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ORIGINAL ARTICLE

Is routine hepaticojejunostomy at the time of unplanned surgical bypass required in the era of self-expanding metal stents?

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Abstract

Background: Hepaticojejunostomy is routinely performed in patients when inoperable disease is found at planned pancreatoduodenectomy; however, in the presence of self-expanding metal stent (SEMS) hepaticojejunostomy may not be required. The aim of this study was to assess biliary complications and outcomes in patients with unresectable disease at time of planned pancreaticoduodenectomy stratified by the management of the biliary tract.

Material and methods: Retrospective analysis of patients undergoing surgery in January 2010–December 2015. Complications were measured using the Clavien–Dindo scale.

Results: Of 149 patients, 111 (75%) received gastrojejunostomy and hepaticojejunostomy (double bypass group) and 38 (26%) received a single bypass in the presence of SEMS (single bypass group). Post-operative non-biliary [7 (18%) vs 43 (38%), (p = 0.028)] and biliary [0% vs 12 (11%), (p = 0.037)] complications were lower in the single bypass group. Hospital readmissions were significantly higher in the double bypass group (p = 0.021). Overall survival and the time to start chemotherapy were equivalent (p = n.s.).

Conclusions: Complications are more common following double bypass compared to single bypass with SEMS suggesting that gastric bypass is adequate surgical palliation in presence of SEMS. This study adds further evidence that preoperative SEMS should be used in preference to plastic stents for suspected periampullary malignancy.

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Introduction

Up to one third of patients undergoing surgical exploration for periampullary malignancy are found to have either local or distant disease that precludes curative resection at laparotomy.[1] Prior to the introduction of biliary and duodenal stenting, surgical double bypass was routinely performed as randomised studies demonstrated a significant proportion of patients developed gastric outlet obstruction at a later date.[2–4] In recent years, the majority of patients who undergo attempted pancreatoduodenectomy already have a biliary stent in situ.[5,6] In the era of removable plastic biliary stents, it remained routine to perform both hepaticojejunostomy and gastrojejunostomy (double bypass) as stent obstruction was a frequent occurrence.[7] However, endoscopic stent technology has improved and self-expanding metal stents (SEMS) are now routinely used to treat obstructive jaundice prior to planned pancreatoduodenectomy. SEMS have been shown to be safe and associated with greatly improved patency as compared to plastic stents.[8,9]

Whether hepaticojejunostomy should be performed at the time of palliative bypass among patients with a SEMS in place is unclear. Studies, which have compared the outcome of patients

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undergoing palliative chemotherapy, have found no difference between those whose biliary obstruction was treated by endoscopic or surgical bypass.[10] Hepaticojejunostomy is associated with complications, including early bile leak, strictures and cholangitis. Patients undergoing double bypass are exposed to post-operative morbidity and mortality of 30% and 2%, respectively.[11,12] In contrast, SEMS have been associated with lower risk of morbidity and lower risk of recurrent biliary obstruction.[13,14]

The aim of this study was to compare outcomes among patients undergoing surgical bypass at the time of planned pancreatoduodenectomy, with the purpose of defining the best management of the biliary tract.

Material and methods

A retrospective observational study of consecutive patients undergoing attempted pancreatoduodenectomy but found to have unresectable disease at the time of surgery was performed. Patients who underwent palliative surgical bypass between January 2010 and May 2015 at the Queen Elizabeth Hospital, Birmingham, United Kingdom were included. Patients with a final histological diagnosis of pancreatic ductal adenocarcinoma, cholangiocarcinoma, ampullary carcinoma or duodenal carcinoma were included with all other patients excluded. The decision to proceed with palliative surgery was made at the time of laparotomy, due to intraoperative findings of unresectable locally advanced disease or identification of previously unknown metastatic liver or peritoneal disease.

During the study period it had been departmental practice to routinely perform gastrojejunostomy in this cohort of patients, however the addition of the hepaticojejunostomy varied for two reasons. Firstly in the presence of SEMS some surgeons stopped performing a routine hepaticojejunostomy and secondly in patients where the tumour mass widely infiltrated the liver hilum it was deemed technically unsafe to perform a hepaticojejunostomy. In this scenario post-operative SEMS was performed. Patients were therefore stratified by whether they received a single bypass (gastrojejunostomy) with SEMS or double bypass (gastrojejunostomy and hepaticojejunostomy – regardless of there being a SEMS or not).

