

Pancreaticojejunostomy (PJ) after pancreatico-duodenectomy (Duct to mucosa versus invaginating end to side anastomosis)

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Abstract

Aim: This prospective randomized trial compares the results of pancreaticoduodenectomy with duct to mucosa pancreaticojejunostomy with external stent versus pancreatico-duodenectomy with invaginating (dunking) end to side pancreaticojejunostomy

Methods: This study included 40 patients who underwent surgical therapy for cancer head of pancreas, between Sep. 2009 and March 2011 at Ain Shams University Hospitals.

Patients were randomly assigned to surgical procedures. Patients in group 1 (n 20) underwent pancreaticoduodenectomy with end to side duct to mucosa pancreatico-jejuno-stomy and external stent, and patients in group 2 (n 20) underwent pancreatico-duodenectomy with invaginating (dunking) end to side pancreaticojejunostomy.

Results: In group 1 two patients (10%) developed pancreatic fistula compared to five patients (25%) in group 2. As regards development of intra-abdominal abscess, one patient in group 1 developed that complication while two patients (10%) in group 2 developed intra-abdominal abscess. One patient (5%) in group 2 had postoperative bleeding. One patient in group 1 (5%) developed septicemia compared to three patients (15%) in group 2. Two patients in group 2 needed reoperation.

Conclusion: Duct to mucosa pancreaticojejunostomy has less post-operative morbidity as pancreatic fistula, intra-abdominal abscess and septicemia than invaginating (dunking) pancreaticojejunostomy.

Introduction:

Whipple and colleagues (1935) in New York ligated the main pancreatic duct as part of their two-stage pancreaticoduodenectomy for cancer of the periampullary region.¹

Mortality after pancreaticoduodenectomy has dropped significantly over the last few decades from 25% to less than 5%. This is due to better patient selection, high-dependency care postoperatively, and centralization of patients to regional surgical centers.²

The pancreaticojejunostomy anastomosis is nicknamed the "Achilles heel" of pancreaticoduodenectomy because of the potentially disastrous sequelae of life-threatening intra-abdominal sepsis and hemorrhage.³

Pancreatic fistulas remains a major cause of postoperative complications; it is reported that the incidence of pancreatic fistulas after PD is 6%-25%.⁴

Roder et al. (1999) showed that external drainage of the pancreatic duct decreased the rate of pancreatic fistula from 29.3% to 6.8%, and reduced the median hospital stay from 29 to 13 days.⁵

Li-Ling and Irving (2001) approved that prophylactic administration of somatostatin does not reduce the incidence of pancreatic anastomotic leak, overall morbidity, or mortality after pancreatic resection.⁶

Patients and methods:

This prospective study included 40 patients who underwent surgical therapy for cancer head of pancreas, between Sep. 2009 and March 2011 at Ain Shams University Hospitals. Patients were randomly assigned to surgical procedures. Patients in group 1 (n 20) underwent pancreaticoduodenectomy with end to side (duct to mucosa) pancreaticojejunostomy and external stent, and

patients in group 2 (n 20) underwent pancreaticoduodenectomy with invaginating (dunking) end to side pancreaticojejunostomy.

Patients were diagnosed as cancer head of pancreas with Multidetector CT scan of abdomen and elevated CA 19-9.

Patients having distant metastasis, locally advanced tumors with invasion of portal or superior mesenteric veins were excluded from the present study.

We have used the International Study Group for Pancreatic Fistula (ISGPF) guidelines defining pancreatic fistula as any measurable volume of fluid on or after postoperative day 3 with amylase content greater than 3 times the serum amylase activity.³

Operative Technique:

End to side (duct to mucosa) pancreaticojejunostomy:

The outer layer is performed with posterior interrupted stitches of 4/0 prolene which extends from the pancreatic capsule to the jejunal mucosa **Figure(1)**. A 2-3 mm opening is made in the jejunum adjacent to the pancreatic duct. The anastomosis between duct and mucosa of jejunum is performed with 5/0 prolene interrupted stitches with an external drainage stent (6 french epidural catheter) placed across the PJ anastomosis into the pancreatic duct and brought out externally via the jejunal loop and abdominal wall **Figure(2)**.

The outer layer is completed anterior.



Figure (1): Duct to mucosa PJ: Posterior outer row is complete, right angle in the pancreatic duct.

