Original Article

Binding Pancreaticojejunostomy: Is It Safe?

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Abstract

Background: Postoperative pancreatic fistula (POPF) or leak from pancreaticojejunostomy (PJ) is one of the most common complications after pancreaticoduodenectomy (PD), with an incidence of 5%–30%. Various techniques have been advocated to bring down the incidence of POPF, but there is still none that can be called the "gold standard". Peng's binding PJ (BPJ) was proposed as a good method of performing PJ with low fistula rates; we present our results with BPJ. **Methods:** The data of all patients who underwent PD with BPJ between January 2016 and March 2018 were retrospectively analyzed for demographics, clinical features, type of procedure performed, complications (especially POPF), hospital stay, morbidity, and mortality. **Results:** A total of 24 patients (18 males and 6 females) were identified. The mean age at the diagnosis was 65.5 ± 6.4 years. Majority of the patients had ampullary carcinoma (62.5%). The most common postoperative complication was delayed gastric emptying seen in 10 patients, whereas only 2 (8.33%) had POPF and there was one mortality. **Conclusion:** BPJ is safe and is associated with a low incidence of POPF.

Keywords: *Pancreatic fistula, pancreaticoduodenectomy, pancreaticojejunostomy*

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Introduction

Pancreaticoduodenectomy (PD) is still the best option for resectable carcinoma head of the pancreas or periampullary region and is also indicated for some benign lesions involving duodenum or pancreas. With improvement in surgical technique and better perioperative management, the procedure-related mortality has come down to <5%.[1] However, this procedure is often associated with complications such as pancreatic fistula (PF), delayed gastric emptying (DGE), pulmonary complications, intra-abdominal abscess, pancreatitis, and hemorrhage.[2] Of these, postoperative PF (POPF) or leak from pancreaticojejunostomy (PJ) is the most common and most feared complication. It is also considered the initial event that initiates a cascade, leading to other complications.[3] The incidence of POPF, as reported by various series ranges from 5% to 30%.[4] To minimize the incidence of POPF, various techniques using different segments of the gastrointestinal tract, fibrin glue, pancreatic duct stenting, and somatostatin analogs have been reported in the literature,[5] but an ideal technique to prevent PF is still not available.

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Binding PJ (BPJ) as a technique for performing PJ was first described and published by Peng *et al*. in a series of 150 patients where they did not encounter even a single case of POPF.[6,7] Going by their encouraging results, our unit also switched to BPJ from conventional two-layered PJ, and the present series reflects our experience with the same.

Materials and Methods

The data of all patients who underwent PD between January 2016 and March 2018 were retrieved. These patients were assessed for demographics, complications (especially POPF), postoperative hospital stay, and mortality.

Operative technique

BPG was done according to the technique described by Peng *et al*.[8] – after resection, the proximal portion of the remnant pancreas was mobilized for at least 3 cm

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off the splenic vessels [Figure 1]. The cut end of the jejunum was everted using three 2-0 silk sutures taken approximately 6 cm from the cut end to have 3 cm of the everted jejunal mucosa. The everted jejunum was isolated from the rest of the abdominal viscera using surgical pads, and its mucosa was fulgurated using a swab soaked in 10% carbolic acid until it was whitish and discolored. The jejunal stump was then cleansed with normal saline and brought close to the mobilized pancreatic stump. Using 3-0 polydioxanone, the mucosa of jejunum was sutured to the posterior margin of the pancreatic stump in a continuous manner, with a few sutures passing through the lumen of the duct posteriorly [Figure 2]. After the completion of this layer, the everted jejunum was rolled over the pancreatic stump all around, and the margins of the everted jejunum were sutured to the pancreas using 3-0 polyglactin suture. A silk suture was then passed through the mesentery of the small bowel leaving distal 1–2 vessels and tied around the anastomosis gently just to approximate the jejunal mucosa with the pancreatic surface [Figure 3]. Hepaticojejunostomy and gastrojejunostomy were done to the same jejunal loop distal to PJ. Tube drain was placed in all cases near the PJ site.

