D1 lymphadenectomy was performed in 15 patients for early stage gastric cancer and D2 lymphadenectomy in 23 patients with high-risk cancers. An acceptable median of 17 lymph nodes were retrieved (range, 8-46). The pTNM showed 14 stage I, 13 stage II, 11 stage III and no stage IV lesion. Two patients had tumour recurrence – one 5 months after surgery and the other 14 months after.

Conclusions

Laparoscopic gastrectomy for both benign and malignant disease has similar short-term outcomes to conventional surgery that testify to the oncological safety and radicality of the procedure in addition to all the advantages of minimal-

ly invasive access. It has a low complication rate and it is safe and feasible in the hands of experienced surgeons.

These results would suggest that laparoscopic gastric resections can be performed for malignant disease; however, long-term follow-up studies are required to validate oncological outcomes in these patients.

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