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Original articles

Laparoscopic gastric bypass for gastric outlet obstruction is associated with smoother, faster recovery and shorter hospital stay compared with open surgery

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Abstract
Background/Purpose. Laparoscopic gastric bypass for relief of gastric outlet obstruction (GOO) is feasible and safe. However, comparative data to confirm the benefits of the laparoscopic approach remain scarce.
Methods. Between 1998 and 2003, 26 patients underwent 15 laparoscopic (surgeon A) and 12 open (surgeon B) gastrojejunostomies (GJs) for GOO. The indications for surgery included malignant ($n = 17$) and benign ($n = 10$) diseases.
Results. There were no conversions to open surgery in the laparoscopic group, and no operative mortality occurred in either group. The groups were comparable for age, sex, American Society of Anesthesiology (ASA) score, frequencies of previous abdominal surgery and of malignant or benign disease, and type of GJ fashioned. There were no differences between the laparoscopic and open groups with regard to the operating time (median, 90 vs 111 min; $P = 0.113$), and patients receiving intraoperative blood transfusion. However, laparoscopic surgery was associated with significantly shorter durations of postoperative intravenous hydration (60 vs 234 h; $P = 0.001$), opiate analgesia (49 vs 128 h; $P = 0.025$), and hospital stay (3 vs 15 days; $P = 0.005$). Operative morbidity occurred more frequently following open surgery (33% vs 13%; $P = 0.219$).
Conclusions. Laparoscopic GJ for the relief of GOO is associated with a smoother and more rapid postoperative recovery and shorter hospital stay compared with open surgery. In experienced hands, the laparoscopic approach to GJ should become the new gold standard.

Key words Gastrojejunostomy · Laparoscopic · Obstruction · Cancer · Hospital stay

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Introduction

Gastric outlet obstruction (GOO) complicates up to one-third of patients with periampullary malignancy[1] and some one in seven patients with antral gastric cancer.[2] The management of these patients is, by and large, palliative, and traditionally involves a laparotomy and the fashioning of a gastrojejunostomy (GJ). In the modern era of proton-pump inhibitor therapy and eradication treatment for *Helicobacter pylori*, benign disease has become an uncommon cause for GOO even in developing countries.[3]

The laparoscopic approach to gastric bypass for the relief of GOO represents a feasible and safe advance in surgery.[4–7] However, there are currently limited comparative data available to examine the potential benefits of laparoscopic GJ over open surgery.[7,8] The aim of this study was to compare the outcome of laparoscopic gastric bypass for the relief of GOO with that of open surgery in patients with malignant and benign diseases.

Patients and methods

Patients

Patients who underwent open or laparoscopic GJ at our Hepatobiliary Unit, performed by two surgeons (R.F.M. and B.J.A.) between November 1998 and November 2003 were identified through a review of the theatre log books.

Indications for gastric bypass

Gastric bypass surgery was offered to patients presenting with GOO secondary to locally advanced or metastatic malignancy of the gastric antrum or periampullary region (pancreatic head, ampulla, distal bile duct, and

duodenum) and to those unfit for, or who declined, major resection. Major vascular involvements, e.g., hepatic, celiac, or superior mesenteric arteries, or portal vein for more than 1 cm, were considered contraindications to resection. Surgery was, in general, reserved to patients in whom attempts at endoscopic palliation, e.g., insertion of an expandable metal stent, had failed. Patients with GOO secondary to benign disease were managed conservatively in the first instance with the administration of drug therapy (e.g., proton-pump inhibitors or anti-tuberculous chemotherapy as appropriate) and endoscopic balloon dilatation of pyloric and duodenal strictures. Surgery was therefore reserved to patients in whom medical therapy had failed.

Data management

Data related to the laparoscopic procedures were prospectively entered into purpose-designed audit forms and logged into a computerized database that was regularly maintained. Data for open surgery were collected retrospectively by reference to the patients' medical records. The data collected included age, sex, American Society of Anesthesiology (ASA) score, previous abdominal surgery, the nature of the disease (benign or malignant), operating time, need for blood transfusion, durations of postoperative parenteral hydration and of opiate analgesia, hospital stay, and operative morbidity and mortality. Patients with periampullary cancer who underwent a trial dissection and in whom a pancreaticoduodenectomy was abandoned for a palliative bypass surgery, due to the detection of locally advanced disease, were excluded from this study in order to avoid bias. The additional component of a trial dissection would undoubtedly have increased the operating time, and may increase morbidity and prolong recovery, rendering any comparison with a planned laparoscopic bypass inappropriate. In addition, patients who underwent a concomitant biliary bypass at the time of the GJ were excluded from this study.