A side-to-side gastrojejunostomy was performed in all patients. Any hepaticojejunostomy consisted of a Roux-en-Y end to side hepaticojejunostomy with a 50 cm Roux limb. Any biliary stent present was removed where possible at the time of hepaticojejunostomy. Bile was routinely sent for culture and sensitivity to guide post-operative antibiotic therapy. Every patient was reviewed daily with complications and outcomes recorded prospectively by a dedicated data manager (CC).

Preoperative mortality and morbidities were recorded using the Clavien–Dindo scale.[15] The need for post-operative biliary treatment was defined as any post-operative intervention (surgical or otherwise) on the biliary tract and/or need for hospital readmission for a biliary tract complication such as cholangitis. These were observed until death or last follow-up. Survival was determined and crosschecked by review of clinical follow-up information in the surgical and oncological services. The last update of the clinical data and follow-up was performed in December 2015.

Statistical analysis

Data were recruited from a prospectively collected consecutive database (Microsoft Access 2.0; Microsoft Corporation, Redmond, WA, USA). Demographic characteristics and clinical data are shown (wherever applicable) as either median with interquartile range (IQR) or mean ± standard deviation. Univariate data were analysed using the Mann–Whitney test and Fisher's exact test. Normal distribution continuous data were analysed by parametric test (Student's t-test). A p-value of <0.05 was considered significant. Survival was defined as overall survival from the time of surgery to death. Survival rates and the treatment free duration were calculated using the Kaplan–Meier method. The program used for statistical analysis was SPSS® 13.0 (233 South Wacker Drive, Chicago, USA) for Windows.

Table 1 Demographic characteristics of the study population

Variables	Double bypass group	Single bypass group	p-Value
Number of patients	111	38	–
Median age (years)	65 (IQR: 12)	60 (IQR: 9)	0.583
Gender (male)	66	21	0.705
Indication for palliative surgery:			
- Tumour locally advanced	58 (52)	23	0.451
- Liver metastasis	43 (39)	10	0.239
- Peritoneal metastasis	10 (9)	5	0.533
Histological diagnosis:			
- Pancreatic adenocarcinoma	82 (74)	25	0.404
- Ampullary tumour	11 (10)	1	0.297
- Cholangiocarcinoma	16 (14)	10	0.135
- Duodenal tumour	2 (2)	2	0.269
Comorbidities:			
Hypertension	37 (33)	14	0.697
Diabetes mellitus	22 (20)	13	0.080
COPD	9 (8)	1	0.453
CVA	3 (3)	2	0.602
IHD	9 (8)	6	0.212

Continuous values are reported as medians and interquartile ranges (IQR). Histological diagnoses were intraoperatively confirmed. Abbreviations: COPD, chronic obstructive pulmonary disease; CVA, cerebrovascular accident; IHD, ischemic heart disease.

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Results

Study population

Demographic characteristics, indications for palliative bypass, preoperative comorbidities and characteristics of the tumours were comparable between the two groups and reported in Table 1. The surgical management of the patient cohort is described in Fig. 1. Perioperative outcomes are shown in Table 2.

In the double bypass group, during the early post-operative period 7 (6%) patients developed bile leaks among which 3 (3%) required surgical revision of the anastomosis, 3 (3%) were treated with percutaneous drainage and 1 (1%) was treated conservatively. When medium and long-term biliary complications were analysed a further 5 (5%) patients developed complications, all among the double bypass group. Late biliary strictures occurred in 3 patients (3%) all of which were treated with percutaneous metal stent insertion. Two further patients (2%) developed cholangitis requiring hospital admission and intravenous antibiotics (Table 2). Thus the total number of biliary complications affected significantly more patients in the double bypass group (12 [11%] vs 0, p = 0.037). The biliary tract treatment free duration of both groups is shown in Fig. 2.

All hospital readmissions within 90 days of surgery occurred within the double bypass group [14 (13%) vs 0, p = 0.021]. Of these patients, 6 (5%) were readmitted for abdominal collections requiring percutaneous drainage, 2 (2%) for biliary sepsis, 2 (2%) for unspecific abdominal pain, 1 (11%) for urinary tract infection,

Table 2 Post-operative complications and outcomes

	Double bypass group (n = 111)	Single bypass group (n = 38)	p-Value
Surgical complications (CD scale)[a]			
Total number of complications	55 (50)	7	0.001*
Grade I	13 (12)	1	0.118
Grade II	23 (21)	6	0.637
Grade III	18 (16)	None	0.007*
Grade IV	1 (1)	None	1.000
Management of biliary complications			
Surgical revision of hepaticojejunostomy	3 (3)	None	0.571
Radiological procedures	6 (5)	None	0.338
Intravenous antibiotics	2 (2)	None	1.000
Hospital stay (days)	8 (IQR: 5)	8 (IQR: 4)	0.921
Hospital readmission with 90 days	14 (13)	None	0.021*
In hospital-mortality	3 (3)	None	0.571

Abbreviations: CD scale, Clavien–Dindo scale.
* p-value of <0.05 was considered significant.
[a] Post-operative complications are defined according with Clavien–Dindo classifications, including both biliary and non-biliary complications.

