

Single vs double bypass anastomosis for locally advanced periampullary tumors

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Background

Pancreatic adenocarcinoma is one of the most serious malignancies in the world. Endoscopic retrograde cholangiopancreatography is limited to cases of bile duct obstruction owing to its association with severe adverse effects and low efficacy. Surgical resection offers the greatest chance of long-term recovery by a procedure called pancreaticoduodenectomy. Palliative surgical options involve an open or laparoscopic loop over a Roux-en-Y gastrojejunostomy (GJ). Various studies have looked at the idea of prophylactic GJ.

Patients and methods

This is a comparative retrospective study, designed for patients having locally advanced periampullary tumors who were treated by palliative bypass (single or double bypass) between January 2011 and December 2016 at Gastrointestinal Surgery Center of Mansoura University. This study aims to evaluate and compare the results of single vs double bypass procedure. Full preoperative assessment was done.

Results

There was no statistically significant factor between the single and double bypass groups with respect to demographic data. With respect to postoperative data, the single bypass group showed its upper hand regarding the day of starting oral fluids. The amount discharge from the nasogastric tube was significantly higher for the double bypass group. The overall complications were more or less similar between the two groups.

Conclusion

This study showed that prophylactic GJ substantially reduces the incidence of gastric outlet obstruction and thus, decreases the rate of readmission and the need for another surgery after the single bypass. The overall complications as well as the short-term survival did not differ between single and double bypass operations.

Keywords:

endoscopic retrograde cholangiopancreatography, pancreaticoduodenectomy, postoperative day

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Introduction

Pancreatic adenocarcinoma is one of the most serious malignancies in the world. It remains the fourth leading cause of cancer-related deaths in the USA [1]. In most cases, pancreatic adenocarcinoma is seen in the arterial process of computed tomography (CT) as a hypodense pancreatic lesion with poorly defined margins. In addition, CT scans monitor artery activity, extrapancreatic territorial expansion, and development of lymph nodes and identify liver or peritoneal nodules [2]. The development of high-quality multidetector CT (preferably ≥ 16 detectors) combined with expertise in the analysis of these trials has shown more effective preoperative staging and improved patient care [3]. MRI has the same sensitivity and accuracy as CT for pancreatic adenocarcinoma staging but is not commonly used owing to its high expense and limited quality and is typically reserved for complicated cases, cystic

pancreatic neoplasms, and biliary anatomy [3]. Upper gastrointestinal endoscopy is useful for obtaining biopsies from duodenal invasion tumors. Endoscopic retrograde cholangiopancreatography is limited to cases of bile duct obstruction with hepatic dysfunction.

Just 20–30% of newly diagnosed cases are vulnerable to surgical resection, and more than 50% of the patients have distant diseases on presentation. Surgical resection offers the best chance of long-term recovery. Careful patient selection, diagnosis, and adjuvant therapy have been shown to improve 5-year survival to more than 20% [4]. Monitoring has

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shown that ~70% of all patients experience metastatic recurrence even after successful surgical resection [5].

Around the time of diagnosis, 80–90% of all patients with pancreatic cancer had obstructive jaundice. It is owing to the presence of the tumor of the intrapancreatic part of the distal common bile duct. Biliary drainage has been shown to reduce the underlying diarrhea, pruritus, and cholangitis in order to improve the quality of life. Malignant gastroduodenal obstruction is a late complication of local pancreatic carcinoma development in up to 20% of patients. In addition to mechanical obstruction owing to the involvement of a celiac nerve plexus, patients also experience impaired gastric emptying [6].

Artificial and physical obstructions, in combination, lead to nausea, fatigue, and weight loss. Hepatojejunostomy is a normal biliary palliative bypass treatment. Side-to-side choledoduodenostomy is usually discouraged as tumor growth can lead to repeated obstruction and cholangitis. It is also associated with a higher risk of hepatolithiasis, cholangitis (10–15%), and rare 'sump disease', where the distal bile duct is used as a source of stones and debris [7].

