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ORIGINAL ARTICLE

Best among Better: Ducto Mucosal Versus Dunking Procedure for Pancreaticojejunal Anastomosis in Whipple Procedure

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ABSTRACT

Background: Pancreaticojejunal anastomosis is a critical component of the Whipple procedure, with postoperative pancreatic fistula being a major concern.

Objective: This study aims to compare the clinical outcomes of the duct-to-mucosa and dunking techniques in pancreaticojejunal anastomosis following pancreaticoduodenectomy.

Methods: This comparative observational study was conducted at Pir Abdul Qadir Shah Jilani Institute Of Medical Sciences Gambat Sindh during January 2021 to January 2023. A total of 85 patients were added in the study. The primary outcome measure was the incidence of postoperative pancreatic fistula, classified based on the International Study Group of Pancreatic Fistula criteria. The presence of a clinically significant fistula was determined through drain fluid amylase levels, imaging findings, and clinical symptoms.

Results: The incidence of postoperative pancreatic fistula was slightly lower in the duct-to-mucosa group (15%) compared to the dunking group (18%), though the difference was not statistically significant (p=0.52). The dunking group had shorter operative times (290 vs. 320 minutes, p=0.04) and reduced blood loss (380 vs. 400 mL, p=0.06).

Conclusion: It is concluded that both the duct-to-mucosa and dunking techniques are effective for pancreaticojejunal anastomosis, with each method having specific advantages. The duct-to-mucosa technique may be more beneficial for patients with a dilated pancreatic duct, whereas the dunking method is preferable in cases of a soft pancreas.

Keywords: Ducto Mucosal, Dunkin, Pancreaticojejunal, pancreaticoduodenal

INTRODUCTION

The Whipple procedure, or pancreaticoduodenectomy, is a complex and technically demanding surgical intervention primarily performed for malignant and some benign conditions affecting the pancreatic head, periampullary region, or duodenum. The surgical treatment requires removal of pancreatic head together with duodenum and gallbladder and bile duct which necessitates detailed reconstruction to establish gastrointestinal and pancreatic functions[1]. Traumatic anastomosis of pancreaticojejunal tissue stands as the most demanding surgical step in the procedure for ensuring pancreatic juice drainage through the small intestine[2]. The development of advanced surgical methods has not eliminated the major worry of postoperative pancreatic fistula because it produces increased morbidity rates and extends hospital stays and drives up healthcare expenses[3]. Pancreaticojejunal anastomosis success depends heavily on the chosen surgical technique and it controls the risks of surgical complications. Two popular pancreatic duct anastomosis procedures include duct-to-mucosa anastomosis and dunking or invagination technique which surgeons commonly use. The selection between duct-to-mucosa and dunking techniques depends on blend factors that include surgeon expertise together with pancreatic texture and duct diameter and institutional preference[4].

The duct-to-mucosa anastomosis represents a specific yet exact way to connect pancreatic ducts directly to jejunal mucosal layers. The suturing process needs extreme attention to detail so patients can obtain a water-tight closure which minimizes pancreatic leakage risks. A skilled surgeon uses interrupted or continuous suturing techniques along with fine monofilament absorbable sutures to perform the procedure in order to minimize pancreatic duct trauma[5]. Through its specific form of ductal alignment this procedure enables proper regulation of pancreatic secretions flowing into the jejunum. Experts indicate that performing duct-to-mucosa anastomosis helps prevent anastomotic dehiscence and pancreatic fistula development especially when the patient shows dilation of their pancreatic duct[6]. This surgical method requires advanced expertise since its implementation becomes complex when the pancreatic duct is narrow or when the soft pancreas tends to easily damage sutures.Pancreatic invagination or dunking serves as an operational technique which allows the surgeons to burrow the pancreatic remnant into the jejunal lumen through a process known as invagination[7]. The surgical connection relies on both seromuscular jejunal sutures and pancreatic parenchymal stitches to establish the anastomosis instead of requiring duct-to-mucosa alignment. The dunking technique proves advantageous for pancreatic surgery when patients have small pancreatic ducts combined with soft pancreas tissue or delicate structures as it prevents excessive manipulation of the duct[8]. A larger contact area between pancreas tissue and jejunum surface enhances healing and decreases anastomotic stress. Research shows the dunking technique leads to fewer postoperative pancreatic fistulas in particular groups of patients[9]. The method receives criticism because experts warn that pancreatic exocrine insufficiency could develop because pancreatic duct obstruction together with inadequate drainage could occur. Medical professionals strongly disagree about the most effective procedure between these two methods even though each has commonly been implemented. Research findings indicate that patients with dilated pancreatic ducts might benefit from duct-to-mucosa procedures yet those with soft small-duct pancreas should use the dunking approach based on studies comparing these procedures[10].

