

Endoscopic stenting versus operative gastrojejunostomy for malignant gastric outlet obstruction

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Abstract

Background Malignant gastric outlet obstruction represents a terminal stage in pancreatic cancer. Between 5% and 25% of patients with pancreatic cancer ultimately experience malignant gastric outlet obstruction. The aim in palliating patients with malignant gastric outlet obstruction is to reestablish an oral intake by restoring gastrointestinal continuity. This ultimately improves their quality of life in the advanced stages of cancer. The main drawback to operative bypass is the high incidence of delayed gastric emptying, particularly in this group of patients with symptomatic obstruction. This study aimed to compare surgical gastrojejunostomy and endoscopic stenting in palliation of malignant gastric outlet obstruction, acknowledging the diversity and heterogeneity of patients with this presentation.

Methods This retrospective study investigated patients treated for malignant gastric outlet obstruction from December 1998 to November 2008 at Nepean Hospital, Sydney, Australia. Endoscopic duodenal stenting was performed under fluoroscopic guidance for placement of

the stent. The operative patients underwent open surgical gastrojejunostomy. The outcomes assessed included time to diet, hospital length of stay (LOS), biliary drainage procedures, morbidity, and mortality.

Results Of the 45 participants in this study, 26 underwent duodenal stenting and 19 had operative bypass. Comparing the stenting and operative patients, the median time to fluid intake was respectively 0 vs. 7 days ($P < 0.001$), and the time to intake of solids was 2 vs. 9 days ($P = 0.004$). The median total LOS was shorter in the stenting group (11 vs. 25 days; $P < 0.001$), as was the median postprocedure LOS (5 vs. 10 days; $P = 0.07$).

Conclusions Endoscopic stenting is preferable to operative gastrojejunostomy in terms of shorter LOS, faster return to fluids and solids, and reduced morbidity and in-hospital mortality for patients with a limited life span.

Keywords Duodenal stenting · Gastroduodenal cancer · Gastrojejunostomy · Malignant gastric outlet obstruction · Palliative bypass · Pancreatic cancer

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Malignant gastric outlet obstruction is a debilitating terminal event in pancreatic cancer that affects 5% to 25% of patients with pancreatic cancer [1–4]. Patients present with intractable nausea, vomiting, abdominal pain, and distension and are unable to maintain an oral intake (Fig. 1). They often are profoundly dehydrated and malnourished.

The aim in palliating patients with malignant gastric outlet obstruction is to reestablish an oral intake by restoring gastrointestinal continuity. This ultimately improves patients' quality of life in the advanced stages of cancer.

Terminal pancreatic cancer is complex because the malignancy can obstruct either gastroduodenal or biliary drainage or both. Patients with malignant gastric outlet

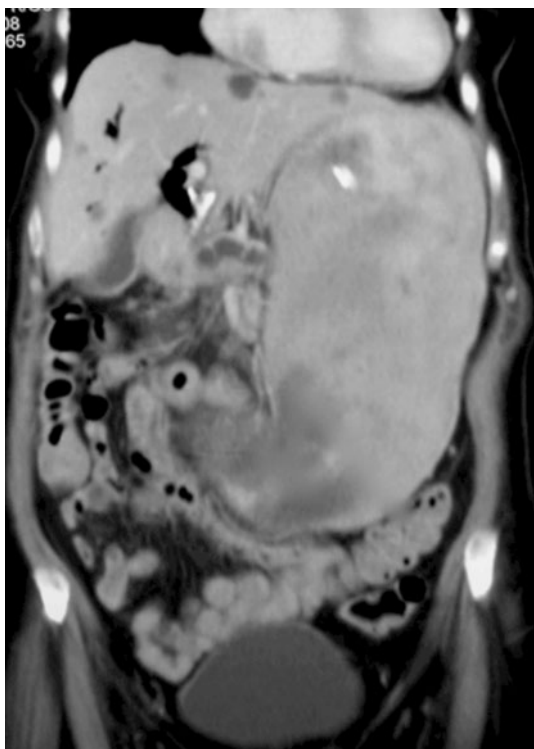


Fig. 1 Computed tomography (CT) scan showing a grossly dilated stomach in a patient with gastric outlet obstruction from metastatic pancreatic cancer. Liver metastatic deposits can be seen, as well as gas within the biliary resulting from of the biliary stent

obstruction often are heterogeneous, with varying incidences of coexistent biliary obstruction. Some patients never experience biliary obstruction, whereas others experience this before or sometimes after the development of malignant gastric outlet obstruction. No study can adequately answer all the complexities of both biliary and enteric drainage, but this study aimed to compile existing data available from our patients, to collate meaningful knowledge, and to aid interpretation.

