

COMPARATIVE STUDY BETWEEN PANCREICOJEJUNOSTOMY AND PANCREICOGASTROSTOMY FOLLOWING PANCREICODUODENECTOMY

By

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ABSTRACT

Background: Pancreicojejunostomy and pancreaticogastrostomy are the two techniques for pancreatic anastomosis that are widely established for the reconstruction after pancreaticoduodenectomy.

Aim: To study the effect of the type of pancreaticoenteric reconstruction pancreaticojejunostomy versus pancreaticogastrostomy (PJ versus PG) after pancreaticoduodenectomy regarding the post-operative mortality and morbidity particularly pancreatic fistula (PF).

Patients and Methods: A prospective cohort study included 40 patients with pancreatic or periampullary cancer who undergone pancreaticoduodenectomy. The patients divided randomly into two groups; Group (A) included 20 patients who had undergone pancreaticojejunostomy reconstruction while group (B) included 20 patients who had undergone pancreaticogastrostomy reconstruction.

Results: Mean operative time in group A and B was 7.6 ± 2.2 and 7.2 ± 2.7 , mean blood loss 984.7 ± 253.2 and 852.5 ± 152.6 , in most of the cases there was a Drains in contact with anastomosis was 85% and 70%, respectively. Also, there is no significant difference between both groups regarding intraoperative data. Considering postoperative complications, there was significant difference between both groups regarding pancreatic fistula, bile leak, postoperative pancreatitis and peptic ulcer.

Conclusion: This study observed that PG is associated with a lower risk for PF compared with PJ.

Keywords: Pancreicojejunostomy, Pancreicogastrostomy, Pancreicoduodenectomy.

INTRODUCTION

Pancreatic surgery, in particular pancreatico-duodenectomy (PD), has been called a formidable operation. It is not only a technical challenge to surgeons, it is also demanding for patients, and it exerts a substantial logistical strain on healthcare resources (*Ho et al., 2009*).

Pancreicojejunostomy and pancreaticogastrostomy are the two techniques for pancreatic anastomosis that are widely established for the reconstruction after pancreaticoduodenectomy.

Pancreicogastrostomy is the most recent

and to date less frequently performed method (*Tittelbach et al., 2017*).

Since postoperative complications contribute to the overall mortality (*Bakkevoid and Kambestad, 2001*), efforts to reduce morbidity rates are now turned to the four most frequent procedure-related complications following pancreatic resection, namely pancreatic fistula, delayed gastric emptying (DGE), septic complications in particular intra-abdominal abscess, and abdominal hemorrhage. The major complications after pancreatic surgery such as intra-abdominal abscesses, anastomotic leakage and postoperative bleeding are responsible for most of the postoperative mortality (*Buchler et al., 2005*).

We aimed to study the effect of the type of pancreaticoenteric reconstruction pancreaticojejunostomy versus pancreaticogastrostomy (PJ versus PG) after pancreaticoduodenectomy regarding the post-operative mortality and morbidity particularly pancreatic fistula (PF).

PATIENTS AND METHODS

A prospective cohort study conducted at General Surgery Department, Al Azhar University during the period from 1 September 2017 to 1 March 2021.

This study included 40 patients with pancreatic or periampullary cancer who underwent pancreaticoduodenectomy. The patients divided randomized into two groups:

- Group (A) patients: included 20 patients who had undergone pancreaticojejunostomy reconstruction for pancreatic duct after PD. Pancreatic duct had been anastomosed with proximal jejunum (end to side)

with interrupted duct to mucosa method in two layers.

- Group (B) patients: included 20 patients who had undergone pancreaticogastrostomy reconstruction for pancreatic duct after PD. Pancreatic duct had been anastomosed with the posterior wall of the stomach with invagination technique in two layers.

Then the sequence of reconstruction had been completed by end to side hepatico-jejunostomy and gastrojejunostomy.

• Inclusion criteria:

The study included forty patients in the period of study with suspected pancreatic or periampullary cancer that was assumed to be resectable, according to preoperative clinical examination and work up.

• Exclusion criteria:

Patients with locally advanced and metastatic tumors had been excluded from the study, as indicated by clinical examination, preoperative workup and intraoperative findings.

• Methods:

The design of this study had been consisted of a pretreatment evaluation and treatment with either a PJ or PG reconstruction of the pancreatic duct after PD.

All patients subjected to full history taking, clinical assessment and investigation which involved CBC, coagulation profile, liver function tests, renal function tests, tumor markers, electrolytes level, ECG, ECHO, computerized tomography (CT) pancreatic protocol, MRI, endoscopic retrograde

cholangio-pancreatography (ERCP) and endoscopic U/S.

The postoperative morbidity (especially the Pancreatic fistula), mortality and the postoperative hospital stay had been evaluated.