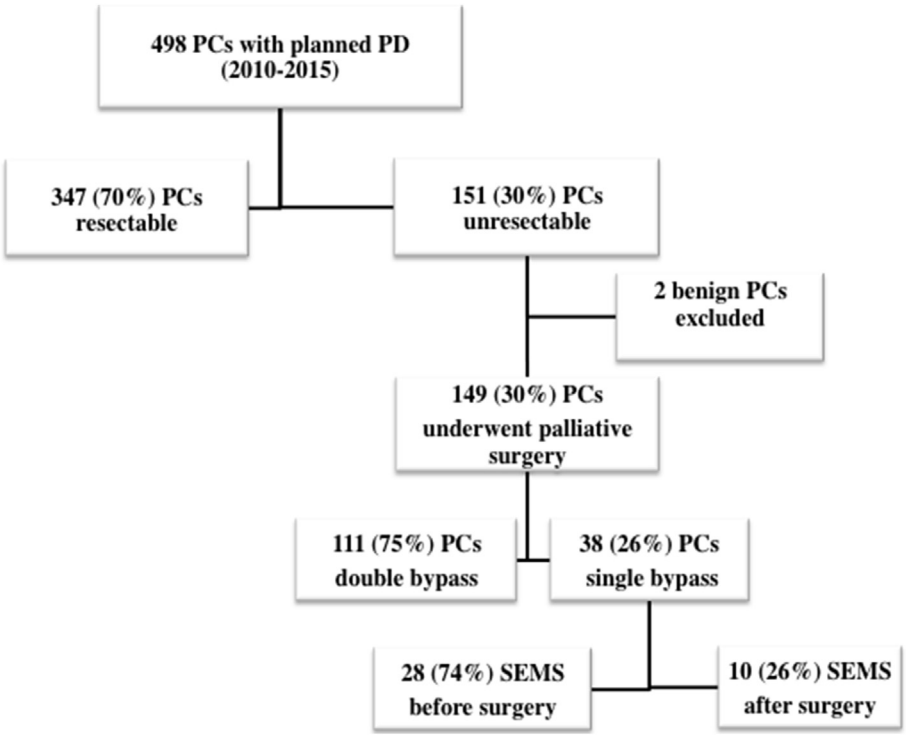

Figure 1 Study population selection for unresectable pancreatic cancer. Surgical management of patients with periampullary/pancreatic cancers (PCs) within the study. *Abbreviations:* PD, pancreaticoduodenectomy