Endoscopic stenting has been used to treat unresectable malignant gastric outlet obstruction for more than 15 years [5–8]. Studies have shown it to be a safe, effective method of palliation associated with a shorter hospital length of stay (LOS) and a faster resumption of oral intake than surgical bypass [9–14].

Operative bypass is associated with a higher incidence of complications, and this also is seen with the laparoscopic approach for malignant gastric outlet obstruction compared with duodenal stenting [1, 15, 16]. The main drawback of surgical palliation is the insult of surgery, the potential for morbidity, the prolonged recovery of patients with terminal cancer, and the very limited life span. Gastrojejunostomy has a significant incidence of delayed gastric emptying of 20% [1]. Among patients undergoing gastrojejunostomy for malignant gastric outlet obstruction,

the incidence of delayed gastric emptying can be as high as 57% [17]. This is a major disadvantage of the procedure in terms of palliation, which aims to restore oral intake, to comfort, and to discharge home.

This study aimed to compare return to oral intake, LOS, biliary drainage, morbidity, and mortality between surgically and endoscopically managed patients.

Methods

We conducted a retrospective study of endoscopic duodenal stenting compared with operative gastrojejunostomy in the management of malignant of gastric outlet obstruction over a 10-year period from December 1998 to November 2008. Patients admitted to hospital with symptomatic gastric outlet obstruction were investigated with blood tests, computed tomography (CT) scan of the abdomen, and barium swallow to establish the diagnosis of malignant gastric outlet obstruction. Wide-bore nasogastric tube drainage was used for symptomatic control of their vomiting and nausea. Nutritional support was started, with either parenteral nutrition or enteral nutrition, using an endoscopically placed fine-bore feeding tube.

The patients were managed by the Upper Gastrointestinal Surgical Unit, which consisted of four surgeons, all of whom performed interventional endoscopic procedures. During the study period, two surgeons performed all the endoscopic duodenal stenting to ensure consistent outcomes. Since the study period, all four surgeons currently perform duodenal stenting. Patients unfit for surgery and those with metastatic or inoperable disease had duodenal stenting performed as the preferred method. However, despite the preference for duodenal stenting, this approach was available in the unit only from 2004.

Endoscopic stenting was performed using the Wallflex duodenal stent (Boston Scientific) (Fig. 2). The stents used were either 60 or 90 mm long and either 20 or 22 mm in diameter depending on the case. Palliative bypass to restore gastrointestinal continuity was performed with an open operative gastrojejunostomy.

The medical records were reviewed to extract age, gender, diagnosis, LOS, biliary drainage procedures, and morbidity and mortality data. Progression of oral intake was assessed by time to postprocedure fluid intake, time to intake of solids, and diet on day 5, day 10, and at discharge. The use of parenteral and enteral nutrition and the time until weaning also were assessed.

Statistical methods

Summary statistics are presented as mean \pm standard deviation for parametric data and as median and interquartile range for nonparametric data. Proportions were

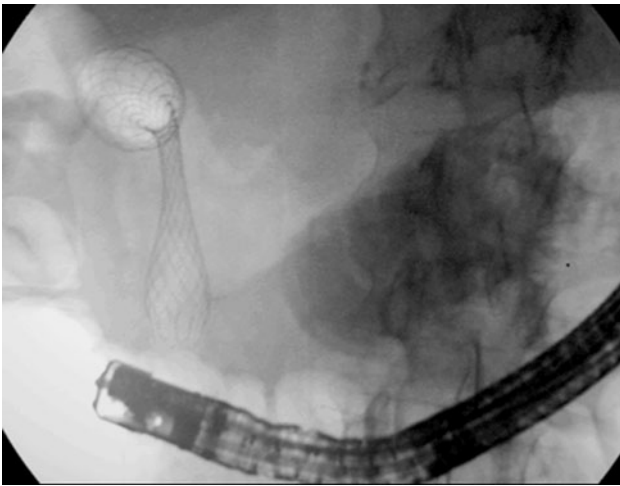


Fig. 2 Duodenal stent in malignant gastric outlet obstruction

compared using chi-square tests or Fisher's exact test for small numbers. For time-to-event data, it was not necessary to use time-to-event analysis because every patient experienced the event except those who died. Statistical analysis of LOS and oral intake was performed for those discharged alive.

