Postoperative Pancreatic Fistula Following Duct To Mucosa Pancreaticojejunostomy After 100 Consecutive Whipple's Surgery

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Abstract

Background: Postoperative pancreatic fistula (POPF) remains a concerning complication following pancreaticojejunostomy (PJ). Its incidence can be as high as 20%, with identified risk factors including soft gland texture, small main pancreatic duct (MPD) diameter, pancreatic pathology, and significant intraoperative blood loss. Our primary objective is to determine the incidence of POPF and assess its associated risk factors by consistently applying a uniform surgical technique and utilizing uniform suturing materials.

Methods: Our study included patients who underwent PJ following pancreaticoduodenectomy at our center using a consistent duct-to-mucosa technique and the same suturing material, PDS 5-0. Data from 100 consecutive patients were collected and entered into the Statistical Package for the Social Sciences (SPSS 26) for analysis of postoperative pancreatic fistula (POPF).

Results: Among the 100 patients, the incidence of clinically relevant POPF was 5%. Factors such as gland texture and main pancreatic duct (MPD) diameter did not demonstrate any statistically significant correlation with POPF, however the frequency of POPF was notably high in cases with an MPD diameter of less than 3 mm. Mortality following clinically relevant POPF was substantial, reaching 4%, and this association was statistically significant ($p < 0.001$).

Conclusion: POPF represents a severe complication associated with statistically significant mortality. Employing a uniform standard duct-to-mucosa anastomotic technique along with consistent use of suturing material is imperative to mitigate bias and minimize the risk of POPF.

Keywords: Pancreaticoduodenectomy, POPF, postoperative pancreatic fistula, Whipple's surgery

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Introduction

In 2005, the International Study Group of Pancreatic Fistula (ISGPS) introduced the first classification for postoperative pancreatic fistula (POPF), widely acknowledged worldwide.[1] A publication by the Modified Heidelberg group in 2015 prompted ISGPS to revise their grading system for POPF.[2] Consequently, in 2016, ISGPS updated their classification system, which has been universally adopted since.[3]

Postoperative pancreatic fistula represents a significant concern following pancreatico-jejunostomy. The overall prevalence of POPF is documented at 19.2%.[4]

According to ISGPS guidelines, biochemical leaks lacking clinical significance are classified as grade-A POPF. Grade-B encompasses cases with persistent amylase in drains beyond three weeks post-surgery, necessitating interventions like drainage, procedures for bleeding, with signs of infection but no organ failure. Grade-C entails organ failure requiring supportive measures such as hemodialysis, ventilation, or inotropic support for over 24 hours, or resulting in mortality.[3]

Various research studies have highlighted ductal diameter, gland texture, and intraoperative blood loss as independent risk factors for POPF[4].[5,6,7,8] Furthermore, the technique of anastomosis and the choice of suture material may also influence POPF outcomes. Thus, investigating POPF while controlling for these variables using a uniform technique and suture material is crucial. Our study seeks to examine the relationship between different risk factors for POPF under controlled conditions, employing consistent techniques and suture materials for the anastomosis.

Methodology

This retrospective study was conducted at BP-Koirala Memorial Cancer Hospital (BPKMCH) following ethical approval from the Institutional Review Committee of BPKMCH. This study included 100 patients who underwent pancreaticoduodenectomy from 2014 to 2020. All individuals who had undergone pancreaticoduodenectomy surgery at the Department of Thoracic Surgery and received PJ using same surgical techniques and suture materials were enrolled in the study. Those who had modifications in the anastomotic technique or suture material, as well as those who did not provide consent for participation, were excluded from the study. PJ was performed using 5-0 PDS suture, and the Modified Heidelberg duct to mucosa anastomosis technique was consistently applied in all cases (see figure 1).

Duct diameter measurement involved inserting an infant feeding tube. The French (Fr) value of the tube that fit snugly in the duct was divided by 3 to obtain the diameter in millimeter. Tube ranging from 5 Fr to 14 Fr for duct sizes less than 5 mm was used conversely see table 1. For ducts larger than 5 mm, a scale was employed to directly measure the duct diameter. Gland texture assessment was subjectively determined by the operating surgeon through palpation.