Statistical Analysis of Data:

The collected data organized, tabulated and statistically analyzed using statistical package for social sciences (SPSS) version 22 (SPSS Inc, Chicago, USA). For qualitative data, frequency and percent distributions was calculated. For quantitative data, mean, standard Error

(SE), minimum and maximum was calculated. Statistical significance was defined as P value < 0.05.

The following tests were done:

- Independent-samples t-test of significance was used when comparing between two means.
- Chi-square test of significance was used when comparing between frequencies.
- P-value <0.05 was considered significant.

RESULTS

A total of 40 patients enrolled in this study, the mean of age in group A and B was 60.7±25.3 and 62.1±28.6, respectively. There is no significant difference between both groups regarding age, sex, BMI and indication of surgery (Table 1).

There is no significant difference between both groups regarding Hematocrit (%), White blood cell count, Creatinine, Total bilirubin and Albumin levels (Table 2).

Mean operative time in group A and B was 7.6 ± 2.2 and 7.2 ± 2.7, mean blood

loss 984.7 ± 253.2 and 852.5 ± 152.6, in most of the cases there was a Drains in contact with anastomosis was 85% and 70%, respectively. Also, there is no significant difference between both groups regarding intraoperative data (Table 3).

Considering postoperative complications, there was significant difference between both groups regarding pancreatic fistula (group A 20%, group B 10%), bile leak (group A 5%, group B 15%), postoperative pancreatitis (group A 5%, group B 15%), peptic ulcer (group A 10%, group B 0%) (Table 4).

Table (1): Demographic and clinical data of studied groups

	Group A (N=20)	Group B (N=20)	P value
Age (year)			
- Mean ±SD	60.7±25.3	62.1±28.6	0.517
- Range	(56-71)	(59-75)	
Sex			
- Male	12 (60%)	9 (45%)	0.352
- Female	8 (40%)	11 (55%)	
BMI (kg/m²)	24.7±5.8	23.8±6.3	0.583
Indication of operation:			
- Pancreatic cancer	15 (75%)	13 (65%)	0.316
- Ampullary cancer	3(15%)	4 (20%)	
- Cancer of distal bile ducts	2 (10%)	3(15%)	

Table (2): Comparison between both groups regarding preoperative laboratory

	Group A (N=20)	Group B (N=20)	<i>P</i> value
Hematocrit (%)	37.5 ±15.6	36.4±18.2	0.335
White blood cell count (10 ³ cells/mm ³)	9.3 ± 2.5	9.1 ± 2.8	0.128
Creatinine (mg/dL)	1.1 ±0.1	1.0 ±0.1	0.831
Total bilirubin (mg/dL)	7.6 ± 2.4	5.7 ± 1.9	0.182
Albumin (g/dL)	3.5 ± 1.3	3.7 ± 1.5	0.311

Table (3): Comparison between both groups regarding intraoperative data

	Group A (N=20)	Group B (N=20)	<i>P</i> value
Operative time (hr)	7.6 ± 2.2	7.2 ± 2.7	0.461
Blood loss (mL)	984.7 ± 253.2	852.5 ± 152.6	0.274
Texture at transected neck			0.115
- Hard	3 (15%)	7 (35%)	
- Intermediate	12 (60%)	9 (45%)	
- Soft	5 (25%)	4 (20%)	
Mean length of remnant mobilized (cm)	3.1 ± 0.1	3.0 ± 0.2	0.624
Mean diameter of pancreatic duct at transected neck (mm)	3.2 ± 1.2	2.7 ± 1.4	0.258
Pancreatic duct in inner layer of anastomosis (%)	17 (85%)	15 (75%)	0.424
Drains in contact with anastomosis (%)	17 (85%)	14 (70%)	0.217

Table (4): Comparison between both groups regarding postoperative complications

	Group A (N=20)	Group B (N=20)	<i>P</i> value
Delayed gastric emptying ¹	5 (25%)	4 (20%)	0.181
Wound infection	4 (20%)	5 (25%)	0.374
Pancreatic fistula ²	4 (20%)	2 (10%)	< 0.001*
Cholangitis	2 (10%)	3 (15%)	0.265
Pneumonia	1 (5%)	2 (10%)	0.113
Intra-abdominal abscess	3 (15%)	2 (10%)	0.253
Cardiac arrhythmia	1 (5%)	1 (5%)	1.0
Bile leak	1 (5%)	3 (15%)	< 0.001*
Urinary tract infection	4 (20%)	3 (15%)	0.218
Postoperative pancreatitis	1 (5%)	3 (15%)	< 0.001*
Peptic ulcer	2 (10%)	0 (0%)	< 0.001*

¹Defined as follows: (1) nasogastric tube in place ≥10 days plus one of the following: (a) emesis after nasogastric tube removed, (b) reinsertion of nasogastric tube, or (c) failure to progress with diet; or (2) nasogastric tube in place < 10 days plus two of (a) to (c) above.