Operative techniques

All patients admitted under the care of surgeon A with an indication for a gastric bypass were offered surgery through a laparotomy, while surgeon B carried out the bypass surgery laparoscopically for "all comers" under his care. The open approach to gastric bypass surgery involved the construction of an antecolic posterior GJ, while the laparoscopic bypass was fashioned using an antecolic anterior GJ. The method of construction of the GJ involved either a simple loop GJ or a Roux-en-Y loop GJ, and either a standard side-to-side GJ or exclusion GJ. An exclusion GJ was reserved to patients with unresectable antral gastric cancer. The GJ was fashioned using either a hand-sutured two-layer technique or a combination of staples and sutures. The operative techniques of laparoscopic loop, Roux-en-Y, and exclusion gastric bypass have been described preciously.[9–12]

Statistical analysis

Data were analysed using the software package SPSS 10 (Chicago, IL, USA). Results were expressed as medians and interquartile ranges (IQR). Univariate analysis was performed utilizing the χ^2 test for categorical variables and the Mann Whitney *U*-test for continuous variables. Results were expressed as numbers (percent) and as medians (interquartile ranges), respectively. Significance was accepted at the 5% level.

Results

Patients and procedures

Over the 6-year period of this retrospective comparative study, 26 patients underwent 27 procedures. The underlying causes of GOO (Table 1) included periampullary malignancy (n = 10), benign duodenal strictures (n = 11), antral gastric cancer (n = 4), and metastases from colonic cancer (n = 1).

The patients in the open and laparoscopic surgery groups were comparable for age, sex, ASA score, and the frequencies of previous abdominal surgery and of benign and malignant causes for GOO (Table 2).

The procedures performed via the laparoscopic and open approaches included 15 and 12 bypasses, respectively. The patients were comparable for the type of GJ that was fashioned (Table 3). One patient in the laparoscopic group who suffered with nonsteroidal anti-

Table 1. Underlying causes of gastric outlet obstruction

	Open GJ (n = 12)	Laparoscopic GJ (n = 15)
CA pancreas	4	5
CA duodenum	0	1
Cholangiocarcinoma	0	1
CA stomach	2	2
CA colon	1	0
Benign duodenal stricture	5	6
Peptic stricture	2	3
NSAID-induced	0	2
Acute pancreatitis	0	1
Chronic pancreatitis	1	0
Gunshot injury	1	0
Adhesions	1	0

GJ, gastrojejunostomy; CA, carcinoma; NSAID, nonsteroidal anti-inflammatory drug

Table 2. Patient details

	Open GJ ($n = 12$)	Laparoscopic GJ ($n = 15$)	*P* value
Age (years)	57.5 (53–62)	70 (44.5–71.5)	0.206
Sex: M/F	6/6	10/5	0.452
ASA score III-IV	2 (17%)	7 (47%)	0.108
Previous abdominal surgery	7 (58%)	6 (40%)	0.288
Indications for surgery			
Malignant	8 (67%)	9 (60%)	0.519
Benign	4 (33%)	6 (40%)	

GJ, gastrojejunostomy; ASA, American Society of Anesthesiology

Table 3. Surgical procedures

	Open GJ ($n = 12$)	Laparoscopic GJ ($n = 15$)	*P* value
Simple loop GJ	9	12	0.557
Roux-en-Y GJ	3	1	0.216
Exclusion GJ	2	2	0.611
Revision GJ	1	1	0.701

GJ, gastrojejunostomy

inflammatory drug (NSAID)-induced duodenal strictures underwent laparoscopic revision of a previous Roux-en-Y GJ at 2 months, for symptomatic stenosis of the stoma.[10]

Outcomes

There were no conversions to open surgery in the laparoscopic group. The main outcome measures examined are detailed in Table 4. No operative deaths (death within 30 days of surgery) occurred in either group. The operating time was shorter in the laparoscopic group, although the difference was not significant. Intraoperative blood transfusion was required in three patients in the open group (2, 3, and 5 units of blood) and in none in the laparoscopic group. The laparoscopic approach, however, was associated with significant reductions in the durations of postoperative parenteral hydration, opiate analgesia, and postoperative hospital stay compared to open surgery (Table 4).

Postoperative complications occurred less frequently following laparoscopic surgery (Table 4). Complications in the laparoscopic group included postoperative respiratory depression that required overnight ventilation, and catheter-related bloodstream infection in a patient who was receiving intravenous hydration prior to surgery. Complications following open surgery included bleeding from the gastrojejunal anastomosis in two patients (both of whom required blood transfusion and re-laparotomy with suture hameostasis), bleeding into the abdominal drain that required postoperative blood transfusion, and delayed gastric emptying that persisted for 11 days.

Discussion

Several randomised[13–18] and comparative[19–22] studies have demonstrated the benefits of laparoscopic surgery over laparotomy, such as in patients undergoing colonic resection,[17,18] elective[15] and emergency[14] cholecystectomy, Nissen fundoplication,[13] splenectomy,[19,20] adrenalectomy,[21] liver resection,[22] and hysterectomy.[16] The laparoscopic approach was associated with quicker postoperative recovery,[14,18–20] reduction in opiate requirements,[15,17,19–22] lower morbidity,[14,19] and shorter postoperative hospital stay[13–15,17,19–22] compared with open surgery.