Gastric canal obstruction significantly affects the quality of life, leading to intractable fatigue, vomiting, and stomach pain. Subsequent dehydration, electrolyte abnormalities, and malnutrition may delay the administration of palliative chemotherapy. Delayed gastric emptying may be distinguished from mechanical blocking by endoscopy and radiographic studies, but it is important to remember that both conditions coexist. Delayed gastric emptying should be safely handled using prokinetic agents, and surgical procedures should be reserved for mechanical gastroduodenal malignancies [8].

Palliative surgical options involve an open or laparoscopic loop over a Roux-en-Y gastrojejunostomy (GJ). The principle of prophylactic GJ in asymptomatic patients with unrespectable pancreatic cancer was identified in a number of studies at the time of attempted resection. In most cases, GJ will be performed on the basis of level 1 results, unless a life expectancy of less than 3–6 months is expected [4,5].

Patients and methods

This is a comparative retrospective study, designed for patients having locally advanced periampullary tumors who were treated by palliative bypass (single or double

bypass) between January 2011 and December 2016 at Gastrointestinal Surgery Center of Mansoura University. This research was performed at the Department of General Surgery, gastroenterology center Mansoura University Ethical Committee approval and written, informed consent were obtained from all participants. This study aims to evaluate and compare the results between single vs and double bypass procedures regarding morbidity, mortality, survival, and quality of life.

Patients who underwent palliative bypass procedure in the period between January 2011 and December 2016 at Gastrointestinal Surgery Center, Mansoura University, Egypt, were included. A total of 94 patients were divided into two groups:

- (1) Group A included 52 patients who had single bypass (bilioenteric bypass).
- (2) Group B included 42 patients who had double bypass (bilioenteric plus GJ).

Inclusion criteria were patients who were found to be locally advanced periampullary carcinomas either preoperative or intraoperative. Exclusion criteria were patients with duodenal infiltration by upper endoscope, patients with gastric outlet obstruction, and patients with distant metastases. A written informed consent was obtained from all patients before the operation after describing and explaining the operative and postoperative details and complications of each approach.

Preoperative data: preoperative assessment for diagnosis and staging included complete history taking, associated comorbidities, clinical examination, full laboratory investigation, tumor markers, and imaging (abdominal ultrasound, magnetic resonance cholangiopancreatography, triphasic abdominal CT, CT portography, and angiography and endoscopic ultrasound if needed). Preoperative endoscopic retrograde cholangiopancreatography and biliary stenting was performed in case of cholangitis or hepatic dysfunction.

Operative data: the usual incision used for exploration of such cases was extended through right subcostal incision. After its creation, the abdominal cavity was explored for any metastatic disease. Moreover, the pancreatic mass was assessed carefully for any potential signs of respectability. The transverse mesocolon was lifted up to see any indentation at its base in relation to the mass suggesting infiltration. Additionally, the middle colic vein was identified at the mesocolon up to its junction with superior

mesenteric vein, and if any infiltration was noticed, palliative bypass was performed in these patients. If the two previous attempts revealed no infiltration, the dissection is started around the lower end common bile duct (CBD) trying to create a tunnel between it and the portal vein down to the inferior border of the pancreatic neck. Failure to do such passage suggested portal or superior mesenteric vein infiltration, and bypass procedure was completed.

Palliative bilioenteric bypass: cholecystectomy was performed in the classic manner, and then the common hepatic duct (CHD) was transected with closure of distal part leaving a proximal stump for the bilioenteric anastomosis. Once single bypass was decided, the jejunal loop was divided ~20–30 cm from the duodenojejunal flexure. The distal loop was carried up to perform a hepaticojejunostomy. Hepaticojejunostomy was often created in an end-to-side fashion. The blind end of the jejunal loop was closed by Vicryl 3/0 sutures in one or two layers. After that, the anastomosis was created by Vicryl 3/0 in continuous manner posteriorly and interrupted manner anteriorly. Some surgeons like to perform it in continuous manner for both walls. The alimentary limb of the jejunum was anastomosed with the Roux loop about 40 cm from the hepaticojejunostomy with either end-to-side or side-to-side configuration in continuous manner for both walls.