Results

Demographics

The 45 patients available for this study over the 10-year period comprised 26 patients who had a duodenal stent and 19 patients who underwent operative gastrojejunostomy for malignant gastric outlet obstruction. The two main causes of gastric outlet obstruction were pancreatic (20/45, 44%) and gastroduodenal (19/45, 42%) cancer (Table 1). There were significantly more females in the duodenal stenting group (42% vs. 26%, $P < 0.001$). The groups did not differ in terms of age (67 vs. 65 years; $P = 0.66$).

For 19 patients, surgery was performed to create a gastrojejunostomy. The majority of the operative gastrojejunostomies were performed before the availability of duodenal stenting. In addition, almost half of the patients in the operative group (8/19 patients, 42%) had inaccurately assessed resectable disease at preoperative imaging. For these patients, Whipple's pancreaticoduodenectomy was planned, but they were found unresectable at surgery. They instead had palliative gastrojejunostomy, and all except two (6/8 patients) had a biliary bypass as well at the time.

Oral intake

The progression of oral intake in those who had duodenal stenting was significantly faster than in the gastrojejunostomy

group (Table 2). The median time to fluid intake was 0 days (i.e., day of the procedure) in the stenting group and 7 days in the gastrojejunostomy group ($P < 0.001$). The time to the intake of solids also differed significantly: 2 days for the stenting group and 9 days for the gastrojejunostomy group ($P = 0.004$).

By day 5 after the procedure, the majority of the duodenal stenting patients (88%, 22/25) were receiving an oral diet of fluids or solids compared with only 17% (3/18) of the gastrojejunostomy patients. By day 10 after the procedure, all the duodenal stenting patients were receiving an oral diet compared with only half of the patients in the gastrojejunostomy group (Table 3).

LOS

The median total LOS was significantly shorter in the duodenal stent group (11 days) than in the gastrojejunostomy group (25 days) ($P < 0.001$). The median postprocedure LOS was not significantly different between the duodenal stenting group (5 days) and the gastrojejunostomy group (10 days) ($P = 0.07$) (Table 4).

Morbidity

The incidence of major morbidity was 12% (3/26) in the stent group and 37% (7/19) in the open gastrojejunostomy group ($P = 0.07$). The stent group had two cardiac complications and one aspiration pneumonia. The gastrojejunostomy group had two respiratory complications, one case of heparin-induced thrombocytopenic syndrome (HITTS), and four gastrointestinal complications. For one patient, the complications were a deep wound dehiscence, a biliary anastomotic leak requiring reoperation, a fecal fistula, and a hepatic abscess. In this patient, a migrated biliary stent could not be replaced, leading to severe septic complications.

Mortality

The in-hospital mortality rate was 8% (2/26) in the stent group and 21% (4/19) in the gastrojejunostomy group ($P = 0.38$).

Recurrent gastric outlet obstruction

Two patients had early recurrent gastric outlet obstruction due to technical failure resulting from incorrect deployment of the stents. Both patients were managed successfully with a repeat endoscopic stent. These two patients and an additional patient developed delayed gastric outlet obstruction (median, 201 days) due to tumour ingrowth. Each of these patients was managed successfully with repeat endoscopic stenting.

Table 1 Patient demographics and diagnosis by treatment group

Patient demographics	Duodenal stent group (<i>n</i> = 26)	Gastrojejunostomy group (<i>n</i> = 19)	<i>P</i> value
Female gender: <i>n</i> (%)	11 (42)	5 (26)	<0.001
Mean age (years)	67 ± 12	65 ± 10	0.66
Diagnosis: <i>n</i> (%)			
Pancreatic cancer	12 (46)	8 (42)	
Gastro-duodenal cancer	10 (38)	9 (47)	
Gastric cancer	6	0	
Gastric lymphoma	0	1	
Duodenal cancer	4	8	
Metastatic	4 (15)	2 (11)	
Colon cancer	2	1	
Breast Cancer	1	0	
Lung cancer	1	0	
Squamous cell cancer	0	1	

Table 2 Oral intake after the procedure

	Duodenal stent group (<i>n</i> = 26)	Gastrojejunostomy group (<i>n</i> = 19)	<i>P</i> value
Median time to oral fluids: days (IQR)	0 (0–1)	7 (5–15)	<0.001
Median time to oral solids: days (IQR)	2 (1–4)	9 (7–16)	0.004