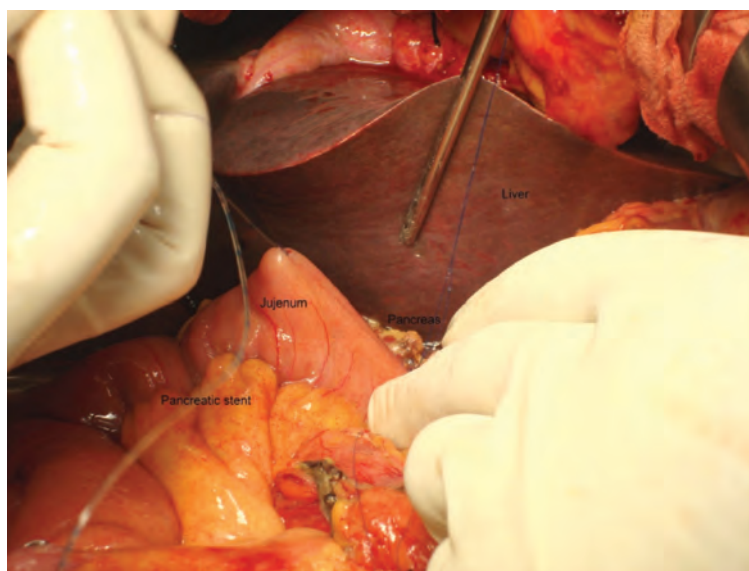


Figure (2): Duct to mucosa PJ: Pancreatic stent is brought out through jejunum.

End to side invaginating (dunking) pancreaticojejunostomy:

A row of interrupted sutures is placed through the dorsal capsule, with the needle entering the pancreatic tissues at about 1 cm away from the cut end of the stump and taking an adequate bite of the parenchyma. The needle is driven through the serosa of the jejunal limb at about 1 to 2 cm from the mesenteric border. A longitudinal enterotomy is made about 5 to 10 mm away from the posterior row of sutures. The posterior inner row of sutures is then constructed, first catching the pancreas in an inside-out fashion, ensuring an adequate bite of the parenchyma, and exiting just at the cut edge of the remnant pancreas. The suture is driven through the posterior edge of the enterotomy, ensuring a full-thickness bite, in an outside-in fashion. All knots are tied after completion of the suture row. This is followed by the anterior inner row of sutures. The final step is the second row of anterior sutures, the aim of which is to cover the inner suture line by imbricating the jejunal serosa over it.

Surgical drains were placed near not at the pancreaticojejunostomy and the choledochojejunostomy (One learns early in training not to place a drain directly on anastomosis because it encourages leakage) and were connected to a closed drainage system. Pancreatic tube was connected to urinary bag and was removed after 6 weeks if there is no pancreatic fistula.

We always use loupes for magnification (x 3).

No prophylactic somatostatin or Octreotide was used.

Statistical analysis:

Analysis of data was done by IBM computer using SPSS (statistical program for social science version 12) as follows:

- Description of quantitative variables as mean, SD and range
 - Description of qualitative variables as number and percentage
 - * Chi-square test was used to compare qualitative variables between groups.
 - * Fisher exact test was used instead of chi-square when one expected cell less than or equal to 5.
 - * Unpaired t-test was used to compare quantitative variables, in parametric data (SD<50% mean).⁷
- P value >0.05 insignificant
P<0.05 significant
P<0.01 highly significant.

Results:

During the period between September 2009 and March 2011, 40 patients diagnosed as cancer head of pancreas underwent pancreaticoduodenectomy. Group 1 included 20 patients who underwent pancreaticoduodenectomy with end to side duct to mucosa pancreaticojejunostomy and external stent, and patients in group 2 (n 20) underwent pancreaticoduodenectomy with invaginating (dunking) pancreaticojejunostomy.

Group 1 included 15 males and 5 females; the mean age was 62.4±2.8. Group 2 included 13 males and 7 females; the mean age was 61.2±1.3 **Table(1)**.

Table (1): Comparison between both studied groups as regard general data.

Variables	Duct to mucosa N=20	Dunking N=20	T	P
Age	62.4±2.8	61.2±1.3	1.1	>0.05 NS
Gender				
Male	15(75%)	13(65%)	Fisher	>0.05
Female	5(25%)	7(35%)	Exact	NS

This table shows that no statistically significant difference could be detected between both groups as regard general data.

In group 1 two patients (10%) developed pancreatic fistula compared to five patients (25%) in group 2. As regards development of intra-abdominal abscess, one patient in group 1 developed that complication while two patients (10%) in group 2 developed intra-abdominal abscess. One patient in group 1 (5%) developed septicemia compared to three patients (15%) in group 2.

In group 1, one patient of the 2 patients with pancreatic fistula required percutaneous drainage of an infected intra-abdominal collection and he was treated with somatostatin, total parenteral nutrition and antibiotics for 22 days. Sepsis was relieved and the patient improved. The other patient was treated conservatively with somatostatin, oral nutrition and antibiotics for 19 days.