Postoperative management

Oral intake was allowed on the 3rd postoperative day. As per our protocol, drain fluid amylase was assessed only if drain output was more than 50 ml after the 3rd postoperative day. Somatostatin or analogs were not administered, either preoperatively or postoperatively. Complications such as POPF and DGE were defined as per the criteria laid down by the International Study Group on Pancreatic Fistula.[9,10]

Results

A total of 24 patients (18 males and 6 females) underwent BPJ, with a mean age of 65.5 ± 6.4 years at the diagnosis. Most of our patients who underwent PD had ampullary carcinoma (62.5%), probably due to high unresectability rate associated with pancreatic head carcinoma on presentation.[11] The overall morbidity and mortality associated with PD were 41.6% and 4.1% in our hands, respectively [Tables 1 and 2]. The average duration of postoperative stay was 15 ± 3 days.

The most common complication encountered was DGE (41.6%), with most patients having Grade A DGE (8 patients). All patients with DGE responded to conservative treatment (nasogastric tube insertion and prokinetics). POPF was seen in only two patients (8.3%).

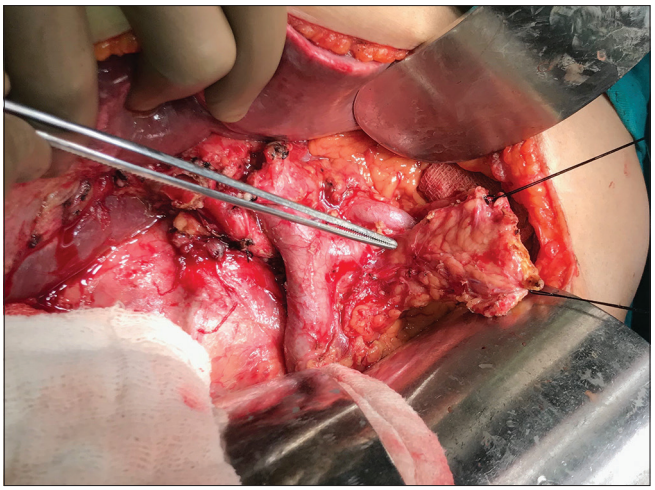

Figure 1: Mobilized pancreatic stump

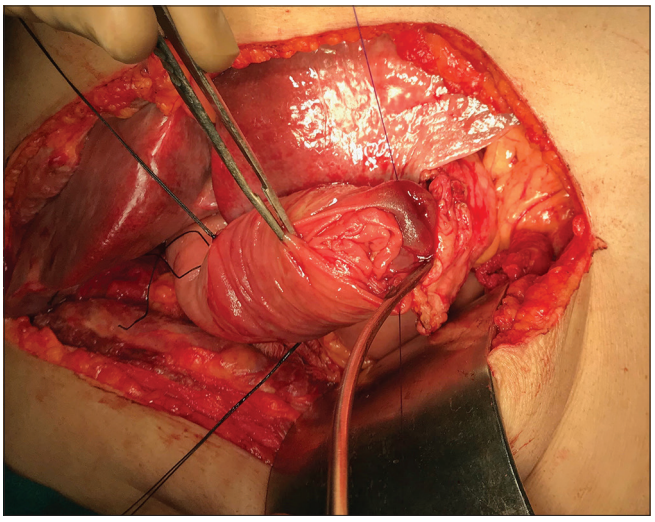

Figure 2: Approximation of the jejunal loop to pancreatic stump

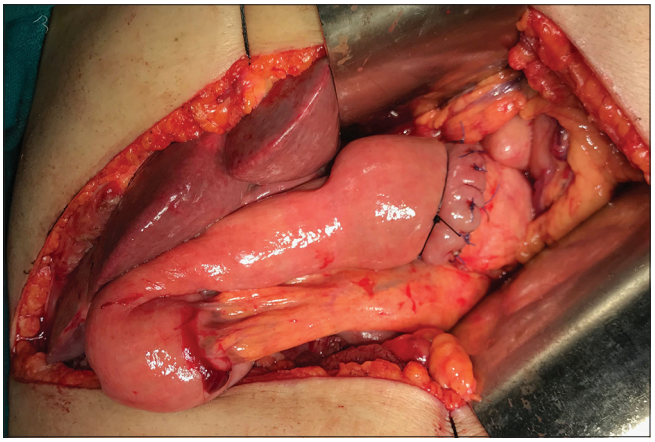

Figure 3: Completed binding pancreaticojejunostomy

Both of these patients had Grade B POPF, drain output more than 100 ml after the 3rd postoperative day, and their drain fluid amylase level was found to be more