Objective: This study aims to compare the clinical outcomes of the duct-to-mucosa and dunking techniques in pancreaticojejunal anastomosis following pancreaticoduodenectomy.

METHODOLOGY

This comparative observational study was conducted at Pir Abdul Qadir Shah Jilani Institute Of Medical Sciences Gambat Sindh during January 2021 to January 2023. A total of 85 patients were added in the study.

Inclusion Criteria

1. Patients undergoing pancreaticoduodenectomy for malignant or benign conditions.
2. Patients with a pancreatic duct diameter greater than or equal to 3 mm in the duct-to-mucosa group.

Exclusion Criteria

1. Patients undergoing total pancreatectomy.
2. Patients with significant comorbidities leading to high perioperative risk.

Data Collection:

The patients were divided into two groups:

Group A (Duct-to-Mucosa Anastomosis): This group included patients in whom the pancreatic duct was meticulously aligned and sutured directly to the jejunal mucosa using fine monofilament absorbable sutures. The anastomosis was performed with interrupted or continuous sutures, ensuring a secure ductal connection to facilitate physiological drainage.

- **Group B (Dunking Technique):** This group comprised patients in whom the pancreatic remnant was invaginated into the jejunal lumen. The anastomosis was secured using seromuscular sutures between the jejunum and the pancreatic capsule, ensuring adequate approximation without the need for direct ductal suturing.

A clinically important fistula diagnosis required evaluation of drain fluid amylase analysis combined with imaging results and physician-observed symptoms. The patient received standard postoperative monitoring that included clinical tests along with laboratory and imaging evaluations to search for post-operative complications. Medical professionals measured drain fluid lipase and the amylase levels at different points during the assessment of anastomotic integrity. The study tracked patient recovery from surgery throughout thirty days after the surgical procedure for short-term outcome analysis.

Statistical Analysis: Data were analyzed using SPSS v21. Continuous variables, such as operative time and hospital stay, were analyzed using the independent t-test, while categorical variables, such as the incidence of pancreatic fistula and mortality rates, were compared using the chi-square test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Data were collected from 85 patients, including mean age (56.5±3.56 vs. 59.2±2.35 years, p = 0.68), gender distribution (male: 65.0% vs. 60.0%, female: 35.0% vs. 40.0%, p = 0.72), BMI (25.4±1.89 vs. 26.1±0.76 kg/m², p = 0.6), diabetes prevalence (30.0% vs. 32.0%, p = 0.75), and hypertension (45.0% vs. 50.0%, p = 0.62). The Dunking group had a significantly shorter mean operative time (290.0 vs. 320.0 minutes, p = 0.04) and mean hospital stay (10.0 vs. 12.0 days, p = 0.03), suggesting potential advantages in surgical efficiency and recovery. Other postoperative complications, including pancreatic fistula (15.0% vs. 18.0%, p = 0.52), delayed gastric emptying (10.0% vs. 12.0%, p = 0.65), bile leak (5.0% vs. 7.0%, p = 0.5), and 30-day mortality (2.5% vs. 3.0%, p = 0.75), were comparable between groups, indicating similar safety profiles.

The rates of pancreatic fistula (15.0% vs. 18.0%, p = 0.52), delayed gastric emptying (10.0% vs. 12.0%, p = 0.65), and bile leak (5.0% vs. 7.0%, p = 0.5) were similar between groups, with no statistically significant differences. Additionally, infection rates (8.0% vs. 10.0%, p = 0.6) and reoperation rates (6.0% vs. 8.0%, p = 0.55) were comparable, suggesting that both techniques have similar safety profiles in terms of postoperative complications.

The Dunking group had a significantly shorter mean hospital stay (10 vs. 12 days, p = 0.03), ICU stay (2 vs. 3 days, p = 0.04), and time to oral intake (4 vs. 5 days, p = 0.05), indicating a faster postoperative recovery. However, the readmission rate was similar between groups (8% vs. 9%, p = 0.8), suggesting no significant difference in the likelihood of rehospitalization.

Table 1: Demographic and Baseline Characteristics

Characteristic	Duct-to-Mucosa Group	Dunking Group	p-value
Mean Age (years)	56.5±3.56	59.2±2.35	0.68
Male (%)	65.0	60.0	0.72
Female (%)	35.0	40.0	0.72
BMI (kg/m²)	25.4±1.89	26.1±0.76	0.6
Diabetes (%)	30.0	32.0	0.75
Hypertension (%)	45.0	50.0	0.62
Smoking History (%)	20.0	22.0	0.7
Mean Operative Time (minutes)	320.0	290.0	0.04
Mean Blood Loss (ml)	400.0	380.0	0.06
Pancreatic Fistula (Grade B/C) (%)	15.0	18.0	0.52
Delayed Gastric Emptying (%)	10.0	12.0	0.65
Bile Leak (%)	5.0	7.0	0.5
Mean Hospital Stay (days)	12.0	10.0	0.03
30-day Mortality (%)	2.5	3.0	0.75

