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## Intraoperative Pancreatic Assessment in Pancreaticoduodenectomy The Correlation with Pancreatic Fistula Formation

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### Abstract

**Introduction.** Anastomotic leaks are most of the complications after pancreaticoduodenectomy. About 45% followed with fistula formation. The study aimed to discover intraoperative pancreatic assessment associated with postoperative pancreatic fistula (POPF).

**Method.** A cross-sectional design study carried out enrolling patients with tumor of the pancreatic tumors whose underwent pancreaticoduodenectomy. Pancreatic duct diameter, pancreatic texture, the use of stent in the pancreaticojejunal anastomosis, and pancreaticojejunal anastomosis' technique were the independent variables in the study. While the postoperative pancreatic fistula (POPF) referred to a dependent one, these variables analyzed using the Spearman test due to abnormality data distribution.

**Results.** Of 70 subjects enrolled in the study, Subjects with no POPF found in and with POPF noted in 78.6% subjects and those with no POPF in 21.4% subjects. Of the subjects with POPF, type A found in 69.1%, type B in 14.5%, and type C 16.4% subjects, respectively

**Conclusion:** Intraoperative assessment of the pancreatic duct diameter associated significantly in predicting pancreatic fistula after pancreaticoduodenectomy.

**Keywords:** pancreaticoduodenectomy, postoperative pancreatic fistula

### Introduction

Currently, the safety of pancreaticoduodenectomy shows more advances, although the mortality remains high<sup>1,2,3</sup> Mortality in the skilled surgeon is about 2-4%.<sup>4</sup> Mortality rate in Egypt is decreasing from 6.6% to 3.1%,<sup>5</sup> whereas the mortality rate in Jakarta, Indonesia is decreasing from 16.9% to 5.5% in 2016.<sup>7</sup>

The pancreatic fistula remains the most common complication after pancreaticoduodenectomy leading to a more extended hospital stay and higher cost.<sup>3</sup> The incidence of fistula reaches 45%.<sup>8</sup> In Australia, the incidence was 41%,<sup>9</sup> while in Jakarta was approximately 24.2% in 2017.<sup>7</sup> Although many studies identified the risk factors associated with pancreatic fistula after pancreaticoduodenectomy, the conclusion remains contradictory. Anastomosis leaks after Pancreaticojejunostomy are the most critical factor in morbidity and mortality.<sup>16</sup> However, no study focused on the pancreas' factor that may influence the incidence of pancreatic fistula at dr. Cipto Mangunkusumo General Hospital (CMGH), Jakarta. Thus, we run a study that aims to identify pancreas' factor on pancreaticojejunal anastomosis. The study focused on the correlation to pancreatic fistula after pancreaticoduodenectomy.

### Method

We carried out a cross-sectional design study. The study was enrolling patients by Digestive Consultant at dr. Cipto Mangunkusumo General Hospital from January 2016 to December 2019; diagnosed with tumor of the pancreatic head, the tumor of distal CBD, and periampullary duodenal tumors whose underwent pancreaticoduodenectomy. The data

collected from the medical record. Those excluded from the study were inoperable, the residuals, operated in other hospital, and pancreaticogastrostomy procedure. Demographic characteristics, including gender, body mass index (BMI), and blood glucose, represent diabetes mellitus as the comorbid recorded descriptively. Pancreatic duct diameter, pancreatic texture, the use of stent in the pancreaticojejunal anastomosis, and pancreaticojejunal anastomosis' technique were the independent variables in the study. While the postoperative pancreatic fistula (POPF) referred to the dependent one, these variables analyzed using the Spearman test due to abnormality data distribution. The study approved by independent reviewer board of Faculty of Medicine, Universitas Indonesia No. 965/UN2.F1/ETIK/PPM.00.02/2019.

### Results

There were 70 subjects enrolled in the study, comprising of 29 males (41.4%) and 41 females (58.6%). The BMI in 15 subjects (21.4%) were underweight, of 40 subjects (57.1%) were normal weight, 11 subjects (15.7%) were overweight, and four subjects (5.7%) were obese. Diabetes mellitus as the comorbid found in eight subjects (11.4%). Mean of blood glucose was  $136.03 \pm 41.369$  mg/dL with median 125.5 (53-260) mg/dL, and mode of 87 mg/dL. No dilatation pancreatic duct diameter found in 78.6% subjects, while dilatation found in 21.4% subjects. Soft pancreatic texture found in 22.9% subjects, and hard in 77.1% subjects. The use of stent noted in 21.4% subjects and no stent 78.6% subjects. Pancreaticojejunal anastomotic type of dunking or invaginating noted in 82.9% subjects. Duck to the mucosa of 17.1% subjects. Subjects with no POPF found in and with POPF noted in 78.6% subjects and those with no POPF in 21.4% subjects.

Table 1 Subjects characteristics in the study

| Variable                            | Frequency (n)           | Percentage (%) |
|-------------------------------------|-------------------------|----------------|
| Gender                              | Male                    | 29<br>41.4     |
|                                     | Female                  | 41<br>58.6     |
| Body Mass Index (BMI)               | Underweight             | 15<br>21.4     |
|                                     | Normal weight           | 40<br>57.1     |
|                                     | Overweight              | 11<br>15.7     |
|                                     | Obese                   | 4<br>5.7       |
| Diabetes Mellitus as a comorbid     | Yes                     | 8<br>11.4      |
|                                     | No                      | 62<br>88.6     |
| Pancreatic duct diameter            | No dilatation           | 55<br>78.6     |
|                                     | Dilatation              | 15<br>21.4     |
| Pancreatic Texture                  | Soft                    | 16<br>22.9     |
|                                     | Hard                    | 54<br>77.1     |
| Use of stent in anastomosis         | Yes                     | 15<br>21.4     |
|                                     | No                      | 55<br>78.6     |
| Pancreaticojejunal anastomosis type | Dunking or invaginating | 58<br>82.9     |
|                                     | Duct to mucosa          | 12<br>17.1     |
|                                     |                         |                |
| Pancreatic Fistula                  | Yes                     | 55<br>78.6     |
|                                     | No                      | 15<br>21.4     |
| Pancreatic fistula type             | Type A                  | 38<br>69.1     |
|                                     | Type B                  | 8<br>14.5      |
|                                     | Type C                  | 9<br>16.4      |