Table 1: Patients characteristics

Total patients (*n*=24)	*n* (%)
Age (mean)	65 years
Sex ratio (male:female)	9:3
Comorbidity	
Diabetes	4 (18.1)
Hypertension	2 (09.09)
Imaging	
PD ≥5 mm	17 (70.8)
PD <5 mm	7 (29.2)
Type of procedure	
PD	16 (66.6)
Pylorus preserving PD	8 (33.3)
Pancreatic stump	
Hard	14 (58.3)
Soft	10 (41.8)
Indication of resection	
Ampullary carcinoma	15 (62.5)
Cholangiocarcinoma	2 (8.3)
Adenocarcinoma of pancreatic head	3 (12.5)
Adenocarcinoma of uncinate	1 (4.1)
Duodenal adenocarcinoma	1 (4.1)
Neuroendocrine tumor of the ampulla	1 (4.1)
Solid pseudopapillary neoplasm	1 (4.1)

PD: Pancreaticoduodenectomy

Table 2: Postoperative outcome

Postoperative complications	
Hospital stay (mean±SD)	15±3 days
1. Delayed gastric emptying	10
Grade A	8
Grade B	2
Grade C	0
2. Postoperative pancreatic fistula	2
3. Wound infection	3
4. Postoperative pancreatitis	2
5. Collection in the lesser sac	1
6. Pulmonary infection	3
7. Postpancreatectomy hemorrhage	0
8. Mortality	1

SD: Standard deviation

than three times the normal serum amylase level – none of these patients required any intervention and drain was removed on the 8–10th POD. One of these had a pus collection in the lesser sac (probably due to contained leak from PJ) which was drained under ultrasound guidance.

Other complications that were documented included wound infection (3), pancreatitis (2), and pulmonary infection (3). One patient died of multi-organ failure on the 7th postoperative day, the exact cause of which could not be ascertained. Postoperative CT did not show any collection, and drain output was also <50 ml/day with amylase level 30 IU/l (normal serum level 23–125 IU/L).

Table 3: Outcome of various studies after binding pancreaticojejunostomy

Author (year)	Number of BPJ	POPF (%)	Morbidity (%)	Mortality (%)
Peng *et al*., 2004[8]	227	0	71 (31.28%)	5 (2.2)
Peng *et al*., 2007[16]	106	0	26 (24.5)	3 (2.8)
Kim *et al*., 2009[17]	15	0	5 (33.3)	0
Buc *et al*., 2010[18]	45	4 (8.9)	24 (53.3)	2 (4.4)
Maggiori *et al*., 2010[19]	22	8 (36.3)	14 (64)	0
Silvestri *et al*., 2010[20]	10	2 (20)	NA	0
Targarona *et al*., 2013[21]	30	2 (6.6)	11 (36.7)	0
Casadei *et al*., 2013[12]	69	13 (18.8)	33 (47.8)	4 (5.8)
Kim *et al*., 2014[22]	21	5 (23.8)	NA	1 (4.76)
Present Study	24	2 (8.33)	10 (41.6)	1 (4.1)

BPJ: Binding pancreaticojejunostomy, POPF: Postoperative pancreatic fistula, NA: Not available

