



## Postoperative Pancreatic Fistula following Pancreaticoduodenectomy for Periampullary Carcinoma – A Comparative study

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### Abstract

**Background:** Postoperative Pancreatic Fistula (POPF) formation is an important complication following pancreatic resections. International Study Group on Pancreatic Fistula (ISGPF) has defined POPF as 'an abnormal communication between pancreatic ductal epithelium and another epithelial surface, containing pancreas derived enzyme-rich fluid.' Although Pancreatic Fistula (PF) is generally treated conservatively (grade A), some cases may require interventional procedures (grade B) or maybe life-threatening and necessitate emergency reoperation (grade C).

This study aims to compare the incidence of POPF after pancreatico-duodenectomy (PD) following duct-to-mucosa and dunking methods.

**Materials and Methods:** A total number of 48 patients diagnosed with periampullary carcinoma attending to OPD, King George Hospital from August 2017 to August 2018 are included. All the patients were subjected to routine blood investigations and imaging studies. Cases were randomized based on block randomization. Postoperatively biochemical and imaging studies done for leak identification. Patients who didn't give their consent and who succumbed immediately postoperatively were excluded.

**Results:** Of the 48 cases who underwent PD, 24 underwent pancreaticojejunostomy using duct to mucosa method, rest with invagination or dunking method. Three cases developed POPF following surgery (6.23%). Of these, two (8.33%) following duct-to-mucosa and one (4.16%) following the invagination method. All three managed conservatively. No mortality due to POPF.

**Conclusion:** POPF continues to be the nemesis of pancreatic resection. Many technical variations have been developed with the hope of decreasing the incidence of POPF. In a nutshell, a successful pancreatico-enteric anastomosis requires a tension-free anastomosis with adequately placed and tied sutures, preserved blood supply to the pancreatic remnant and jejunum, and unobstructed flow from the pancreas into the gastrointestinal tract, whatever the chosen technique may be.

**Keywords:** Postoperative Pancreatic fistula-pancreaticojejunostomy-Whipple's procedure.

## Introduction

Pancreaticoduodenectomy (PD) is the choice of treatment for operable periampullary malignancies. It is described as one of the most complex procedures in gastrointestinal surgeries. Following the resection, gastrointestinal continuity is established using three anastomoses: 1) pancreatico-enteric 2) biliary-enteric and 3) gastric/duodenal-enteric anastomosis. The “Achilles heel” of Pancreaticoduodenectomy is Pancreatico-enteric anastomosis<sup>(1)</sup>. It is often the most problematic because of significant risk in healing, leading to Post-operative Pancreatic fistula (POPF). It remains the major source of morbidity and mortality after pancreatic resection. It leads to various complications varying from simple collection to abscess, re-exploration, and can lead to death.

The mortality rate following pancreatic resection decreased in comparison with the historical series from 33% to less than 2%. Although the mortality rate dropped to less than 5% in high volume centres, the morbidity rate is still 30-35%<sup>(2)</sup>. POPF significantly results in increased hospital stay and costs.

International Study Group on Pancreatic Fistula (ISGPF) defined POPF as ‘an abnormal communication between pancreatic ductal epithelium and another epithelial surface, containing pancreas derived enzyme-rich fluid.’<sup>(2)</sup> This definition also includes clinically asymptomatic patients and for the same reason, the severity of POPF has been graded (Grade A, B, and C)<sup>(2)</sup>.

Various surgical procedures have been developed to improve the outcome of PD. Pancreatico-jejunostomy (PJ) is the most popular one among them. Duct-to-mucosa and invagination methods are the two major techniques of PJ.

This study aims to compare the incidence of POPF after pancreatico-duodenectomy (PD) following duct-to-mucosa and dunking methods in periampullary malignancies.

## Materials and Methods

The study is an observational comparison study of 48 cases attended to our surgical department, diagnosed with periampullary malignancies, and underwent surgery, i.e., Pancreatico-duodenectomy (PD) from August 2017 to August 2018. All patients are subjected to routine investigations. Imaging studies (Ultrasonogram abdomen (USG) and Contrast-enhanced CT of the abdomen) are done to stage the disease and to assess operability.

