

Omental Flap Technique in Pancreaticojejunostomy: Does it Prevent Pancreatic Fistula Development after Pancreaticoduodenectomy?

Ann. Ital. Chir., 2024 95, 3: 411–415
<https://doi.org/10.62713/aic.3512>

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AIM: The aim of our study was to investigate the clinical results of omental flap application during pancreaticojejunostomy (PJ) anastomosis in pancreaticoduodenectomy (PD) surgeries.

METHODS: The data of patients who underwent pancreaticoduodenectomy in our hospital were evaluated retrospectively. The patients were divided into two groups; patients with an omental flap (Group 1) and those without an omental flap (Group 2). The demographic and other characteristics of the groups and the incidence of postoperative pancreatic fistula (POPF) development were compared.

RESULTS: One hundred patients were included (39 females, 61 males) Group 1 consisted of 20 patients with omental flaps and Group 2 consisted of 80 patients without omental flaps. While no clinically significant (Grade B and C) leaks were observed in Group 1, both biochemical and clinically significant leak rates were lower in Group 1 compared to 4 patients (5%) in Group 2. There was no statistically significant difference compared with Group 2 ($p > 0.05$).

CONCLUSIONS: Although not statistically significant in this study, postoperative complication rates and the incidence of POPF tended to decrease in patients who underwent omental flaps.

Keywords: pancreatoduodenectomy; postoperative pancreatic fistula; omental flap

Introduction

Pancreatoduodenectomy (PD) is the standard treatment for many periampullary lesions. The mortality rate of PD has been greatly reduced in high-volume centers as a result of developments in surgical technique and equipment [1]. Postoperative complications such as postoperative pancreatic fistula (POPF) (3–45%), delayed gastric emptying (7–37%), anastomotic stenosis (3.3–30%), intra-abdominal infection (2.5–23.3%), and postoperative bleeding (5–12%) can occur [2]. The overall morbidity rate is still high approximately 65.9–77.5% [3]. POPF is one of the most serious complications and the main cause of other complications. Pancreaticojejunostomy (PJ) is a commonly performed procedure in PD. The technique used to perform PJ is important in determining the incidence of POPF. The safety of PJ and the risk of POPF are thought to be related to many factors such as remnant pancreatic tissue, width of the main pancreatic duct, duration of jaundice, amount of intraoperative bleeding, duration of surgery and experience level of the center [4]. In the case of POPF, length of hospital stay, cost, and more importantly, mortality increases. To reduce the incidence of POPF; various methods such as

pancreatic stenting, the use of somatostatin analogs, use of filling material, and wrapping of the anastomosis with soft tissue have been tried [5]. The technique of wrapping the pancreaticojejunal anastomosis with the omental flap has also been used for this purpose, and its advantages are the use of autologous tissue, easy application, no prolonging of operation time and no extra cost [6]. The aim of our study was to investigate the protective effect of this application on the development of POPF by comparing patients with and without omental flaps.

Materials and Methods

Study Design

Between January 2015 and December 2019, data of patients who underwent PD with the diagnosis of periampullary tumor in our general surgery clinic, approved by the Haydarpaşa Numune Training and Research Hospital clinical research ethics committee (No: HNEAH-KAEK 2021/KK/296), was retrospectively reviewed in the hospital registry database. Patients who underwent PD due to trauma, who received neoadjuvant chemotherapy or radiotherapy, and who had insufficient records were excluded from the study.

The operations were performed by experienced surgeons and end-to-end or end-to-side dunking, duct to mucosa, or simple invagination techniques were used for PJ. The omental flap technique involved mobilizing the omentum to extend from the anterior to the posterior of the PJ anas-

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Table 1. Demographic and clinicopathological characteristics of the two groups.

Indicators	Group 1	Group 2	<i>p</i> -value
	n: 20	n: 80	
	n (%) or mean (±SD)	n (%) or mean (±SD)	
Age, years	65.7 ± 9.9	63.1 ± 12.9	0.403 ^t
Sex			0.356 ^{X²}
Male	14 (70.0%)	47 (58.8%)	
Female	6 (30.0%)	33 (41.3%)	
Albumin (g/dL)	3.6 ± 0.4	3.9 ± 2.5	0.986 ^m
ALP (IU/L)	372.4 ± 290.7	353.3 ± 296.7	0.696 ^m
GGT (IU/L)	513.2 ± 423	467.9 ± 419.6	0.381 ^m
Total Bilirubin (mg/dL)	9.8 ± 8.1	7.5 ± 7.1	0.382 ^m
Direk Bilirubin (mg/dL)	6.9 ± 5.8	5.4 ± 5.3	0.425 ^m
ASA Score			0.181 ^{X²}
I	0 (0.0%)	2 (2.5%)	
II	5 (25.0%)	31 (38.8%)	
III	14 (70.0%)	44 (55.0%)	
IV	1 (5.0%)	3 (3.8%)	

ALP, Alkaline phosphatase; GGT, Gamma-glutamyltransferase; ASA, American Society of Anesthesiologists; SD, Standard deviation; ^t, *t*-test; ^{X²}, Chi-square test (Fischer test); ^m, Mann-Whitney U-test.

tomosis and was applied anteriorly by being tied between 2 or 3 sutures that were left uncut for this fixation from the sutures used in the anastomosis, with a tightness that would not cause ischemia.