Discussion

POPF contributes significantly to postoperative morbidity and mortality after PD.[12] To reduce the rate of POPF, various techniques have been developed and compared from time to time, such as invagination versus duct to mucosa anastomosis, PJ versus pancreaticogastrostomy, dual-loop with isolated PJ, gastric partition technique, pancreatic duct stenting, fibrin glue, and use of somatostatin analogs.[3,5] Among the various available pancreatic-enteric anastomotic techniques, PJ is the most commonly practiced, usually performed as duct to mucosa or end-to-side invagination in single or two layers but is still associated with a POPF rate of 6%–24%.[13,14] However, to date, no technique has been found to be superior over another, and it is difficult to recommend any specific technique in a given situation to decrease the incidence of POPF.[3] In addition to operative technique, the risk of developing POPF is related to various patient-related perioperative and intraoperative factors and is significantly dependent on texture of the pancreatic parenchyma, type of pathology (pancreatic adenocarcinoma/pancreatitis or other), duct diameter, and intraoperative blood loss.[15]

Binding type of PJ was first described by Peng *et al*. when they reported a remarkable nil PF rate in 150 consecutive patients who underwent BPJ.[7] This was further substantiated with a randomized controlled study on 217 patients, comparing conventional PJ (end-to-end two-layered anastomosis) with BPJ.[16] To explain their

low leak rate after BPJ, they hypothesized that their technique caused less injury to the pancreatic parenchyma and ductules, thereby leading to less leak of pancreatic juice and autodigestion around the anastomosis.[16] In addition, chemical cauterization of the jejunal mucosa with carbolic acid promotes adhesion between the jejunal mucosa and pancreatic surface leading to a more secure PJ.[16] Since then, a number of studies have been done to study the efficacy of BPJ [Table 3];[8,12,16-22] none except for Kim *et al*. could reproduce similar results.[17] However, the majority of studies (except for Morggiori)[19] observed that the incidence of POPF was either less or comparable to conventional PJ. Buc *et al*. found that BPJ is safe and better technique even in high-risk patients, i.e., in the presence of nondilated duct and soft pancreatic remnant.[18] It was only the series by Morggiori *et al*. that reported a contrary opinion that BPJ was associated with higher leak rate (36% vs. 28%) and a high incidence of postpancreatectomy hemorrhage (27% vs. 0%) as compared to conventional PJ.[19] Difference in the definition of POPF as adopted by various authors and exposure of large pancreatic surface to the jejunal lumen were given as plausible reasons for increased incidence of POPF and PPH in this series.

Although ours is a small series, we found our results to be comparable to most of the reported series; of the 24 patients who underwent BPJ, there were only two cases of POPF (8.33%). Other complications after PD with BPJ were also comparable to conventional PD with PJ, similar to the results published in a recent meta-analysis by Zhang *et al*. who also found that BPG is comparable to conventional PJ in terms of incidence of POPF, DGE, postpancreatectomy hemorrhage, morbidity, mortality, operation time, blood loss, blood transfusions, and hospital stay.[5]

Although BPJ appears to be promising, the procedure has its own limitations. It is technically more demanding – the pancreatic stump needs to be mobilized further after resection of the specimen, and it can be difficult to perform if there is a significant discrepancy between the size of the pancreas stump and the jejunal lumen. Correct placement, as well as tightening of the binding ligature, is also very important – if it is too tight, it can compromise duct lumen as well as the vascularity of the pancreatic stump, whereas if it is loosely kept, it can compromise anastomotic integrity; incorrect placement of the binding suture can lead to mesenteric ischemia.[16] Thus, the outcome with BPJ can vary depending on the experience of the surgeon and the intraoperative scenario.

A number of other variants of classical invaginating PJ such as "colonial wig" and "serous touch" have been described in the literature. The reported incidence of POPF with these techniques varies from 0% to 15%.[23,24] Despite multiple randomized studies and meta-analyses, there are still no clear guidelines on how to construct an ideal pancreatico-enteric anastomosis. No technique has been found to be superior to the other, and ISGPS in its position statement on pancreatic anastomosis concluded that it is not the technique, but the practice of a standardized technique that can decrease the rate of clinically relevant POPF.[3] The same holds true for BPJ – though our initial results with BPJ are comparable to other techniques, we believe that consistent practice can further bring down the incidence of POPF in our hands.

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Conflicts of interest

There are no conflicts of interest.

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