Table 2 Bivariate Analysis

| Variable                                 | Pancreatic Fistula      |        | p* |       |
|--|-------------------------|--------|----|-------|
|  | Yes (n)                 | No (n) |    |       |
| Pancreatic duct diameter                 | No Dilatation           | 8      | 47 | 0.007 |
|  | Dilatation              | 7      | 8  |       |
| Pancreatic Texture                       | Soft                    | 1      | 15 | 0.095 |
|  | Hard                    | 14     | 40 |       |
| Pancreaticojejunal anastomosis technique | Dunking or invagination | 12     | 46 | 0.745 |
|  | Duct to mucosa          | 3      | 9  |       |
| Use of stent in anastomosis              | No                      | 11     | 44 | 0.583 |
|  | Yes                     | 4      | 11 |       |

\* Spearman analysis

Of the subjects with POPF, type A found in 69.1%, type B in 14.5%, and type C 16.4% subjects, respectively. A significant association found between the pancreatic duct diameter with pancreatic fistula ( $p = 0.007$ ), but not with pancreatic texture ( $p = 0.095$ ), the use of the stent in pancreaticojejunal anastomosis ( $p = 0.583$ ), and pancreaticojejunal anastomosis technique ( $p = 0.745$ ).

## Discussion

The pancreatic fistula following pancreaticoduodenectomy in a recent study about 78.6%. Whereas type A fistula referred to the highest of 69.1%. Type B fistula places the second (16.4%), and the third was type B (14.5%). Based on the consensus of the International Study Group of Pancreatic Fistula (ISGPF), type A fistula had no clinical consequences. Type B and C fistula had more severe consequences than the other type.<sup>16</sup> Pancreatic fistula in this study is quite high due to no amylase examination from the drain in a few patients. Subjects with no clinical sign and pancreatic fluid in drain considered as pancreatic fistula after pancreaticoduodenectomy. The condition is the weakness of the study. Although the pancreatic fistula is quite high, the highest fistula is

type A. This fistula type has no effect on morbidity and mortality after the operation due to a lack of clinical sign on subjects.

This study has identified and analyzed pancreatic assessment intraoperatively with pancreatic fistula, namely, pancreatic duct diameter, pancreatic texture, pancreaticojejunal anastomosis technique, and stent in the anastomosis. The surgeon marks the pancreatic duct diameter. It marked as dilated or not. The pancreatic duct is mostly not dilated. In bivariate analysis, pancreatic duct diameter is significant with pancreatic fistula ( $p = 0.007$ ). It means if pancreatic duct dilated intraoperatively, pancreatic fistula lower after the operation. According to literature, pancreatic duct  $>3$  mm has a lower risk due to patency of pancreatic fluid flow. Thus, pancreatic fistula risk lower.<sup>21</sup> The weakness is pancreatic duct marked subjectively and no standard measurement device. No physical size of the diameter. This measurement can be inaccurately and influence data processing.

The pancreatic texture is a common risk factor significantly in a few studies. Based on the literature, pancreatic texture has a role in the anastomosis. If the texture is soft, it can make anastomosis more difficult. If it happens, the anastomosis leak increased. In this study, the pancreatic texture did not correlate significantly with pancreatic fistula. Thus, it

cannot be used clinically. The weakness is the assessment of the texture by palpation to the whole part of the pancreas, as there was no objective in measurement. It can make data inaccurately. It is better to measure this factor with measurement device intraoperatively such as durometer. The use of a stent in an anastomosis is still contradictory in previous studies. Theoretically, the use of a stent can prevent pancreas fluid accumulation in pancreas remnant and anastomosis site contact with pancreas fluid. It used in the normal or nondilated pancreatic duct. With the use of a stent, hopefully, prevent pancreatic fistula. In this study, this factor did not correlate significantly with pancreatic fistula ( $p = 0,583$ ). The use of stent does not affect to prevent pancreatic fistula clinically. The chance of pancreatic fistula is the same whether used stent or not. It is because surgeons in Cipto Mangunkusumo Jakarta hospital have a good skill to do pancreaticoduodenectomy very well.

Anastomosis type is still contradictory too. Pancreaticojejunal anastomosis considered the most critical part of pancreaticoduodenectomy. It may cause intraabdominal sepsis and bleed, even mortality (Stojadinovic et al., 2003).<sup>16</sup> The anastomosis type duct to mucosa showed a lower risk of pancreatic fistula. It because of direct anastomosis pancreatic duct to the jejunum. It reduces the pancreas fluid contact to the anastomosis site. In this study, this factor is no correlation significantly with pancreatic fistula ( $p = 0,745$ ). Clinically, it has an equal probability for pancreatic fistula in two type anastomoses. It is because patient preparations preoperatively excellent and good skilled surgeons at dr. Cipto Mangunkusumo Hospital, Jakarta

## Conclusion

We concluded that intraoperative assessment of the pancreatic duct diameter associated significantly in predicting pancreatic fistula after pancreaticoduodenectomy. However, this study has limitations due to retrospective, subjective, and sample size. Hopefully, there is more study that held prospectively, multicenter and more objective in measurement intraoperatively.

## Disclosure

The author(s) declare have no conflict of interest.

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