Cases are block-randomized between duct-to-mucosa and invagination methods for PJ. None of the cases are given Octreotide (somatostatin analog) perioperatively and none of them underwent neoadjuvant radiotherapy, and other preoperative factors are comparable between the two groups.

Postoperatively all cases are followed up using biochemical (drain and serum amylase) and imaging modalities (USG) for identification of leak and fistula development.

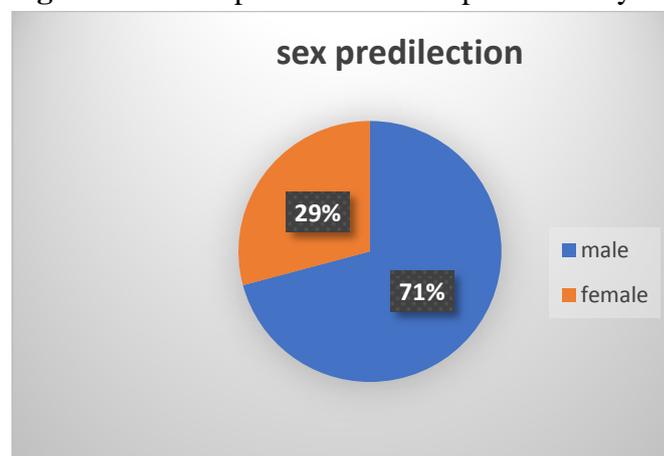
## Exclusion Criteria

- 1) Patients who didn't give consent for the study.
- 2) Patients succumbed postoperatively due to other reasons.

## Results

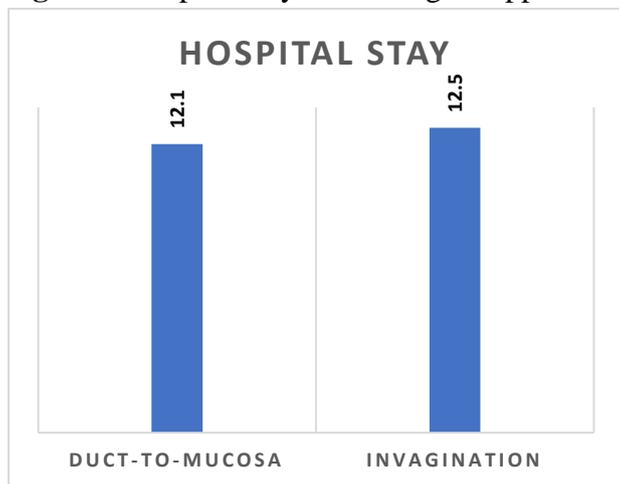
Of the 48 patients who participated in the present study, 34 are male, and 14 are female.

**Figure 1** Gender prevalence in the present study



The mean age is 58.7 years with the most common age group being 50-60 years. The average hospital stay is 12.3±1.3 days. Of the 48 cases, 24 underwent PJ using duct-to-mucosa and rest using the invagination method. The average hospital stay in the invagination group is 12.5±0.9 days, and in the duct-to-mucosa group is 12.1±1.1 days.

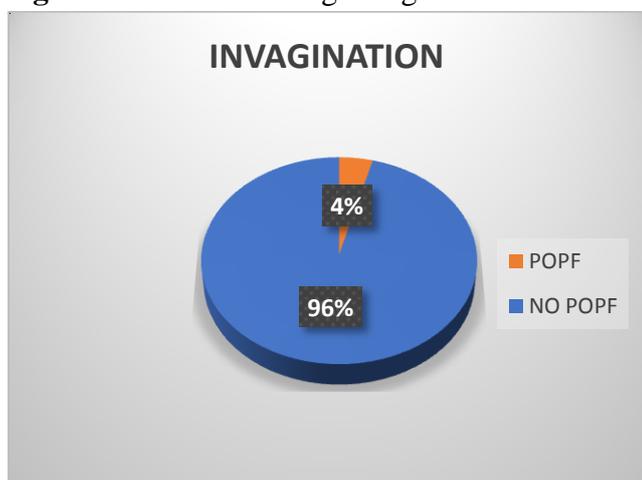
**Figure 2** Hospital stays following Whipple’s PD