Using the hospital database; clinical, laboratory, and radiological data of the patients, as well as operative (operation time, amount of bleeding) and postoperative (duration of hospital stay, complications, reexploration, and mortality) data were collected. Postoperative complications were evaluated according to the modified Clavien-Dindo classification [7]. For the POPF definition and grading, the 2016 revision of the International Study Group of Pancreatic Surgery was used [8]. Accordingly, in POPF there is more than three times the upper limit of normal serum amylase level on or after postoperative day 3. The termination of this drainage without causing any additional problems and without the need for intervention exceeding 3 weeks is called biochemical leakage. True fistulas are clinically significant Grade B and C pancreatic fistulas. Grade B refers to a properly defined fistula in association with a clinically relevant condition (more than 3 weeks of peripancreatic drainage, change in management, percutaneous or endoscopic drainage, angiographic procedure for bleeding, signs of infection without organ failure). In addition to Grade B findings, reoperation, organ failure and mortality put POPF in grade C [9].

Statistical Analysis

For the descriptive statistics of the data; mean, standard deviation, median minimum, maximum, frequency and ratio

values were used. The distribution of variables was measured with the Kolmogorov-Smirnov test. Independent sample *t*-test and Mann-Whitney U-test were used in the analysis of quantitative independent data. Chi-square test was used in the analysis of qualitative independent data, and the Fischer test was used when the conditions for Chi-square test were not met. SPSS 28.0 (IBM Corp, Version 28.0., Armonk, NY, USA) program was used in the analysis. A *p*-value < 0.05 was considered statistically significant.

Results

One hundred patients who underwent pancreaticoduodenectomy were included in the study (39 females and 61 males). Group 1 consisted of 20 patients with omental flaps while Group 2 consisted of 80 patients without omental flaps. The demographic and clinicopathological characteristics of the groups are presented in Table 1.

Age, sex, American Society of Anesthesiologists (ASA) score, and laboratory results did not differ significantly between the two groups (*p* > 0.05). The pancreaticojejunostomy technique applied in the two groups was similar. The duration of operation, the amount of perioperative bleeding, the rate of biochemical leaks, the rate of clinically significant POPF, other postoperative complications, the length of hospital stay, and the mortality rate did not differ significantly between the two groups (*p* > 0.05) (Table 2).

Table 2. Operative and postoperative characteristics of the two groups.

Indicators	Group 1	Group 2	p-value
	n: 20	n: 80	
	n (%) or mean (±SD)	n (%) or mean (±SD)	
Pancreaticojejunostomy Technique			
Duct to Mucosa	1 (5.0%)	10 (12.5%)	0.242 ^{X²}
End to End Dunking	16 (80.0%)	60 (75.0%)	0.514 ^{X²}
End to Side Dunking	2 (10.0%)	1 (1.3%)	0.099 ^{X²}
Simple Invagination	1 (5.0%)	9 (11.3%)	0.683 ^{X²}
Operation Time (min)	350.0 ± 54.1	367.3 ± 75.8	0.589 ^m
Perioperative Blood Loss (mL)	576.0 ± 239.3	610.1 ± 295.7	0.634 ^t
Biochemical Leak	2 (10.0%)	16 (20.0%)	0.148 ^{X²}
Clinically Significant POPF			0.581 ^{X²}
POPF B	0 (0.0%)	3 (3.8%)	
POPF C	0 (0.0%)	1 (1.3%)	
Postoperative Biliary Leakage	1 (5.0%)	3 (3.8%)	1.000 ^{X²}
Other Postoperative Complications	1 (5.0%)	9 (11.3%)	0.405 ^{X²}
Surgical Site Infection	0 (0.0%)	7 (8.8%)	
Delayed Gastric Emptying	1 (5.0%)	2 (2.5%)	
Length of Stay (days)	16.3 ± 3.3	17.5 ± 3.8	0.273 ^m
Mortality	0 (0.0%)	3 (3.8%)	1.000 ^{X²}

POPF, postoperative pancreatic fistula; SD, Standard deviation; ^t, t-test; ^{X²}, Chi-square test (Fischer test); ^m, Mann-Whitney U-test.