IQR interquartile range

Biliary drainage

Biliary obstruction and drainage were complex and diverse in these patients. A subgroup of patients (13/45, 29%) experienced biliary obstruction before gastric outlet obstruction and had prior biliary drainage with a biliary stent (Table 5) (Fig. 3). Interestingly, 19 (42%) of the 45 patients in this series did not require biliary drainage. Five of the patients in the stenting group (20%) who required biliary drainage at the time of gastric outlet obstruction or soon afterward were managed with a biliary stent placed either endoscopically or radiologically (percutaneous transhepatic cholangiography). Six of the eight patients in the gastrojejunostomy group who had unresectable disease

Table 3 Oral intake and parenteral and enteral nutrition after the procedure

	Duodenal stent group (<i>n</i> = 26) <i>n</i> (%)	Gastrojejunostomy group (<i>n</i> = 19) <i>n</i> (%)
Diet on day 5 (no. of patients)		
Solids	17 (65)	1 (5)
Puree	1 (4)	0
Fluids	4 (15)	2 (11)
Nothing by mouth (no supplements)	2 (8)	1 (5)
Enteral feeds (EF)	0	8 (42)
Parenteral feeds (TPN)	1 (4)	7 (37)
Deceased	1 (4)	1 (5)
Diet on day 10 (no. of patients)		
Solids	19 (73)	7 (37)
Puree	1 (4)	0
Fluids	5 (19)	1 (5)
Enteral feeds (EF)	0	6 (32)
Parenteral feeds (TPN)	0	4 (21)
Deceased	1 (4)	3 (16)

Table 4 Median total hospital length of stay (LOS) and median LOS after the procedure by treatment group

Outcomes	Duodenal stent group Median (IQR) (<i>n</i> = 26)	Gastrojejunostomy group Median (IQR) (<i>n</i> = 19)	<i>P</i> value
Median total LOS (days)	11 (7–16)	25 (14–37)	<0.001
Median postprocedure LOS (days)	5 (2–8)	10 (7–19)	0.07
Median postprocedure survival (days)	70 (2.1 months) (range 5–592)	134 (4.4 months) (range 3–601)	0.21

IQR interquartile range, *LOS* length of stay

at the planned Whipple's resection underwent operative biliary bypass (Table 5).

Median survival

Survival data were available for 16 patients in both groups (stenting group, 61.5%; operative bypass group, 84.2%). The median time to death after the procedure was 70 days in the duodenal stenting group and 134 days in the gastrojejunostomy group. This difference was not statistically significant (*P* = 0.21) (Table 4).

Table 5 Biliary drainage procedures by treatment group

Outcomes	Duodenal stent group (<i>n</i> = 26) <i>n</i> (%)	Gastrojejunostomy group (<i>n</i> = 19) <i>n</i> (%)
No biliary drainage performed	12 (46)	7 (37)
Biliary stents before gastric outlet obstruction	8 (31)	5 (26)
Biliary stent or bypass at or after procedure	5 (19)	7 (37)
Difficulty with subsequent biliary drainage	1 (4) Failed ERCP, supportive care/palliated	1 (5) Migration of biliary stent; could not be replaced (died of septic complications/hepatic abscess)

ERCP endoscopic retrograde cholangiopancreatography

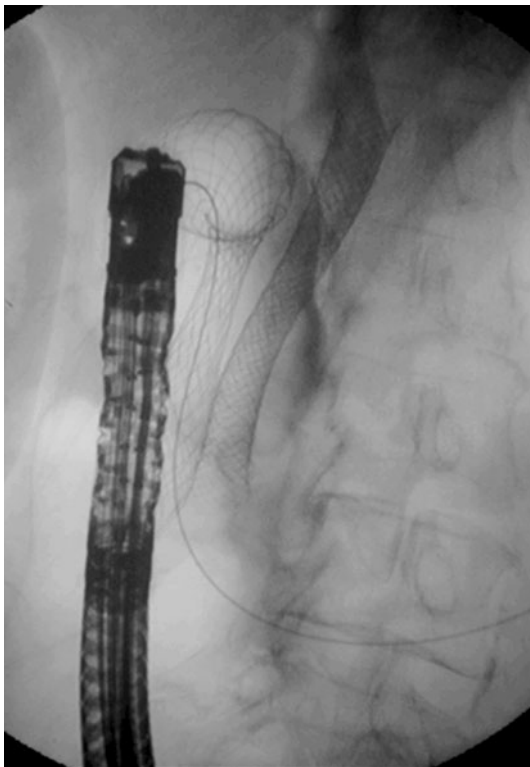


Fig. 3 Duodenal stent deployed in a patient with a preexisting biliary stent

Discussion

The current study suggests that patients with duodenal stenting versus gastrojejunostomy differ significantly in terms of their outcomes following management of malignant gastric outlet obstruction. Duodenal stenting provided a faster return to oral fluids and solids, a shorter total LOS, and a shorter postprocedure LOS than gastrojejunostomy.