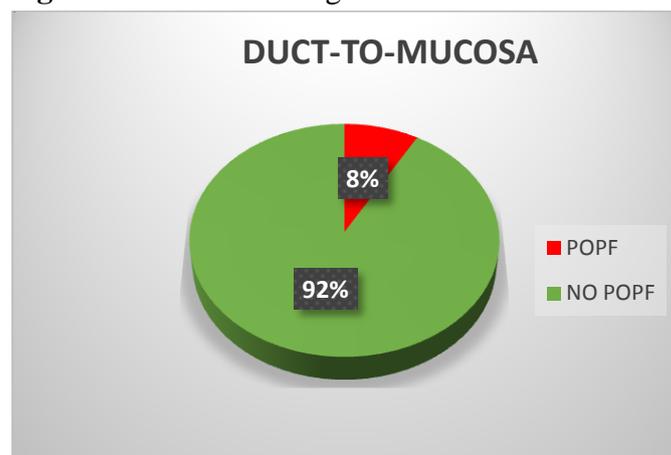
Three cases (6.25%) developed POPF following PD. Of these, two cases (8.33%) developed following duct-to-mucosa and one case (4.16%) following the dunking method. All diagnosed using serial monitoring of drain amylase in comparison to serum amylase. All three are of grade B severity and managed conservatively.

The average drain amylase level on POD-3 in the duct-to-mucosa group is 110 units/liter and in the invagination group, which is 101 units/liter.

**Figure 3** POPF following invagination PJ



**Figure 4** POPF following duct-to-mucosa PJ



**Discussion**

In this study, the incidence of postoperative pancreatic fistula among the two widely known methods of PJ was evaluated among patients who underwent Whipple’s PD for periampullary malignancies.

In the present study, the incidence of POPF was comparable between the two groups, similar to other studies. (p>0.05). This is comparable to other studies available in the literature.

Six randomized controlled trials published by various authors compared these two methods. Only **Berger et al., (2009)<sup>(3)</sup>** reported an increased risk of POPF following duct-to-mucosa method (p<0.05). Rest observed that there is no significant difference in the risk of POPF between the two methods.

**Table 1** Percentage of POPF in various studies

Study	Duct-to-mucosa (%)	Invagination (%)
Present study	8.33	4.16
Senda Y et al. 2017 <sup>(4)</sup>	23	10
Han et al. 2009 <sup>(5)</sup>	2	6
Berger et al. 2009 <sup>(3)</sup>	23	12
Langrehr et al. 2005 <sup>(6)</sup>	2	2
Bassi et al. 2003 <sup>(7)</sup>	13	15
Chou et al. 1996 <sup>(8)</sup>	2	7

**Singh AN et al. (2018)<sup>(9)</sup>** – observed that POPF following two methods are similar, and duct-to-mucosa is not superior w.r.t invagination group.