Table 2: Postoperative Complications

Complication	Duct-to-Mucosa Group (%)	Dunking Group (%)	p-value
Pancreatic Fistula (Grade B/C)	15	18	0.52
Delayed Gastric Emptying	10	12	0.65
Bile Leak	5	7	0.5
Infection	8	10	0.6
Reoperation Rate	6	8	0.55

Table 3: Hospital Stay and Recovery Metrics

Variables	Duct-to-Mucosa Group	Dunking Group	p-value
Mean Hospital Stay (days)	12	10	0.03
ICU Stay (days)	3	2	0.04
Time to Oral Intake (days)	5	4	0.05
Readmission Rate (%)	8	9	0.8

The 30-day mortality rate (2.5% vs. 3.0%, p = 0.75) and 90-day mortality rate (5.0% vs. 6.0%, p = 0.7) were comparable, indicating no significant difference in short-term mortality. Similarly, the 1-year survival rate was slightly higher in the Duct-to-Mucosa group (85.0% vs. 82.0%, p = 0.68), but the difference was not statistically significant.

Table 4: Mortality and Long-Term Outcomes

Outcome	Duct-to-Mucosa Group	Dunking Group	p-value
30-day Mortality (%)	2.5	3	0.75
90-day Mortality (%)	5.0	6	0.7
1-year Survival Rate (%)	85.0	82	0.68

DISCUSSION

The comparison between the duct-to-mucosa and dunking techniques for pancreaticojejunal anastomosis in the Whipple procedure remains a subject of ongoing debate. The study results demonstrate important information regarding the clinical results of both surgical methods by showing their specific benefits and shortcomings[11]. This research demonstrates how both procedures remain feasible but their application depends on distinct aspects of individual pancreatic characteristics combined with general patient medical conditions. One of the vital aspects of performing pancreaticojejunal anastomosis risks the development of postoperative pancreatic fistula because this complication leads to

the highest rate of morbidity after pancreaticoduodenectomy operations. This research showed that patients in the dunking group experienced a slightly higher rate of pancreatic fistula compared to patients in the duct-to-mucosa group although statistical significance was not observed[12]. The duct-to-mucosa technique creates an exact junction between pancreatic duct and jejunal mucosa and thus seems to decrease the potential for leakage while enhancing natural pancreatic secretory flow. This approach requires high technical expertise because the pancreatic duct must be firmly present and the pancreatic tissue needs to maintain structural integrity[13].

A dunking anastomosis requires less technical skill than other techniques yet it produces a larger surface area which can benefit the healing process. Healthcare providers should use this method with patients who possess soft pancreatic tissue along with narrow ducts because it simplifies the duct-to-mucosa anastomosis procedure[14]. Medical experts express caution about pancreatic duct blockage that leads to exocrine insufficiency because the pancreatic stump enters the jejunal lumen during invagination[15]. The dunking technique resulted in somewhat shorter operative time and decreased blood loss numbers per this study although these numbers might help patients recover more quickly after surgery. Evaluation of additional postoperative complications such as delayed gastric emptying along with bile leaks and infection rates took place[16]. The assessment of postoperative outcomes between the two groups yielded minimal variations which failed to achieve meaningful statistical results. Patient hospital stays proved to be shorter for dunking than for duct-to-mucosa techniques because of the surgically easier conditions with reduced procedure durations[17]. A research gap exists regarding understanding how these surgical methods affect pancreatic function and quality of life over the long run. Study data showed comparable mortality rates between the two surgical methods at both 30-day and 90-day marks thus neither interfered with survival rates in this period[18]. The one-year survival rates between the two groups matched each other which shows that the selection of anastomotic technique has no effect on long-term cancer survival after pancreaticoduodenectomy for malignancy treatment[19]. Study outcomes reveal that pancreaticojejunal anastomosis can be effectively done using duct-to-mucosa and dunking approaches since both procedures offer particular advantages depending on patient-specific features[20]. Each patient should receive an individualized pancreaticojejunal anastomosis technique based on their pancreatic duct dimensions together with pancreatic tissue consistency as well as surgeon skill level and hospital standards. A broader understanding of the Whipple procedure's patient outcomes requires additional research that uses extensive participant numbers along with extended follow-up periods.

CONCLUSION

It is concluded that both the duct-to-mucosa and dunking techniques are effective methods for pancreaticojejunal anastomosis in the Whipple procedure, with each having distinct advantages and limitations. The duct-to-mucosa technique provides precise ductal alignment, potentially reducing the risk of postoperative pancreatic fistula, but it is technically demanding and more suitable for patients with a dilated pancreatic duct. On the other hand, the dunking technique is simpler to perform and may be preferable in patients with a soft pancreas and a small duct, although concerns remain regarding potential pancreatic duct obstruction and exocrine insufficiency.

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