²Defined as follows: (1) drainage of > 50 mL of amylase-rich fluid (greater than threefold elevation above upper limit of normal in serum) via the operatively placed drains on or after postoperative day 10 or (2) pancreatic anastomotic disruption demonstrated radiographically.

*p value significant

DISCUSSION

Pancreatic reconstruction is particularly demanding; a variety of methods and techniques have been proposed to maintain the continuity of the anastomosis and diminish rates of leak. The conventional anastomosis described for this operation is pancreaticojejunostomy (PJ), Pancreaticogastrostomy (PG) has been described and studied as an alternative to jejunal anastomosis in both observational studies and randomized controlled trials (RCTs) with inconsistent results (*Topal et al., 2013*).

Most common indication of surgery of our study was Pancreatic cancer, this also was confirmed by many studies, in the study of (*El Nakeeb et al., 2019*) to evaluate Laparoscopic Pancreaticoduodenectomy, most of operated cases had Pancreatic head mass (55%).

In the study of (*Karim et al., 2018*), concerning the indications behind this procedure for our patients, 16.33% of patients had benign tumors, whereas, the commonest malignant tumors were periampullary (43.88%), followed by pancreatic cancer (16.33%), and the least indications were ampullary carcinoma (9.18%).

Regarding intraoperative data, there was no statistically significant difference between both groups regarding intraoperative data. Mean operative time in our study was (7.6 ± 2.2 , 7.2 ± 2.7) in both groups, mean blood loss (984.7 ± 253.2 , 852.5 ± 152.6), in most of the cases there was a Drains in contact with anastomosis (85%, 70%). These results

were near results of (*El Nakeeb et al., 2019*), (*Senthilnathan et al., 2015*), (*Topal et al., 2013*).

Operative time relies on surgical skills and technical feasibility, in the study of (*Romano et al., 2015*), the The mean operative time was 4.9 min (± 55 min). The mean blood loss was 450 ml and median blood transfusion was 1 unit.

Also, in the study of (*El Nakeeb et al., 2019*), the mean operative time was 5 hours for method and 7 hours for laparoscopic one, while blood loss was 450 ml for open and 250 for laparoscopic methods.

In the study of (*Wang et al., 2016*), there was no significant difference in operative time between PG (7 (3–16)) and PJ (7 (3–13)). This indicates similar technical and operative similarities between both techniques.

Regarding Comparison between both groups regarding postoperative complications, there was statistically significant difference between both groups regarding Pancreatic fistula (group A 20%, group B 10%), Bile leak (group A 5%, group B 15%), Postoperative pancreatitis (group A 5%, group B 15%), Peptic ulcer group A 10%, group B 0%), Duodenojejunosomy leak (group A 0%, group B 15%).

PG has been claimed to be a better pancreatic reconstruction in reducing the incidence and severity of POPF. Four recent meta-analyses based on 8 randomized control trials (RCTs) conclude that POPF rate is significantly lower in PG than that in PJ (*Wang et al.,*

2016), (Hallet *et al.*, 2015), (Que *et al.*, 2015).

PG has been proposed as an alternative to PJ. A number of theoretical advantages of PG have been suggested including: pancreatic enzyme inactivation due to gastric secretions and absence of enterokinase, tension-free anastomosis due to anatomical co-location, excellent blood supply and the thick stomach wall is less likely to dehiscence, early detection of bleeding from the pancreatic remnant by routine postoperative gastric decompression, direct examination of the anastomosis by endoscopy if necessary; and easy exploration of the anastomosis without disassembling the pancreatic anastomosis by opening the anterior wall of stomach if bleeding occur (Kleespies *et al.*, 2008). This explains the lower incidence of peptic ulcer and leakage in PG group.

However, in the study of (Hallet *J et al.*, 2015) PF occurred in 8% of PG cases, while 20% in PJ ($P < 0.001$). They concluded that, this study systematically reviewed and pooled data from four RCTs investigating the impacts of PG compared with PJ on PF. Based on evidence of moderate quality, PG is associated with a lower occurrence of PF (RR 0.41, 95% CI 0.27–0.62), but no significant differences emerged in biliary leak, DGE, postoperative bleeding, major morbidity, mortality or LoS. When only high- or low-risk pancreas groups were considered, there was no difference in RR.

The proposed technical and physiological advantages of PG over PJ have been discussed in several studies reporting the technique. The anastomosis may be facilitated by a thick gastric wall,

can rely on an excellent gastric blood supply, and is subject to less tension as a result of the anatomic proximity of the pancreatic remnant to the posterior gastric wall. Lack of enterokinase in the gastric remnant may prevent the activation of pancreatic enzymes, thereby avoiding both damage to the anastomosis itself and the repercussions associated with potential PF (He *et al.*, 2008).