Palliative double bypass after division of the jejunal loop was done as previously, and hepaticojejunostomy was performed as described before. It was the operator choice to choose to create the gastrojejunal anastomosis by the Roux limb or the proximal one coming from the duodenum. This anastomosis could be created in a retrocolic or ante-colic manner, iso-peristaltic or ante-peristaltic configuration. This anastomosis was created usually in classic four layers. Anterior and posterior outer seromuscular layer followed by inner through and through bites sewn in continuous manner. Vicryl 3/0 sutures were used for the inner layer, whereas silk 3/0 sutures were used for the external layer. The nasogastric tube (NGT) was flushed with 500 ml warm saline, allowing them to return back into the collecting bag to exclude anastomotic bleeding.

Enteroenterostomy was performed as described before. After that, mesenteric defects were closed. Abdominal drain was placed to drain the Morrison pouch. Finally, abdominal wall was closed in layers over subcutaneous drain.

Postoperative assessment: All patients were carried to the surgical ward postoperatively, except patients

classified risky by the anesthetic team, who were transferred to high dependency unit (HDU). All patients received postoperative antibiotics, whereas some of them were commenced on proton pump inhibitors. Abdominal drains, NGTs, and urine outputs were estimated daily. Intravenous analgesics were used in the first 3 days and then shifted to oral forms and prescribed according to the WHO ladder. Patients were commenced on intravenous fluids with potassium supplementation, and oral fluid intake was usually started after 2 days after bowel sounds were restored. Oral solids were started on the third postoperative day (POD), and most cases were usually discharged on third to fourth POD.

Follow-up was scheduled at 1 week, 1 month, 3 months, 6 months postoperatively, and then at 1 year.

Primary outcome measures were the rate of total postoperative morbidities. Clavien and Dindo classification for postoperative morbidity was adopted. Secondary outcome measures included the assessment of the following: bile leak, delayed gastric emptying, hemorrhage, pulmonary complications, and re-exploration; total operative time, operative time of dissection and operative time of reconstruction; blood loss, blood transfusion, and tumor size; the length of hospital stay; survival rate; and need for duodenal bypass after single biliary bypass.

Definitions used for complications were as follows: bile leakage was defined as bile-stained fluid in the abdominal drain or bile duct in the abdominal cavity where radiological or surgical intervention is required. The concentration of bilirubin in the drained fluid is at least three times the concentration of plasma bilirubin [9]. Delayed gastric emptying was defined as the requirement or re-insertion of NGT after postoperative day 3 or failure to resume oral diet by postoperative day 7 [10]. GJ or enteric leakage was described as a radiographic or visual indicator of an anastomotic defect [11,12].

Data analysis

Continuous data were expressed as median and interquartile range, and comparison was done by Mann–Whitney test. Categorical data were expressed in numbers and percentages, and comparisons were performed using χ^2 test and Fischer's exact test whenever appropriate. Overall survival was expressed by Kaplan–Meir test. *P* values less than 0.05 were considered significant. SPSS software (version 24) (Armonk, NY: IBM Corp) was used to perform the statistical analysis of patients' data.

Results

Regarding demographics, there was no statistically significant factor between the single (first) and double bypass (second) groups apart from history of previous operations, which was significantly higher in the single bypass group ($P=0.032$) (Table 1).

Regarding symptomatology, no significant differences were found between the two groups (Table 2).

Operative data

No significant differences were found between the two groups regarding operative data (Table 3).