The patients in the gastrojejunostomy group included a cohort of patients (8/19, 42%) deemed sufficiently fit to undergo a trial dissection. This cohort of fitter patients is

reflected in the apparently improved survival of 4.4 months compared with 2.1 months for duodenal stenting, although the difference is not significant. The poorer survival of the stenting patients reflects the inherent selection bias in this group, whose treatment was exclusively palliative from the very start. The current study is in agreement with other published data demonstrating that duodenal stenting is safe, with a low incidence of major complications, a more rapid progression of diet, and a shorter LOS [10, 11, 13, 14].

We acknowledge the disparities between the two groups. In particular, because duodenal stenting was available only after 2004, we acknowledge that the operative group comprised a group of semihistorical control subjects because these patients did not have the opportunity to undergo duodenal stenting. The duodenal stenting group also was clearly a group of patients deemed palliative right at the outset. This is in contrast with the operative group, in which 42% of the patients were deemed fit for resection but found to be unresectable. Although the backgrounds of these patients were indeed variable, their different post-procedural outcomes are a reflection their original disparities. The high morbidity and mortality rates in the operative group reflect poor patient selection, with this group experiencing unfavorable outcomes due to the insults of surgery in the face of advanced malignancy and nutritional depletion. Indeed, at this point, many of these patients would be offered stenting instead at our institution.

Endoscopic duodenal stenting has two potential problems compared with operative bypass. First, stent blockage often necessitates repeat procedures. Second, biliary drainage can pose a challenge due to difficulty accessing the ampulla once the duodenal stent is in place.

In our study, only two patients had early duodenal stent obstructions, and both were managed successfully with another stent. Early stent blockage was reviewed and found to be a technical failure in which the stent did not traverse the obstruction completely to form an hourglass figure but instead partially traversed the obstruction, forming a funnel

shape. This led to early stent blockages in our series, which were managed successfully by placement of another stent within the preexisting stent.

These two patients and another patient experienced late stent blockage from tumor ingrowth 6 to 8 months after the initial stent insertion. These blockages also were managed successfully with repeat stenting.

Despite the terminal nature of the disease, a few patients such as the two aforementioned patients do live longer and go on to have late stent complications and blockages. These patients do not conform to the majority and are difficult to identify at the onset of gastric outlet obstruction. Nonetheless, patients who survive long enough and have recurrent obstruction due to tumor ingrowth are easily managed with a repeat stenting procedure.

Biliary obstruction and drainage proved to be complex and diverse in these patients (Fig. 3). A subgroup of patients (13/45, 29%) experienced biliary obstruction before gastric outlet obstruction and had prior biliary drainage with a biliary stent. Interestingly, 19 (42%) of the 45 patients in this series did not require biliary drainage. Five of the patients in the stenting group (20%) who required biliary drainage at the time of gastric outlet obstruction or soon afterward were managed with biliary stents placed either endoscopically or radiologically.

Biliary stent placement can be technically challenging once the duodenal stent is in place because negotiating cannulation of the ampulla through the wire net of the mesh can be tricky. Percutaneous transhepatic cholangiography is helpful after unsuccessful endoscopic retrograde cholangiopancreatography (ERCP) and certainly was useful in our series for two patients after duodenal stent placement.

The median postprocedural stay in the stenting group was 5 days versus 10 days in the operative group. To some extent, this reflects the complexity of surgery for some of our surgical patients who had a trial dissection for resection followed by a biliary bypass. However, it also reflects the nature of gastrojejunostomy, which works slowly.

The stented patients had some delay in discharge due to the planning required before discharge to ensure that services were in place for the patient returning home. The concept of efficiency in discharge, as measured by LOS, is different after palliative procedures. A more holistic approach that takes into account the readiness and appropriateness of discharge tends to occur, with community support services readied in place for the patients at their return home in the terminal phase of their disease. Most stenting patients were eating within 24 h but required a longer hospital stay for discharge planning. This was less an issue with the operative group, which usually did not consist of palliative cases but fit patients not able to be resected.

In conclusion, our results support the use of endoscopic stenting for inoperable malignant gastric outlet obstruction because it is safe and effective and because it involves a shorter LOS and earlier progression of oral intake for patients with a short life expectancy.

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