CONCLUSION

This study observed that PG is associated with a lower risk for PF compared with PJ. This benefit appeared to be greater in high-risk patients. Surgeons should consider reconstructing the pancreatic remnant following PD with PG, particularly in patients at high risk for PF.

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دراسة مقارنة بين نتائج توصيل البنكرياس بالأمعاء الدقيقة وتوصيله بالمعدة بعد استئصال البنكرياس والاثنى عشر في حالات الأورام الخبيثة

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خلفية البحث: توصيل البنكرياس بالأمعاء الدقيقة وتوصيل البنكرياس بالمعدة هما طريقتان توصيل البنكرياس بالجهاز الهضمي اللتان تم تأسيسهما على نطاق واسع لإعادة الإعمار بعد استئصال البنكرياس والاثنى عشر. توصيل البنكرياس بالمعدة هو أحدث الطرق وأقلها استخدامًا حتى الآن.

نظرًا لأن مضاعفات ما بعد الجراحة تساهم في إجمالي نتائج الإجراءات الجراحية، فقد تحولت الجهود المبذولة لتقليل معدلات مضاعفات ما بعد الجراحة حيث أن المضاعفات الأربعة الأكثر شيوعًا المتعلقة بالإجراء بعد استئصال البنكرياس، وهي ناسور البنكرياس، وتأخر إفراغ المعدة (DGE)، ومضاعفات الإنتان في خراج داخل البطن بشكل خاص، ونزيف في البطن. يذكر أن المضاعفات الرئيسية بعد جراحة البنكرياس مثل الخراجات داخل البطن والتسرب من التوصيل بين البنكرياس والجهاز الهضمي والنزيف بعد الجراحة هي المسؤولة عن معظم الوفيات بعد الجراحة.

الهدف: من هذا العمل هو دراسة تأثير نوع إعادة بناء البنكرياس بالأمعاء الدقيقة مقابل توصيل البنكرياس بالمعدة (PJ مقابل PG) بعد استئصال البنكرياس والاثنى عشر فيما يتعلق بالوفيات والمرضات بعد الجراحة وخاصة ناسور البنكرياس (PF).

المرضى وطرق البحث: تضمنت هذه الدراسة 40 مريضًا يعانون من سرطان البنكرياس أو ماحول فتحة القناة المرارية داخل الإثنى عشر والذين خضعوا لعملية استئصال البنكرياس و الاثناعشر.

قسم المرضى إلى مجموعتين:

• **مرضى المجموعة (أ):** تضمنت 20 مريضاً خضعوا لتوصيل البنكرياس بالأمعاء الدقيقة. حيث تم توصيل قناة البنكرياس مع الأمعاء الدقيقة (من طرف إلى جانب) بطريقة القناة إلى الغشاء المخاطي في طبقتين.

• **مرضى المجموعة (ب):** تضمنت 20 مريضاً خضعوا لإعادة توصيل البنكرياس بالمعدة. حيث تم توصيل الجزء المتبقى من البنكرياس بالجدار الخلفي للمعدة بطريقة الإنغماس أو الإنغماد في طبقتين.

ثم تم الانتهاء من تسلسل إعادة الإعمار بتوصيل القناة المرارية الكبدية بالأمعاء الدقيقة وكذلك توصيل المعدة بالأمعاء الدقيقة.

أظهرت نتيجتنا أنه لا يوجد فرق معتد به إحصائياً بين المجموعتين فيما يتعلق بالبيانات أثناء العملية.

فيما يتعلق بالمقارنة بين المجموعتين فيما يتعلق بمضاعفات ما بعد الجراحة، كان هناك فرق معتد به إحصائياً بين المجموعتين فيما يتعلق بناسور البنكرياس) المجموعة أ 20٪، المجموعة ب 10٪، ($P < 0.001$)، تسرب الصفراء) المجموعة أ 5٪، المجموعة ب 15٪، ($P < 0.001$)، التهاب البنكرياس بعد الجراحة) المجموعة أ 5٪، المجموعة ب 15٪، ($P < 0.001$)، مجموعة القرحة الهضمية أ 10٪، المجموعة ب 0٪، ($P > 0.001$).

استنتاج: يمكننا أن نستنتج أن هذه الدراسة لاحظت أن توصيل الجزء المتبقى من النكرياس PG يرتبط بانخفاض خطر الإصابة بـ PF مقارنة بتوصيل الجزء المتبقى من البنكرياس بالأمعاء الدقيقة PJ. ويبدو أن هذه الفائدة تكون أكبر في المرضى المعرضين لمخاطر عالية. لذا يجب على الجراحين التفكير في إعادة بناء بقايا البنكرياس بعد استئصال البنكرياس والإثنى عشر PD مع المعدة PG، خاصة في المرضى المعرضين لخطر كبير للإصابة بناسور البنكرياس PF.