Postoperative data

The single bypass group showed its upper hand regarding the day of starting oral fluids when compared with the other group (second POD vs third POD for double bypass - $P=0.00$). The amount discharge from the NGT was significantly higher for the double bypass group (325 and 125 ml vs 100 and 0 ml for the single bypass group in the first and third POD in order). The duration of both hospital and ICU stay were not statistically different between the two groups ($P>0.05$). Neither the nature nor the amount of the surgical drains was significantly different between the two groups (Table 4).

Postoperative complications

The overall complications were more or less similar between the two groups (34.6% in the first group vs 38.1% in the double bypass group - $P=0.727$). Bile leakage was diagnosed in 10 (19.2%) cases in the single bypass group, though diagnosed in six (14.3%) cases in the double bypass group ($P=0.529$). Delayed gastric emptying was noticed more frequently in the double bypass group in 12 (26.8%) cases vs third (5.8%) cases in the other group ($P=0.009$). Leakage from the gastroenteric anastomosis was not detected in our study. Two cases of the single bypass group needed reoperation because of bleeding (one case) or gastric outlet obstruction (one case). Eleven (21.2%) cases of the single bypass group were readmitted to our center for different reasons. The other group (double bypass) experienced readmission in five (11.9%) cases. Conservative management was commenced for five patients in the second group, whereas no cases required surgical intervention or radiological intervention. The readmitted cases of the single bypass group were treated by surgical intervention in nine cases and interventional radiology in the remaining two cases. On the follow-up, mortality was reported in all the cases within the two study groups. Advanced malignancy was the leading cause of mortality in both groups, but two cases in the double bypass group experienced

Table 1 Analysis of the demographic data within the two studied groups

	Single bypass (N=52) [n (%)]	Double bypass (N=42) [n (%)]	P value
Sex: male	35 (67.3)	30 (71.4)	0.669
Female	17 (32.7)	12 (28.6)	
Age	57 (47–61)	53 (48–59)	0.347
Weight (kg)	85 (74–91)	80 (67–89)	0.133
Height (cm)	166 (160–170)	170 (160–180)	0.954
BMI	30 (27–33)	28 (25–32)	0.181
Smoking	16 (30)	16 (38.1)	0.456
Diabetes	23 (44.2)	5 (11.9)	0.001
HTN	9 (17.3)	1 (2.4)	0.02
COPD	4 (7.7)	1 (2.4)	0.254
Previous operations	19 (36.5)	7 (16.7)	0.032

COPD, chronic obstructive pulmonary disease; HTN, hypertension.

Table 2 Analysis of symptoms and duration of the symptoms within the two studied groups

	Single bypass (N=52) [n (%)]	Double bypass (N=42) [n (%)]	P value
Abdominal pain no	4 (7.7)	6 (14.3)	
Mild	23 (44.2)	18 (42.9)	
Tolerable	23 (44.2)	16 (38.1)	0.749
Severe	2 (3.8)	2 (4.8)	
Jaundice	51 (98.1)	42 (100)	0.366
Vomiting	11 (21.2)	5 (11.9)	0.236
Weight loss	16 (30.8)	24 (57.1)	0.01
Ascites no	51 (98.1)	41 (97.6)	0.914
Minimal	1 (1.9)	1 (2.4)	

Table 3 Analysis of operative data within the two studied groups

	Single bypass (N=52) [n (%)]	Double bypass (N=42) [n (%)]	P value
Operative time(h)	2.5 (1.5–6)	3 (1.5–6)	0.818
Liver status healthy	17 (32.7)	13 (31)	
Cholestatic	24 (46.2)	21 (50)	
Fibrotic	7 (13.5)	5 (11.9)	0.986
Cirrhotic	4 (7.7)	3 (7.1)	
Operative size of the mass	5 (4–5)	5 (5–6)	0.012
Operative mass relations			
Vascular encasement	14 (26.9)	5 (11.9)	
Vascular infiltration	23 (44.2)	25 (59.5)	
Crossing the midline	6 (11.5)	3 (7.1)	0.228
Infiltrating mesentery	9 (17.3)	9 (21.4)	
Operative adhesions	8 (15.4)	4 (9.5)	0.397
Incision			
Extended RT subcostal	44 (84.6)	4 (9.5)	
Bilateral subcostal	3 (5.8)	38 (90.5)	0.642
Kehr	5 (9.6)	1 (2.4)	
Blood transfusion	3 (5.8)	1 (2.4)	0.418
Anastomotic technique			
Simple	8 (15.4)	11 (26.2)	0.195
Roux-en-Y	44 (84.6)	31 (73.8)	
Anastomotic configuration			
Continuous	28 (53.8)	17 (40.5)	
Interrupted	4 (7.7)	5 (11.9)	0.416
Combined	20 (38.5)	20 (47.6)	