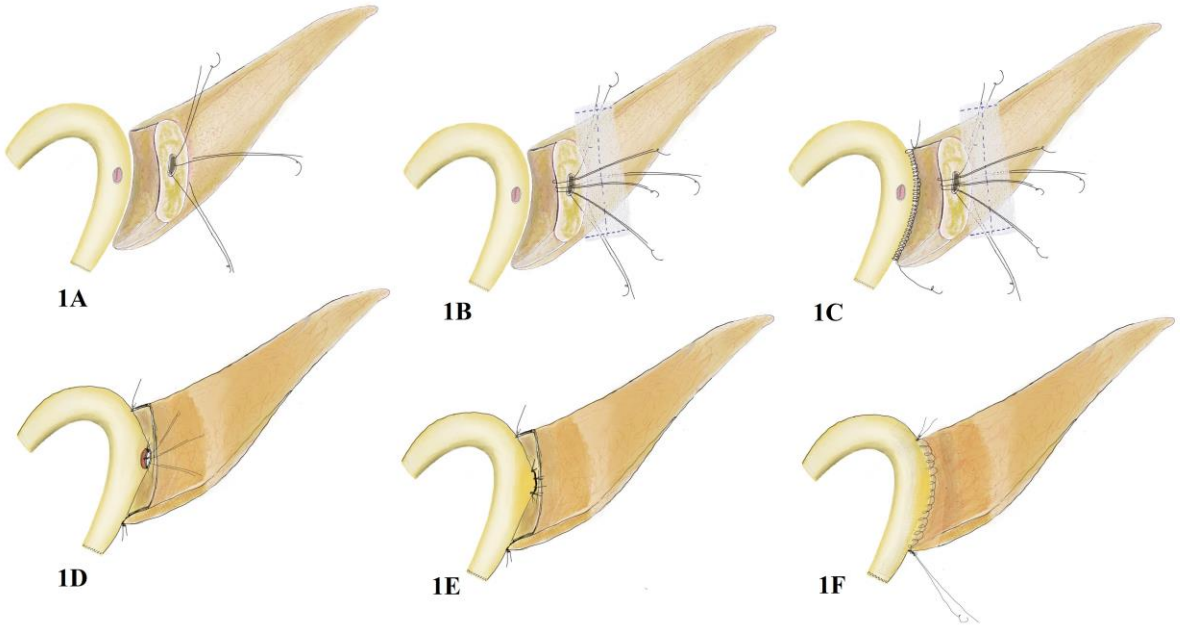

Figure 1 depicts the Modified Heidelberg technique for Pancreaticojejunostomy.1A: Three or more sutures are placed on the anterior side of the pancreatic duct.1B: A gauze pad is positioned over these front sutures, followed by similar sutures on the posterior wall of the duct.1C: A continuous suture is taken between posterior surface of the pancreas to the sero-muscular layer of the jejunum.1D: The suturing of the posterior duct to the mucosa is finished using previously placed sutures.1E: The anterior duct to mucosa suturing is completed.1F: A continuous suture is applied between the front anterior of the pancreas and the sero-muscular layer of the jejunum.

Table 1: Feeding tube in Fr, converted to mm for duct diameter					
Feeding tube diameter	5 Fr	6 Fr	9 Fr	12 Fr	15 Fr
Duct diameter in mm	1	2	3	4`	5

The data was entered into the Statistical Package for the Social Sciences (SPSS-26) for analysis. Descriptive variables were evaluated using frequency and percentages, while continuous variables were characterized by mean and standard deviation. For inferential statistics, students-T tests were employed for analyzing continuous data, while chi-square test were used for categorical data analysis. P-Value of <0.05 was considered as statistically significant.

Results

This study comprised 100 patients, among whom 44% (n=44) were male and 56% (n=56) were female. The average age of the patients was 55 years, ranging from 32 to 77 years. The mean bilirubin level was 11.2 mg/dL. The common hepatic duct had a mean diameter of 25 mm (ranging from 5 to 40 mm), while the pancreatic duct diameter averaged at 4 mm (ranging from 1 to 13 mm). The average duration of the operation was 295 minutes, accompanied by an average blood loss of 420 ml. The primary clinical complaint leading to medical consultation was abdominal pain, reported by 95% of patients, followed by jaundice in 88% of cases. Among the 100 patients, only 31% experienced significant weight loss.

Regarding patient history, ERCP stenting and preoperative PTBD were done in 17% and 4%, respectively. The oncological multidisciplinary treatment characteristics and associated medical illness of respondents are mentioned in table 2 and 3.

Table 2: Medical illness associated with respondents (n=100)	
Medical illness	Frequency
Hypertension	4 (4%)
Diabetes Mellitus	5 (5%)
Hypertension and Diabetes Mellitus	3 (3%)
COPD	3 (3%)
Hypothyroidism	1 (1%)
None	84 (84%)

Abutment of tumor with portal vein was managed by Portal vein resection in 8% (n=8) of respondents. In each case tangential resection with primary repair was done on portal vein. Post-operative pancreatic fistula (POPF) occurred in 12% (n=12) cases. Grade-A POPF occurred in 7% of cases while only 5% of respondents experienced clinically significant Grade-B and Grade-C. Though most of the respondents who experienced POPF had soft gland texture (n=7), it was statistically not significant.