The available data from randomised controlled trials[23–25] and comparative studies[26,27] of the more complex laparoscopic versus open gastric bypass for the correction of morbid obesity showed significant reductions in operating time,[25] requirement for opiate analgesia[23,24] postoperative hospital stay,[24–27] time to recovery,[27] and late morbidity.[25] However, the available data that compare the outcome of laparoscopic gastric bypass for the relief of GOO with that of open surgery are currently scarce. In a case-controlled study of laparoscopic ($n = 9$) versus open ($n = 13$) GJ in patients with GOO secondary to unresectable periampullary cancer, Bergamaschi et al.[8] reported significant reductions in estimated intraoperative blood loss ($P < 0.01$) and postoperative hospital stay ($P < 0.05$). In a similar comparative nonrandomised study of patients with advanced gastric cancer presenting with GOO, Choi[7] reported that the laparoscopic approach to palliative GJ ($n = 30$) was associated with reductions in postoperative analgesic requirements, morbidity (6.7% vs 23.7%), and postoperative hospital stay (mean, 8.5 vs 12.5 days) compared with open surgery ($n = 38$). Our study is the third that has evaluated the potential benefits of the laparoscopic approach to GJ, and has confirmed the

Table 4. Outcomes

	Open GJ ($n = 12$)	Laparoscopic GJ ($n = 15$)	P value
Operating time (min)[a]	111 (80–152.5)	90 (57.5–90)	0.113
Intraoperative blood transfusion: no. of patients (%)	3 (25%)	0 (0%)	0.075
IV fluids (h)[a]	234 (162–324)	60 (29–87)	0.001
Opiate duration (h)[a]	128 (105–141)	49 (27–65)	0.025
Hospital stay (days)[a]	15 (9–22)	3 (3–8)	0.005
Complications	4 (33.3%)	2 (13.3%)	0.219
Mortality	0	0	NS

GJ, gastrojejunostomy; NS, not significant
[a]Data represent medians (interquartile ranges)

above previous findings. In patients with GOO secondary to benign and malignant diseases, we have shown, in this comparative study, that the laparoscopic approach to GJ was associated with a more rapid in-hospital recovery, with shorter need for intravenous hydration and opiate analgesia and an earlier discharge from hospital. Unlike the observations reported by others,[8] the operating time of laparoscopic GJ in our series was shorter than that of open surgery.

These favourable findings should encourage a wider adoption of the laparoscopic approach by surgeons who possess the necessary laparoscopic expertise. The surgeon performing laparoscopic surgery in this study offered laparoscopic GJ to "all comers" with GOO requiring surgical palliation and has had no conversions to laparotomy. The adoption of the laparoscopic approach is particularly relevant to patients with unresectable malignancy who require palliative relief of GOO, as the smoother and quicker recovery associated with the minimally invasive surgery may better preserve the quality of the patients' remaining life. We acknowledge that level-I evidence[28] to support the adoption of the laparoscopic approach for relief of GOO is currently lacking. However, the favourable results of laparoscopic gastric bypass in the absence of detrimental clinical outcomes pose a considerable ethical challenge to the conduction of a randomised clinical trial to compare it with open surgery. It is of more clinical relevance to consider the role of the endoscopic insertion of self-expandable metal stents (SEMS) for the palliation of GOO secondary to unresectable malignancy[29–32] in comparison with that of laparoscopic gastric bypass, as both offer minimally invasive options in the management armamentarium. Wong et al.[31] and Maosheng et al.[32] reported reductions in morbidity and post-intervention hospital stay with SEMS therapy for GOO when compared with laparotomy. Unlike surgical bypass, however, which is largely associated with no recurrence of GOO until the time of death,[1,5,33] tumour ingrowth and the migration of SEMS result in the recurrence of GOO in 17% to 27% of patients.[29,30,34] A randomised comparison of the laparoscopic gastric bypass and SEMS to the palliation of malignant GOO is warranted, and will require[35] a total of 70 patients to give the study a power of 80% and a test size of 5%, with recurrence of the GOO as its primary endpoint. Nonetheless, we agree with Maosheng et al.[32] that SEMS may be best reserved to patients with metastatic malignancy and therefore short life expectancy, particularly when they are unfit for general anaesthesia. Laparoscopic gastric bypass may be reserved to patients with better-prognosis malignant disease, when attempts at endoscopic SEMS insertion have failed, and to patients with distal duodenal obstruction in whom SEMS insertion is awkward. The favourable results of laparoscopic gastric bypass should also encourage the addition of a concomitant prophylactic GJ at the time of a palliative laparoscopic biliary bypass. The single randomised controlled trial that evaluated the role of prophylactic gastric bypass at the time of laparotomy and abandoned resection for periampullary cancer[33] reported a significant reduction in the recurrence rate of GOO (0% vs 19%; $P < 0.01$) in the prophylactic bypass group compared with no GJ. It is our practice to add a laparoscopic gastric bypass to a biliary bypass when palliating obstructive jaundice in better-prognosis patients[36] with periampullary malignancy (locally advanced but non-metastatic disease).

In conclusion, the laparoscopic approach to gastric bypass for the relief of GOO is associated with a smoother and more rapid recovery and a shorter hospital stay when compared with open surgery. In experienced hands, the laparoscopic approach should become the new gold standard. Comparison with SEMS in the setting of a randomised clinical trial is warranted.

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