Table 4 Postoperative data

	Single bypass (N=52) [n (%)]	Double bypass (N=42) [n (%)]	P value
Hospital stay (days)	5 (4–7)	5 (5–7)	0.193
Postoperative ICU (days)	6 (11.5)	5 (11.9)	0.956
Nature of drain first day			
Serosanguinous	42 (80.8)	37 (88.1)	0.335
Bilious	10 (19.2)	5 (11.9)	
Nature of the drain third day serosanguinous	43 (82.7)	37 (88.1)	0.464
Bilious	9 (17.3)	5 (11.9)	
Drain removal (days)	5 (4–7)	5 (5–7)	0.23
Starting oral intake (days)	2 (2–3)	3 (3–4)	0.00
Ryle amount first day	100 (0–220)	325 (325–725)	
Third day	0	125 (125–625)	0.00

cardiopulmonary complications that caused their mortality (Table 5).

Discussion

Duodenal obstruction and pain are of primary importance in patients with unrespectable periampullary cancer palliation of obstructive jaundice, preferably with a short stay in hospital, maximum survival, and optimum quality of life [13]. Nonsurgical techniques are used palliate obstructive jaundice, which are the treatment of choice when unresectable cancer is already detected during diagnostic research, particularly in patients with expected short survival. Endoscopic and percutaneous biliary stenting are effective modalities,

whereas recurrent cholangitis is a well-known problem owing to stent occlusion despite all efforts to avoid this very common complication [14]. The Johns Hopkins group was the first in a randomized trial to demonstrate the benefits of a routinely performed prophylactic GJ, but controversy still exists in general surgical practice [15]). Note that a double bypass procedure which includes a GJ does not increase postoperative morbidity compared with biliary bypass alone. In comparison, a GJ performed with symptoms of gastric outlet obstruction (GOO) in a second phase has a postoperative mortality risk of up to 22% [16]. Some authors have indicated that limited long-term survival in patients with unrespectable periampullar cancer reduces the need for prophylactic GJ. In a retrospective series

Table 5 Postoperative complications

	Single bypass (N=52) [n (%)]	Double bypass (N=42) [n (%)]	P value
Postop complications	18 (34.6)	16 (38.1)	0.727
Sepsis	7 (13.5)	8 (19)	0.462
Bile leakage	10 (19.2)	6 (14.3)	0.529
GJ leakage	0	0	1
Delayed gastric emptying	3 (5.8)	12 (28.6)	0.009
Pulmonary complications	0	1 (2.4)	0.263
Cardiac complications	1 (1.9)	0	0.366
Postoperative collection	7 (13.9)	5 (11.9)	0.614
Need reoperation	2 (3.8)	0	0.199
Cause of reoperation			
GOO	1 (1.9)	0	0.121
Bleeding	1 (1.9)	0	
Postoperative readmission	11 (21.2)	5 (11.9)	0.236
Management of the cause of readmission conservative	0	5 (11.9)	<0.0001
Surgical intervention	9 (17.1)	0	
Radiological intervention	2 (3.8)	0	
Mortality	52 (100)	42 (100)	1
Cause of mortality			
Advanced malignancy	52 (100)	40 (95.2)	0.112
Cardiopulmonary	0	2 (4.8)	

