Intraoperative Pancreatic Assessment in Pancreaticoduodenectomy The Correlation with Pancreatic Fistula Formation

Yarman Mazni
Division of Digestive Surgery, Department of Surgery, Faculty of Medicine Universitas Indonesia, dr. Cipto Mangunkusumo General Hospital, Jakarta, yarmanmazni@gmail.com

Ardani F. Syafiuddin
Training Program of Digestive Surgery, Department of Surgery, Faculty of Medicine Universitas Indonesia, dr. Cipto Mangunkusumo General Hospital, Jakarta, arfitsy@yahoo.com

Agi S. Putranto
Division of Digestive Surgery, Department of Surgery, Faculty of Medicine Universitas Indonesia, dr. Cipto Mangunkusumo General Hospital, Jakarta

Follow this and additional works at: https://scholarhub.ui.ac.id/nrjs
Part of the Surgery Commons

Recommended Citation
Mazni, Yarman; Syafiuddin, Ardani F.; and Putranto, Agi S. (2020) "Intraoperative Pancreatic Assessment in Pancreaticoduodenectomy The Correlation with Pancreatic Fistula Formation," The New Ropanasuri Journal of Surgery. Vol. 5 : No. 1 , Article 4.
DOI: 10.7454/nrjs.v5i1.1066
Available at: https://scholarhub.ui.ac.id/nrjs/vol5/iss1/4

This Article is brought to you for free and open access by the Faculty of Medicine at UI Scholars Hub. It has been accepted for inclusion in The New Ropanasuri Journal of Surgery by an authorized editor of UI Scholars Hub.
Intraoperative Pancreatic Assessment in Pancreaticoduodenectomy
The Correlation with Pancreatic Fistula Formation

Yarman Mazni,1 Andani FitrianiSyah Syafuiddin,2 Agi Satria Putranto.3

1. Division of Digestive Surgery, 2 Training Program in Digestive Surgery, Department of Surgery, Faculty of Medicine Universitas Indonesia, dr. Cipto Mangunkusumo General Hospital, Jakarta.

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.1-3 Mortality in the skilled surgeon is about 2-4%.4 Mortality rate in Egypt is decreasing from 6.6% to 3.1%,5 whereas the mortality rate in Jakarta, Indonesia is decreasing from 16.9% to 5.5% in 2016.6

The pancreatic fistula remains the most common complication after pancreaticoduodenectomy leading to a more extended hospital stay and higher cost.7 The incidence of fistula reaches 45%.8 In Australia, the incidence was 41%,9 while in Jakarta was approximately 24.2% in 2017.17 Although many studies identified the risk factors associated with pancreatic fistula after pancreaticoduodenectomy, the conclusion remains contradictory. Anastomosis leaks after Pancreaticojejunal anastomosis are the most critical factor in morbidity and mortality.10 However, no study focused on the pancreas’ factor that may influence the incidence of pancreatic fistula at the 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 the 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 overweight, 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 ± 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 in 78.6% subjects. Pancreaticojejunal anastomotic type of duodenal type 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            | 41.4           |
| Female                    | 41            | 58.6           |
| Body Mass Index (BMI)     |               |                |
| Underweight               | 15            | 21.4           |
| Normal weight             | 40            | 57.1           |
| Overweight                | 11            | 15.7           |
| Obese                     | 4             | 5.7            |
| Diabetes Mellitus as a comorbid |       |                |
| Yes                       | 8             | 11.4           |
| No                        | 62            | 88.6           |
| Pancreatic duct diameter  |               |                |
| No dilatation             | 55            | 78.6           |
| Dilatation                | 15            | 21.4           |
| Pancreatic Texture        |               |                |
| Soft                      | 16            | 22.9           |
| Hard                      | 54            | 77.1           |
| Use of stent in anastomosis |          |                |
| Yes                       | 15            | 21.4           |
| No                        | 55            | 78.6           |
| Pancreaticojejunal anastomosis type | |        |
| Dunking or invaginating   | 58            | 82.9           |
| Duct to mucosa            | 12            | 17.1           |
| Pancreatic Fistula        |               |                |
| Yes                       | 55            | 78.6           |
| No                        | 15            | 21.4           |
| Pancreatic fistula type   |               |                |
| Type A                    | 38            | 69.1           |
| Type B                    | 8             | 14.5           |
| Type C                    | 9             | 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 invaginating           | 12                 | 46    | 0.745 |
| Duct to mucosa                    | 3                  | 9     |      |
| Use of stent in anastomosis       |                    |       |    |
| No                                | 11                 | 44    |      |
| Yes                               | 4                  | 11    | 0.583 |

*p 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 consensuses 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.20 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.21 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). 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.