Table 3: Multimodality of treatment with respondents (n=100)	
Treatment modality	Frequency
Upfront surgery	91 (91%)
Neo-adjuvant CTRT followed by surgery followed by adjuvant therapy	3 (3%)
Surgery followed by CTRT	1 (1%)
Surgery followed by chemotherapy	5 (5%

Table 4: Pancreatic texture and occurrence of POPF			
	POPF		
Pancreatic texture	Yes	No	P-value
Soft (n= 41)	7 (7%)	34 (34%)	P= 0.27
Firm (n=48)	5 (5%)	43 (43%)	
Hard (n=11)	0%	11 (11%)	
	12 (12%)	88 (88%)	

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Similarly, pancreatic duct diameter with incidence of POPF was evaluated. Out of 12 respondents who experienced POPF, 8 respondents had duct diameter of less than 3 mm. Duct diameter and occurrence of POPF was statistically not significant.

Table 5: Diameter of pancreatic duct and POPF			
Diameter of duct	POPF		P-value
	Yes	No	0.43
< 3 mm	18 (8%)	29 (29%)	
3-6 mm	12 (2%)	49 (49%)	
6-9 mm	1 (1%)	5 (5%)	
9-12 mm	1 (1%)	4 (4%)	
12-15 mm	0 (0%)	1 (1%)	
Total	(12%)	88 (88%)	

Post-operative mortality occurred in 7% of cases. Mortality occurred in 4% of clinically relevant POPF which was statistically significant.

Table 6: Association of Mortality with POPF			
	POPF		p-value
Death	Yes	No	
Yes	4 (4%)	3 (3%)	
No	8 (8%)	85 (85%)	0.001
Total	12 (12%)	88 (88%)	

Discussion

Postoperative pancreatic fistula is one of the dreaded complications after pancreatico-duodenectomy. On the study conducted by Mathhew et.al the incidence of POPF is 19.2% out of which 42.3% was biochemical leak which did not have any clinical impact and clinically relevant POPF occurred in 11.1% of cases.[4] Various techniques have been employed to reduce the incidence of POPF like binding, single layer duct to mucosa, double layered duct to mucosa, end to side invagination etc.[10]

Table 7: Association of mortality with grade of POPF				
	Grade of POPF			P-Value
Mortality	A	B	C	
Yes	0	2 (2%)	2 (2%)	<0.001
No	7 (7%)	1 (1%)	1 (1%)	
Total	7 (7%)	3 (3%)	3 (3%)	

None of the technical alternatives for pancreaticojejunal or pancreaticogastric anastomosis, including variations like duct-mucosa, invagination method, and binding technique, have shown consistent superiority over one another. Randomized trials and meta-analyses comparing pancreaticogastrostomy versus PJ provide conflicting results and are susceptible to bias due to significant heterogeneity among the studies.[9]

The positional statement by ISGPS group have focused for consistent practice of any standard surgical technique and suture material that could prevent bias as well as may decrease POPF rate.[10]

Our study has employed Heidelberg technique of anastomosis and consistent use of same suturing material in each case. They focused to three conditions that are important for anastomoses 1) tension-free anastomosis; (2) an optimal blood supply and (3) an unobstructed passage for the flow of the pancreatic secretions in patients with PJ.[11] Srikhande et al published a series of 331 cases POPF rate in their series is nearly 2% with 0% mortality. While from the same hospital published the article showing POPF of 3.2%.[9] Buchler et al who advocated for Heidelberg technique of PJ also showed the POPF rate of 2%.[11] In our study the incidence of POPF is 12% and clinically relevant POPF is just 5%. Regarding POPF rate, though it is lower than the rate published by Matthew et al, the rate of POPF in our series seems still high compared to Buchler and Srikhande et al.

In article published by Mark P Callery et al they showed ductal diameter, gland texture, amount of intraoperative blood loss and pathology of pancreas being independent risk factor for POPF.[5]

Bing Yang Hu showed no significant difference in POPF and intra operative blood loss while diameter of duct and soft gland texture was significant risk factor.[6] On comprehensive review on 25599 patients including 66 studies showed soft gland texture with statistically significant

incidence of POPF (OR=4.24, 95% CI, P<0.01).[7] In our study we did not find any statistically significant relation of gland texture with POPF. It is probably the systemic review had included studies with heterogeneous technique of anastomosis while we stick with consistent technique.

Similarly, in same systemic review, concluding 37 studies with 14471 patients showed MPD diameter as an independent risk factor for POPF (OR=3.14, 95% CI, p<0.01). MPD diameter <3mm being high risk cut off value of POPF.[7] In our study, we had high frequency of POPF in MPD less than 3 mm (8%) but this was not statistically significant.

In our study postoperative mortality is statistically significant in patient with clinically relevant POPF. Similar result has been described by many studies.

Conclusion

Postoperative pancreatic fistula is dreaded complication with statistically significant impact on postoperative mortality. A consistent standard technique that incorporates duct to mucosa anastomosis and consistent suture material could be a safer technique and may reduce risk of POPF.

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