GJ, gastrojejunostomy; GOO, gastric outlet obstruction.

performed by Egrari and O'Connell, 50 patients with serious pancreatic cancer underwent biliary decompression without prophylactic GJ. Duodenal obstruction occurred in only four (8%) out of the 50 patients; reoperation for therapeutic GJ was necessary. The mean time to develop obstruction was 15.8 months, whereas the mean average survival was 13.0 months. A total of 50 patients with serious pancreatic cancer underwent biliary decompression without prophylactic GJ. Duodenal obstruction occurred in only four (8%) out of the 50 patients; reoperation for therapeutic GJ was necessary. The mean time to develop obstruction was 15.8 months, whereas the mean average survival was 13.0 months. These authors indicated that with the rapid natural development of unrespectable pancreatic cancer, the majority of patients will not live long enough to have an obstruction [17]. Our analysis involved 94 cases divided into two categories: 52 patients underwent a single bypass, whereas the remaining 42 underwent a double bypass for palliation of locally advanced pancreatic cancer. The majority of age of both groups was above 50 years, with a median of 57 and 53 years, for both groups, respectively. Age, sex, and BMI were not significantly different between the two study groups. Van Heek *et al.* [18] also concluded a study regarding the same perspective and included 29 cases for single bypass, and 36 others for double bypass. The median age of the included patients was 65 and 63 years for single bypass and double bypass groups, respectively. Like our study results, the included cases did not show significant difference regarding age and sex. History of smoking was positive in 30.8% of the single bypass group, whereas

being slightly higher in the other group (38.1%). Smoking is one of the most important risk factors for pancreatic cancer. The risk of getting pancreatic cancer is about twice as high among smokers compared with those who have never smoked. Approximately 20–30% of periampullary cancers are thought to be caused by cigarette smoking [19,20]. Obesity is one of the few modifiable risk factors that has been associated with increased risk of pancreatic cancer and also is related to increased risk of diabetes, a condition that in turn has been associated with pancreatic cancer development. Being overweight is a risk factor for pancreatic cancer. Very overweight (obese) people are ~20% more likely to develop pancreatic cancer [21]. In our study, the median BMI was 30 and 29 kg/m², respectively. This decrease in the BMI values can be explained by the weight loss and cachexia, which patients experienced before they were diagnosed in such advanced condition. On exploration of our study cases, vascular infiltration was the most common cause of irresectability in both groups (44.2 and 59.5% for both groups, respectively). Other causes included vascular encasement, midline crossing, or mesenteric infiltration. Other study published that local vascular invasion was detected in 52 and 53% of the included cases for single bypass and double bypass groups, respectively, whereas the remaining cases were irresectable owing to distant metastasis [18]. Another research that studied the palliative surgical procedures for irresectable pancreatic cancer revealed that the causes of irresectability were liver metastasis (52%), peritoneal metastasis (31%), local infiltration (28%), or combined metastasis (11%) [22]. The median operative time was