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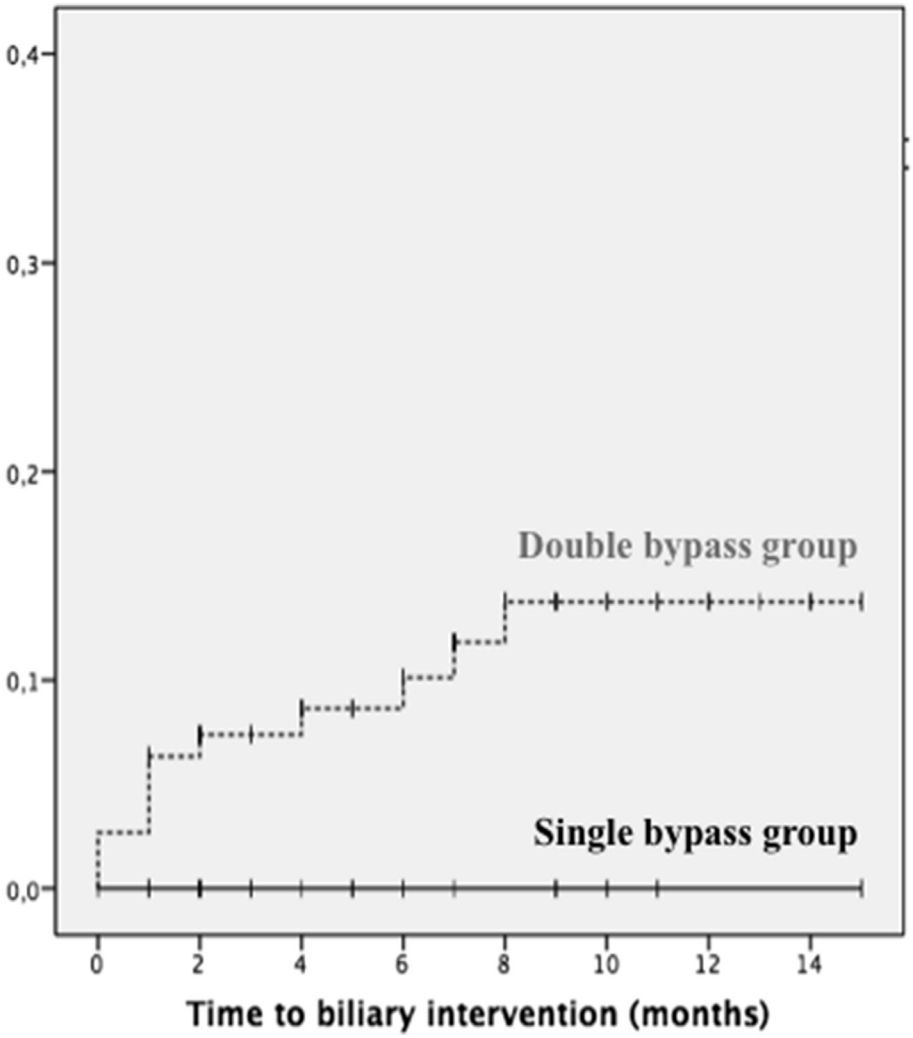

Figure 2 **Biliary tract treatment free duration**. The "biliary tract treatment free duration" refers to the time from surgery to the occurrence of the biliary complications, which required intervention to the biliary tract or readmission and treatment for cholangitis

1 (1%) for wound infection, 1 (1%) for pulmonary embolism and 1 (1%) for persisting vomiting. Out of 3 (3%) in-hospital deaths (all within 30-days of surgery) in the double bypass group, 2 deaths were related to sepsis (of which one patient had a biliary leak) and one following a myocardial infarction.

Effect upon adjuvant chemotherapy

There was no difference in the proportion of patients receiving palliative chemotherapy (63 [56%] vs 18 [47%], p = 0.349) between the double and single bypass groups, respectively. The time to commence chemotherapy was not different (70 [IQR: 31] vs 66 [IQR: 30] days, p = 0.852) between the double and single bypass groups, respectively. Of 12 patients with biliary complications in the double bypass group 6 patients received chemotherapy, while remaining were considered too frail.

The median follow-up was similar in the two groups [9 (IQR: 1–65) in the double bypass group vs 11 (IQR: 1–68) months in the single bypass group (p = 1.000)]. No patients were lost to follow-up. At last follow-up, 93 (84%) and 24 (63%) patients had died in the double and single bypass groups, respectively. The median survival was 8 (range 6–10) months in the double bypass group and 7 (range 4–10) months in the single bypass group, with no significant difference in survival between the two groups (p = 0.121) (Fig. 3).

Discussion

This was a retrospective analysis of patients undergoing palliative bypass for unresectable pancreatic or periampullary cancer with a focus upon the need for routine hepaticojejunostomy in the presence of SEMS. The main finding of the study was that no patient who had SEMS required further treatment or intervention to the biliary tract prior to death or last follow-up. In contrast to this, those patients undergoing surgical biliary bypass