In group 2, two patient of the five patients with pancreatic fistula required percutaneous

drainage of an infected intra-abdominal collection and they were treated with somatostatin, total parenteral nutrition and antibiotics. One of these two patients underwent reoperation on the 11th day postoperative due to peripancreatic collection & sepsis. Drainage of collection and peritoneal toilet were done, there was no evidence of pancreatic leakage. Two tube drains were used for drainage. One patient had clinical leakage with fever and leukocytosis, he developed intra-abdominal bleeding, emergency exploration was done. We found bleeding from the stump of a gastroduodenal artery (because of erosion by local sepsis and the pancreatic juice's proteolytic enzymes). We ligated the stump of a gastroduodenal artery and peritoneal toilet was done. Two tube drains were used for drainage. Postoperative this patient was treated successfully with somatostatin, total parenteral nutrition and antibiotics. The other two patients were treated conservatively with somatostatin, oral nutrition and antibiotics.

Table (2): Comparison between both studied groups as regard complications.

Variables	Duct to mucosa N=20	Dunking N=20	X ₂	P
P. Fistula	2(10%)	5(25%)	3	<0.05 S
Intrabdominal abscess	1(5%)	2(10%)		
Septcemia	1(5%)	3(15%)		
Postoperative bleeding	0	1(5%)		
Reoperation	0	2(10%)		

Table (3): Comparison between both studied groups as regard mortality.

Variables	Duct to mucosa N=20	Dunking N=20	P
No	19(95%)	18(90%)	>0.05
Yes	1(5%)	2(10%)	NS

Table(2) shows that complications were more frequent among dunking, statistically significant difference could be detected between both groups as regard general data.

As regards the mortality, there was one case (5%) of mortality in group1 due to bronchopneumonia compared to two (10%)

mortality cases in group 2, one patient developed pancreatic leakage and died of septic shock and the other patient died due to pulmonary embolism **Table(3)** and **Figure(3)**.

Table(3) shows no statistically significant difference between both groups as regard mortality by using Fisher exact test.

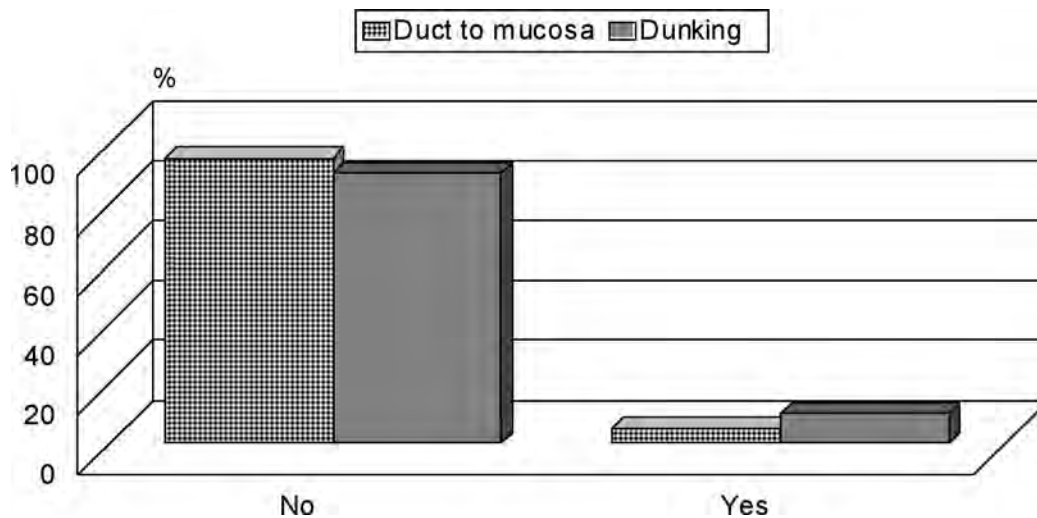


Figure (3): Comparison between both studied group as regard mortality.

The average hospital stay in group 1 was 12.6 ± 3.4 days compared to 27.7 ± 6 days in group 2 and according to these results pancreaticoduodenectomy with end to side duct to mucosa pancreaticojejunostomy and external stent has lower median hospital stay

compared to pancreaticoduodenectomy with invaginating (dunking) pancreaticojejunostomy with statistically highly significant difference in between by using unpaired t-test **Table(4)** and **Figure(4)**.

Table (4): Comparison between both studied groups as regard hospital stay.

Variables	Duct to mucosa N=20	Dunking N=20	t	P
Mean \pm SD	12.6 \pm 3.4	27.7 \pm 6	4.2	<0.001 NS
Median	12	28		
Range	9-35	11-68		

This table shows that dunking group had higher median hospitals stay compared to duct to mucosa group with statistically highly

significant difference in between by using unpaired t-test.