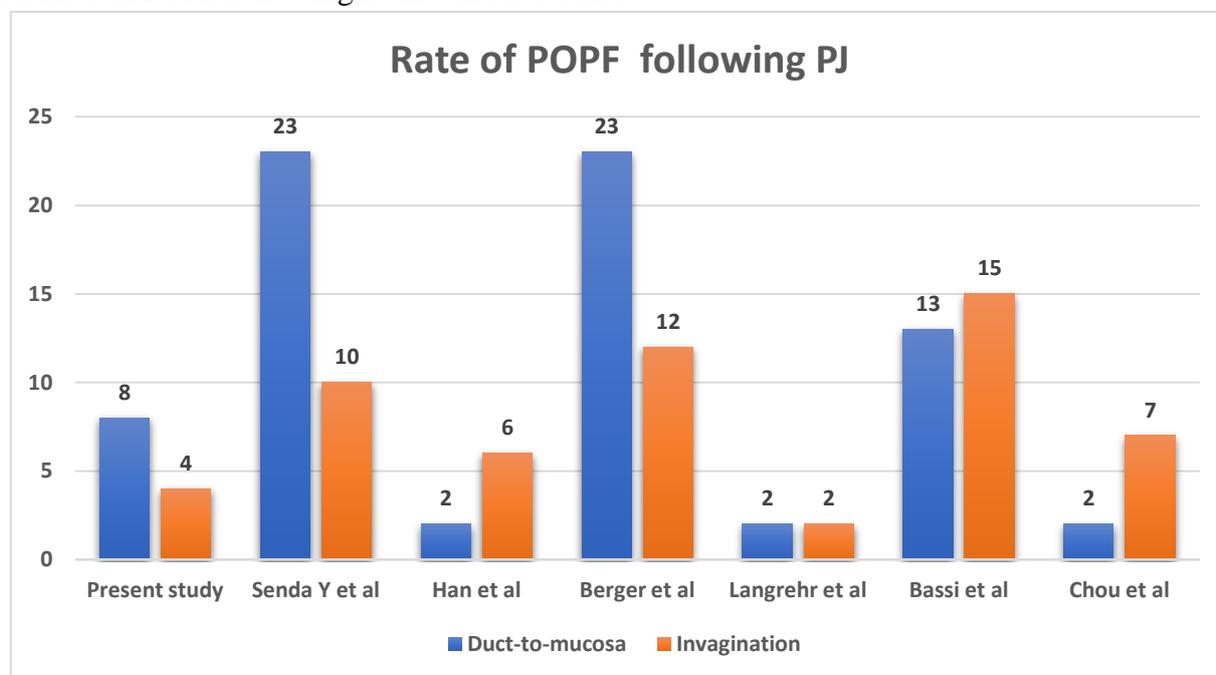
**Bai X et al. (2016)<sup>(10)</sup>**– observed in their study done in an RCT performed by a single surgeon that overall rates of Pancreatic fistula following two methods were similar, except that clinically

relevant ones are lower in the duct-to-mucosa group.

The results observed in this study are similar to a meta-analysis published by **Hua et al. 2015**<sup>(11)</sup> – found that there is no significant difference between the two techniques.

**Hua et al., 2015**<sup>(11)</sup> also observed that clinically significant grade B or higher POPF is less following the invagination method, in contradiction to the present study where all POPF were clinically significant and are of grade B severity.

**Figure 5** Rate of POPF following PJ in various studies



## Conclusion

POPF continues to be the nemesis of pancreatic resection<sup>(12)</sup>. Many technical variations have been developed with the hope of decreasing the incidence of POPF. Even with vast improvements in pancreatic surgery, fistula rates have failed to reduce significantly<sup>(12-14)</sup>.

There are endogenous, perioperative, and operative risk factors that help in stratifying the risk of POPF following surgery<sup>(13)</sup>. The Fistula risk score is developed using these factors as a predictive tool for surgeons<sup>(15,16)</sup>.

Best pancreatico-enteric anastomosis following PD is still a debatable issue. The most commonly preferred method is PJ. Recent evidence throws limelight on PG, showing lesser fistula rates as well as less hospital stay<sup>(17)</sup>.

Mucosa to mucosa suturing in duct-to-mucosa PJ is better for healing, but there is a chance of dead space between the parenchyma and jejunum

leading to leaking from minor ducts and in case of the smaller pancreatic duct, it is challenging to perform anastomosis and prone to obstruction. Invagination PJ is more comfortable to perform and all the pancreatic juice is drained.

**Marcus et al.**<sup>(18)</sup> found that duct-to-mucosa anastomosis was associated with a low POPF in low-risk patients with dilated pancreatic duct or firm fibrotic pancreas, whereas end-to-end invagination technique was safer in high-risk patients with small ducts or soft friable pancreas and this opinion is shared by other workers as well<sup>(19)</sup>.

Several technical modifications developed like trans-anastomotic stenting, fistulation, and transection of pancreas 1.5-2 cm left of the neck of the pancreas and others like preoperative irradiation are designed to decrease the leak rates.

In nutshell, a successful pancreatico-enteric anastomosis requires a tension-free anastomosis

with adequately placed and tied sutures, preserved blood supply to the pancreatic remnant and jejunum, and unobstructed flow from the pancreas into the gastrointestinal tract, whatever the chosen technique may be.

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