References

1. Zollinger RM, Ellison C. Pancreaticoduodenectomy. In: Zollinger RM, Ellison C. Zollinger’s Atlas of Surgical Operations. 9th edition. Plate 129. The McGraw-Hill Companies. 2011.p.276-293.
2. Bhattacharya S. The Pancreas. In: Norman S. Williams, Bulstrode CJK, O’Connell PR. Bailey & Love’s Short Practice of Surgery. 25th edition. Ch. 64. Edward Arnold Publishing. 2008.p.1149-72.
3. Hu BY. Risk Factors for postoperative pancreatic fistula: Analysis of 539 successive cases of pancreaticoduodenectomy. World J Gastroenterol. 2016;34:7797-805. (accessed in June 12th, 2019)
4. Michael L. Malignant Pancreatic Tumor. In: Townsend CM, Beauchamp RD, Evers BM, Mattox KL. Sabiston Textbook of Surgery: The Biological Basis of Modern Surgical Practice, 18th edition. Ch 55. Saunders. 2007.p.320-75.
5. Ayman EN. Trends and outcomes of pancreaticoduodenectomy for periampullary tumors: A 25-year single-center study of 1000 consecutive cases. World J Gastroenterol. 2017;38:7025-36. (accessed in April 30th, 2020)
6. Shia BC. Age comorbidity scores as risk factors for 90-day mortality in patients with a pancreatic head adenocarcinoma receiving a pancreaticoduodenectomy: A National Population-Based Study. John Wiley & Sons Ltd. 2020:9,562-74. (accessed in April 30th, 2020)
7. Toar JM. Characteristics of Pancreaticoduodenal Resection on Periampullary Tumor Cases by Jakarta Tertiary Hospital Team: Three Decade Report. Indonesian J Gastroenterol, Hepatol Digest Endosc. 2019;20:66-72. (accessed in April 30th, 2020)
8. Ilic M. Epidemiology of pancreatic cancer. World J Gastroenterol. 2016;44:9694. (accessed in January 5th, 2020)
9. Christopher BN. Postoperative pancreatic fistula: a review of traditional and emerging concepts. Clin Exp Gastroenterol. 2018;11:105–18. (accessed in April 30th, 2020)
10. Yang YM. Risk Factors of pancreatic leakage after pancreatoduodenectomy. World J Gastroenterol. 2005; 16:2456-61. (accessed in January 5th, 2020)
11. Ke Z. Risk Factors for Postoperative Pancreatic Fistula: Analysis of 170 consecutive cases of pancreaticoduodenectomy based on the updated ISGPS classification and grading system. Medicine. Wolters Kluwer Health, Inc. 2018;97:1-6. (accessed in February 4th, 2020)
12. Rungsasalkij N. Risk Factors for pancreatic fistula following pancreaticoduodenectomy: A Retrospective Study in a Thai tertiary center. World J Gastrointest Surg. 2017;12:270-80. (accessed in February 20th, 2020)
13. Dilmarodjon E. Systematic review and meta-analysis of postoperative pancreatic fistula rates using the updated 2016 International Study Group Pancreatic Fistula definition in patients undergoing pancreatic resection with soft and hard pancreas tissue. IHPBA. 2018;20:992–1003. (accessed in February 20th, 2020)
14. Patel AC. Evaluation of risk factors for postoperative pancreatic fistula following pancreaticoduodenectomy. Formosan J Surg. 2019;52:76-83. (accessed in February 4th, 2020)
15. Xinjiang G. A score model based on pancreatic steatosis and fibrosis and pancreatic duct diameter to predict postoperative pancreatic fistula after pancreaticoduodenectomy. BMC Surg. 2019;19:2-8. (accessed in February 20th, 2020)
16. Barreto SG. Shukla PJ. Different types of pancreatico-enteric anastomosis. Transl Gastroenterol Hepatol. 2017;2:89. (accessed in April 29th, 2020)
17. Liu QY, Zhang WZ, Xia HT, Leng JJ, Wan T, Liang B, et al. Analysis of Risk Factors for postoperative pancreatic fistula following pancreaticoduodenectomy. World J Gastroenterol. 2014;46:17491-7. (accessed in February 20th, 2020)
18. Chen JS. Pancreatic Fistula after pancreaticoduodenectomy: Risk Factors and preventive strategies. J Cancer Res Ther. 2019;15:857-62. (accessed in January 4th, 2020)
19. Eun YK, You YK, Kim DG, Hong TH. A simple pancreatojejunostomy technique for hard pancreases using only two transpancreatic sutures with buttresses: a comparison with the previous pancreaticogastrostomy and duplex methods. Ann Surg Treat Res. 2016;2:64-71. (accessed in February 20th, 2020)
20. Zinner MJ. Pancreas. Maingot’s Abdominal Operations. Eleventh edition. Plate 129. The McGraw-Hill Companies. 2018;97:1-24. (accessed in January 5th, 2020)
21. Werner J, Bächler MW. Resectional techniques: Pancreaticoduodenectomy, distal pancreatic resection, segmental pancreatic resection, total pancreatectomy and transduodenal resection of the papilla of Vater. Available in website. https://clinicalgate.com/resectional-techniques-pancreaticoduodenectomy-distal-pancreatic-resection-segmental-pancreatectomy-total-pancreatectomy-and-transduodenal-resection-of-the-papilla-of-vater/ accessed in January 4th, 2020)
22. Kapoor K. Pancreas Anatomy. Medscape. 2017;1:1-20. (accessed in February 20th, 2020)
23. Temporo MA, Chiorean EG, Czito B, Scarfe C, Narang AK, Fountzilas C, et al. NCCN Guidelines Insights: Pancreatic Adenocarcinoma. Version 1.2019. JNCCN. 2019;17(3):202-10. (accessed in February 20th, 2020)
24. Fisher WE, Andersen DK, Windsor JA, Saluja AK, Brunicardi FC. Pancreas. In: Brunicardi FC, Andersen DK, Dunn DL, Hunter JG, Matthew JB, Pollock RE. Schwartz’s Principles of Surgery. 10th edition. Ch. 33. The McGraw-Hill Co. 2015.p.1342-422.
25. Bassi C, Marchegiani G, Dervenis C, Sarr M, Abu Hilal M, Adham M, et al. The 2016 update of the International Study Group (ISGPS) definition and grading of postoperative pancreatic fistula: 11 years after. Surgery. 2017;3:584-91. (accessed in June 12th, 2019)
26. Solomon SB, Griffin JF, Weiss MJ, Boas FE. Postoperative complications requiring intervention, diagnosis, and management. Ch. 25. In: Jamagin WR. Blumgart’s Surgery of the Liver, Biliary Tract, and Pancreas. Fifth Edition. Elsevier. 2012; p.507.