Discussion

PD has long been a standard technique for the treatment of periampullary tumors. Despite all the advances in pancreatic surgery, POPF still remains one of the most important complications, and its incidence varies between 3 and 45%, even in high-volume centers [2]. The omental flap technique to reduce POPF in the PD procedure is still controversial. Choi *et al.* [6] reported that the omental roll-up technique in post-PD pancreaticojejunostomy anastomosis reduced the rate of POPF. However, Tani *et al.* [10], found no reduction in POPF after PD. A meta-analysis of omental flap or falciform ligament flap technique in PD showed that tissue flap surgery has no benefit in reducing the risk of POPF [9]. Despite contradictory results in the literature, the omentum is known for its special healing and regenerative properties. As the omentum is a physiologically dynamic tissue it can be used by the surgeon in a large variety of procedures. It has an important role in peritoneal defense mechanisms, with functions such as protecting intraperitoneal organs and structures and limiting inflammation. Historically it has been seen that these properties have been most frequently and efficiently applied in cases of perforated peptic ulcer [11]. In our study, in 20 (25%) patients in the group without omental flaps, the amylase level measured on or after the 3rd postoperative day was more than three times the upper limit of normal serum level. Of these, 16 (20%) were biochemical leaks. There were 4 (5%) pa-

tients who had clinically significant leakage. Of these, 3 (3.8%) leaks were grade B and 1 (1.3%) was grade C. In the omental flap group, 2 patients (10%) had a biochemical leak, and there was no clinically significant leakage. The difference between the two groups was not statistically significant. Although the difference in POPF was not statistically significant, it was less in the omental flap group. Following PD, the most likely complication leading to operative mortality is pancreatic fistula. An uncontrolled pancreatic fistula resulting from PJ failure can cause delayed gastric emptying, intra-abdominal abscess formation, or bleeding due to large vessel erosion, increasing in-hospital mortality up to three times [1]. In our study, post pancreaticoduodenectomy hemorrhage (PPH) was not observed in either group. Different studies are showing that omental flap does not reduce or decrease PPH. In a meta-analysis by Andreasi *et al.* [12], it was determined that the omental flap did not decrease the rate of PPH in PJ anastomosis. On the other hand, a study by Maeda *et al.* [13] revealed that the incidence of PPH was lower. In addition, study is showing that omental flap application reduces intra-abdominal complications such as postoperative bleeding, but does not reduce POPF [14].

PD is one of the important operations in general surgery and is performed in large hepatobiliary surgery centers where mortality is below 5%. In our study, 30-day mortality was evaluated. In the group without omental flaps, 3 (3.8%) patients died. There was no mortality in the omental flap

group. The causes of mortality were respiratory in 1 patient and cardiac in 2 patients. Postoperative biliary leakage was present in 3 (3.8%) patients in 1 (5%) group in which omental flap was applied. Other postoperative complications were 11.3% in the group without omental flaps, and 5% in the group with omental flaps (surgical site infection, delayed gastric emptying). If we evaluate the complications adopted for pancreatic surgery according to the modified Clavien-Dindo classification, all 7 patients with surgical site infection were grade-I. One patient with delayed gastric emptying was grade-IIb and an omental flap was applied to this patient. One of the other two patients was grade-I and the other was grade-IIIa. There was no statistically significant difference in the incidence of postoperative complications between the two groups. In addition, operation duration, hospital stay, and perioperative bleeding were similar in the two groups.

Conclusions

The results of our study imply that the application of omental flaps in the PJ anastomosis after PD could reduce the risk of POPF. We believe that the application of the omental flap application to the PJ anastomosis can be used since it is not a technically complicated procedure, does not prolong the operation and does not involve extra costs.

Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Author Contributions

DE: Conceptualization, formal analysis, investigation, data curation, writing; MAU: Methodology, investigation, data curation, writing. Both authors revised the manuscript critically for important intellectual content. Both authors read and approved the final manuscript. Both authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

This study approved by the Haydarpaşa Numune Training and Research Hospital clinical research ethics committee (No: HNEAH-KAEK 2021/KK/296), was retrospectively reviewed in the hospital registry database. Patients who underwent PD due to trauma, who received neoadjuvant chemotherapy or radiotherapy, and who had insufficient records were excluded from the study. This study is retrospective and was conducted in accordance with the Declaration of Helsinki. The Haydarpaşa Numune Training and Research Hospital waived informed consent for the study.

Acknowledgment

Not applicable.

Funding

This research received no external funding.

Conflict of Interest

The authors declare no conflict of interest.

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