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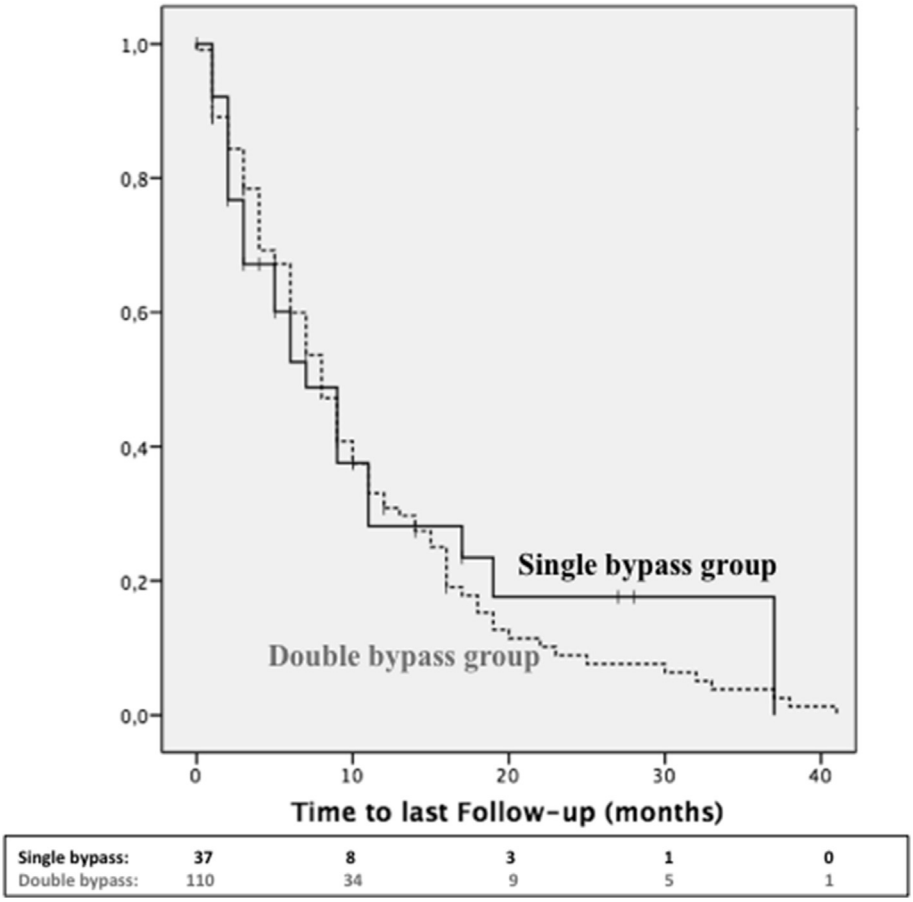

Figure 3 Overall survival of the study population

developed a significantly greater number of biliary and non-biliary complications. Nine patients developed grade III Clavien–Dindo biliary complications requiring intervention.

Despite improvements in preoperative imaging, patients continue to have unidentified unresectable disease at the time of planned pancreatoduodenectomy.[2,16] Whilst it has been common to perform surgical bypass among these patients, it is clear that avoiding complications is desirable given the short expected duration of survival and need to commence palliative chemotherapy. Endoscopic placement of biliary stents is well tolerated and has low rates of early complications and procedure-related mortality.[17] SEMS have advantages over plastic biliary stents as they suffer from lower rates of cholangitis and obstruction.[18–20]

This study demonstrates a small rate of post-operative complications amongst patients treated by surgical biliary bypass. Individual complications did not reach significance, but when considered together over 1 in 10 patients who underwent surgical biliary bypass suffered some form of biliary complication. Conversely no patient treated with a SEMS developed a biliary complication during follow-up.

Some patients presenting for pancreaticoduodenectomy will not have undergone preoperative stenting. If these patients are found to have unresectable disease at the time of laparotomy it is unclear whether they should undergo surgical biliary bypass or placement of a SEMS after surgery. However, there is increasing evidence that early surgery is associated with a very low rate of unplanned bypass and thus this patient group is likely to be very small.[21]

In the current series, the cause for higher rate of non-biliary complications among the double bypass group is unclear. Some of these may be related to biliary complications, such as wound infection or occult biliary leaks which manifested themselves as abdominal collections. However, among those patients with non-biliary complications having abdominal collections, no bile was recorded in the aspirate. This provides further indirect evidence that the need for routine biliary bypass should be questioned in the era of biliary SEMS. Nowadays in patients with combined biliary and duodenal obstructions, concomitant biliary and duodenal stenting seems feasible and justified as the need to repeat endoscopic therapies is rarely required even in long-term survival patients.[22,23]

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In the current series there was no evidence of SEMS adversely affecting the timing of starting chemotherapy after surgery. Though there was no difference in the proportion of patients receiving palliative chemotherapy between the groups, it was disappointing to see that around half didn't receive any and among those the median time to start chemotherapy was in excess of two months. The observational non-randomized nature of this study is its major limitation. However, the proportion of complications among patients treated with surgical or biliary SEMS is in line with other published data.[8]

In summary, the findings of this study question the need for routine hepaticojejunostomy when unresectable disease is found at surgical exploration for tumours in the head of the pancreas, particularly if a SEMS is already in place. The addition of hepaticojejunostomy to a palliative gastrojejunostomy significantly increases perioperative morbidity in patients with unresectable disease at laparotomy.

Disclosure

No funding sources have been employed.

Conflicts of interest

None declared.

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