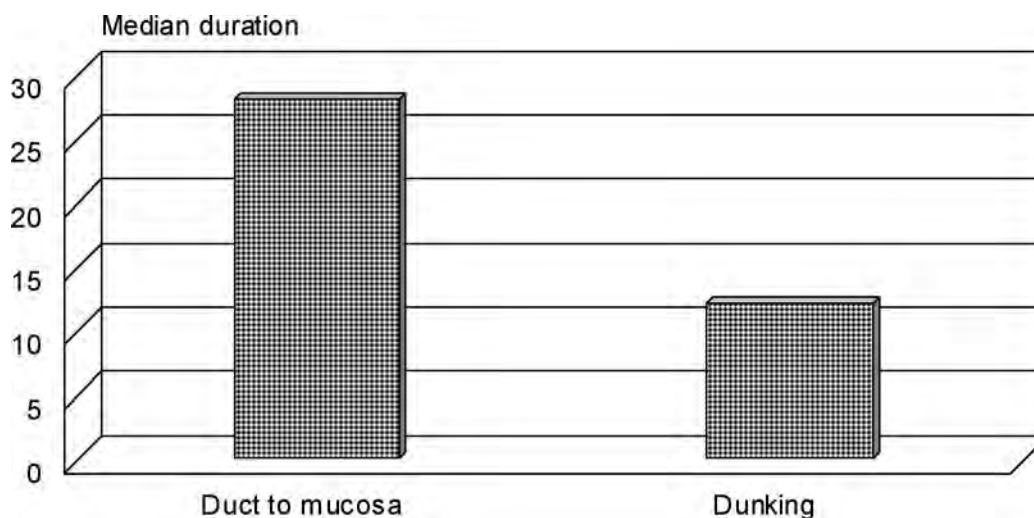


Figure (4): Comparison between both studied groups as regard hospital stay.

Discussion:

Pancreatic fistula, leak, and abscess are major contributors to the morbidity of pancreatic resection. The reported prevalence of these complications varies widely in the literatures. This variation is secondary to differences in definition and to the retrospective nature of most reports. To improve mortality and morbidity, the rate of occurrence of pancreatic fistulas after pancreaticojejunostomy after pancreatic resection must be reduced.

Our study showed that pancreatic fistula was more frequent among dunking PJ cases (25%) than patients who underwent pancreaticoduodenectomy with end to side duct to mucosa pancreaticojejunostomy (10%). Statistically significant difference could be detected between both groups (P 0.05).

Yeo et al., reported that pancreatic fistulas were correlated with anastomotic technique, operative time, a surgeon's skills and experience in performing a PD, tumor location, and co-morbid illnesses.

In study performed by Schmit et al., a duct-to-mucosa anastomosis was performed in 453 patients, and an invaginated anastomosis was performed in 52 patients. In the remaining 5 patients, 3 underwent Peustow reconstruction of the remnant, and in 2, the reconstruction was unclear based upon operative records. There was a more than 3X higher incidence of PF in invaginated anastomoses.

Bartoli et al., observed a higher incidence of fistulas after end-to-side PJ anastomosis (16.5%) than after end-to-end (11.7%) or duct-to-mucosa (11.5%) anastomosis.

Between April 1996 and March 2006, Choe et al., studied 172 consecutive patients who had undergone PD. The methods used for anastomosis were divided into end-to-end dunking anastomosis between cross-sections of the jejunum and the pancreatic stump Group(1), and pancreatic duct to jejunal mucosal anastomosis Group(2). Leakage of the pancreaticojejunostomy occurred in 30 of 172 patients (17.4%). Incidence of pancreatic fistula in group 1 is 16.5% & in group 2 is 19.6% (p value 0.582).

Crist and Cameron observed no difference in the incidence of fistulas between invagination (13%) and duct to mucosa (16%) anastomosis.

Similar data are reported by Grace et al., with fistula rates of 6% to 13% after invagination anastomosis and 11% to 14% after duct-to-mucosa anastomosis.

Roder et al., reported a prospective but nonrandomized study in 85 patients showing that external drainage of pancreatic duct decreased the pancreatic fistula rate from 29.3% to 6.8% compared with no stent.

Tani et al., reported the incidence of pancreatic fistula according to the International Study Group on Pancreatic Fistula criteria was not different (external, 20%; vs internal, 26%), and the incidence of the other complications was similar between stent types. The median postoperative hospital stay was 21 days (range, 8-163 d) in the internal drainage group, which was shorter than the median stay of 24 days (range, 21-88 d) in the external drainage group (P 0.016).

In conclusion, this prospective randomized study showed that duct to mucosa pancreaticojejunostomy has less post-operative morbidity as pancreatic fistula, intra-abdominal abscess, septicemia than invaginating (dunking) pancreaticojejunostomy. But it is not affecting the mortality.

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