2.5 and 3 h for single bypass and double bypass groups, respectively ($P=0.818$). Another study reported that the operative time of double bypass was significantly longer when compared with single bypass procedure (209 vs 254 min, $P<0.001$) [15]. The anastomotic technique and configuration did not show differences between our study groups, and these variables were not described to be significant in other studies [18]. It was reported that the postoperative hospital stay after surgical palliation for pancreatic cancer was about 11.1 days [22]. Another study showed that the postoperative stay period did not differ between the single and double bypass patients (8.0 and 8.5 days, respectively) [15]. In our study, the reported hospital stay was 5 days for both groups ($P=0.193$). Another study conducted by Van Heek *et al.* [18] stated that double and single bypass procedures were associated with a similar hospital stay (11 vs 9 days, $P=0.06$). It was reported that the postoperative hospital stay after surgical palliation for pancreatic cancer was about 11.1 days [22]. Another study showed that the postoperative stay period did not differ between the single and double bypass patients (8.0 and 8.5 days, respectively) [15]. In our study, the reported hospital stay was 5 days for both groups ($P=0.193$). Another study conducted by Van Heek *et al.* [18] stated that double and single bypass were associated with a similar hospital stay (11 vs 9 days, $P=0.06$). It was stated that nasogastric suction remained for 7 days in patients with double bypass, and oral intake was started immediately after NGT removal [16]. In our study, NGT amounts were significantly higher in the double bypass group (325 vs 100 ml for the single bypass group). The double bypass group showed a significant delay in starting oral intake when compared with the single bypass group (3 vs 2 days respectively, $P=0.038$). When it comes to postoperative complications, the overall complications were reported to be 33 and 32% for single and double bypass groups, respectively ($P>0.05$). Bile leakage affected 2% of the first group cases, whereas was reported in 3% for the other group. Moreover, the incidence of delayed gastric emptying was similar in the two groups (2%). The double bypass group did not experience gastroenteric anastomotic leakage [15]. Another study published by Van Heek *et al.* [18] reported that the overall complication occurred in 28% in the single bypass group, whereas affected 31% of the other group. The incidence of bile leakage was similar between the two groups (3%), and delayed gastric emptying was experienced in 17% of double bypass cases, whereas 3% of the other group was only affected. However, statistical analysis showed that no significance existed between the two groups regarding this measure ($P=0.12$). In this study, the overall complication rates were 34.6 and 38.1% for single

bypass and double bypass groups, respectively ($P=0.727$). Bile leakage was reported in 19.2 and 14.3% in single bypass and double bypass groups, respectively. Delayed gastric emptying was reported more significantly in the double bypass group (23.8 vs 5.8%, $P=0.012$). Gastroenteric anastomotic leakage was not reported in our study. There was no significant difference in the median survival between the double and the single bypass groups: 7.2 and 8.4 months, respectively ($P=0.15$). During follow-up, clinical GOO was diagnosed in 2 of 36 patients (5.5%) in the double bypass and in 12 of 29 patients (41.4%) in the single bypass ($P=0.001$). After a double bypass, one patient with GOO (2.8%) underwent relaparotomy and GJ revision. After single bypass, 6 out of the 12 patients with GOO (20.7%) underwent relaparotomy and GJ ($P=0.04$). In our study, the reoperation for gastric outlet obstruction was significantly higher for the single bypass group (13.9 vs 0%, $P<0.0001$). Other causes of readmission were recurrent jaundice, abdominal collection, burst abdomen, and luminal gastrointestinal bleeding. Surgical intervention was the predominant solution for the management of single bypass group complications, whereas conservation was the mainstay of management of the other group complications causing admission. The patients' follow-up did not show significant difference regarding survival after surgery ($P>0.05$). Analysis of short-term outcomes and survival for all patients who underwent surgical palliative bypass procedures was done. A total of 108 patients [median age: 65 (range: 36–86) years; male=61] had palliative surgical bypass procedures for unresectable pancreatic cancer. Patients underwent combined biliary and gastric bypass ($n=81$, 75%), gastric bypass alone ($n=24$, 22.2%), or biliary bypass alone ($n=3$, 2.8%). Overall mortality was 6.5% and the morbidity was 15.7%. Median hospital stay was 11 (range: 4–54) days. Median survival was 6 (95% confidence interval=4.3–7.6) months. No re-explorations for recurrent biliary or gastric obstruction were required. It was concluded that surgical bypass performed in a specialized pancreatic center can offer effective palliation for unresectable PAC, with satisfactory outcomes [23].

Conclusion

This study showed the prophylactic GJ significantly reduces the incidence of gastric outlet obstruction and thus reduces the rate of readmission and the need for further surgery after a single bypass. The overall complications as well as the short-term survival did not differ between single and double bypass operations.

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Conflicts of interest

There are no conflicts of interest.

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