

Effect of Jejunostomy Feeding Tube Placement on Complications and Outcome of Pancreaticoduodenectomy Procedures

Adel ZEINALPOUR^{a, b}, Hossein Zolfaghari BERJOUEI^{a, c}, Barmak GHOLIZADEH^{a, b}

^aDepartment of General Surgery, School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran

^bClinical Research Development Center, Shahid Modarres Educational Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran

^cStudent Research Committee, School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran



ABSTRACT

Objective: The aim of this study was to compare the perioperative outcomes and complications between pancreaticoduodenectomy (PD) candidates with and without jejunostomy tube (J-tube) feeding.

Materials and methods: This retrospective cohort study was performed on 48 patient candidates for PD, with or without J-tube placement during surgery, in Shahid Modarres Hospital, Tehran, Iran, between 2013 and 2021. Two groups were matched for age, gender, history of heart, endocrine, hypertension and kidney diseases, and drug use. A 12 French jejunal feeding tube was placed at 20-30 cm distal to gastrojejunostomy anastomosis. Outcomes, including biliary leak, postoperative pancreatic fistula (POPF), delayed gastric emptying (DGE), surgical site infection (SSI), intra-abdominal infection, duration of nasogastric tube (NGT) stay, postoperative (PO) tolerance length, need for total parenteral nutrition (TPN), hospitalization length, and mortality rate, were assessed.

Results: There were eight cases with leak (37.5% J-tube group, of which six (75%) were pancreatic type and two (25%) biliary type. There were 11 (22.9%) patients with DGE (54.5% in J-tube group). There was no significant inter-group difference in SSI ($P=0.340$), intra-abdominal infection managed non-invasively ($P=0.369$), intra-abdominal abscess managed by percutaneous drainage ($P=0.158$), patients requiring TPN ($P=0.447$), NGT placement duration ($P=0.088$), PO tolerance time ($P=0.327$), hospital stay ($P=0.760$) and mortality rate ($P=0.851$).

Address for correspondence:

Barmak Gholizadeh

Department of General Surgery, School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran

Clinical Research Development Center, Shahid Modarres Educational Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran

ORCID ID: 0000-0002-0592-1402; mobile: +98-914-382-1369; email: barmak.gholizadeh@gmail.com

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Conclusion: *J-tube placement after PD for pancreatic cancer may be associated with increased postoperative complications. The conclusion of the present study is that there is no difference between performing and not performing the J-tube placement method in terms of complications and consequences.*

Keywords: jejunostomy, feeding jejunostomy tube, pancreaticoduodenectomy.

INTRODUCTION

Pancreaticoduodenectomy (PD) is a surgical procedure which is used to resect malignant lesions in the head of the pancreas or distal of common bile duct (1). Despite the decreased surgical mortality in recent years, PD is associated with some complications (2, 3). Postoperative pancreatic fistula (POPF) is one of the important postoperative complications of PD which may cause some degree of morbidity and even mortality after surgery. Its management demands longer hospital stay and more expense for the health system. Another problem in these patients is their lower nutritional status. Malnutrition causes problems in wound healing and increases other postoperative complications (4). It is shown that early feeding after PD can improve wound healing and reduce infectious complications, gastroparesis, anastomotic leakage, and hospitalization length (5).

Oral feeding, nasojejunal feeding, jejunostomy tube (J-tube) placement or total parenteral nutrition (TPN) are nutritional methods after PD that have advantages and disadvantages. Enteral feeding is better than parenteral nutrition due to lower complications (6-8).

Oral feeding is the best nutrition method after PD. However, it is associated to some problems. One of these problems is PO intolerance due to complications or delayed gastric emptying, which can affect up to 25% of cases (9-11). So, it seems that early enteral feeding through J-tube placement can be a good alternative method. J-tube placement in PD is a safe method and is commonly used (13-24%) but its advantages and disadvantages are still not completely understood (12, 13).

Also, no association between early feeding after PD through J-tube placement with decreased complications has been shown (4). Moreover, complications related to J-tube placement meth-

od have been reported, but information regarding those complications is limited.

The aim of this study was to compare the perioperative outcomes and complications between PD candidates with and without J-tube feeding placement. □

MATERIALS AND METHODS

This retrospective cohort study was performed between 2013 and 2021, on 48 patient candidates for PD, with or without J-tube placement during surgery, in Shahid Modarres Hospital, a university hospital in Tehran, Iran, after obtaining the approval of the ethical committee of Shahid Beheshti University of Medical Sciences (IR.SBMU.RETECH.REC.1398.469). Also, all participants signed an informed consent form.

All patients who were candidates for PD surgery were included in the study. Those with previous J-tube placement, metastatic disease, severe malnutrition, inability to tolerate surgery, history of previous gastroparesis and vascular involvement during surgery were excluded from the present study.

Two groups were matched for age, gender and preoperative comorbidities.

In group A (with J-tube), a 12 French jejunal feeding tube was placed at 20-30 cm distal to gastrojejunostomy anastomosis. The majority of patients underwent classical PD surgery with resection of pylorus. Most patients underwent conventional reconstruction after resection and the other group received double Roux reconstruction (14). We were anastomosed to the stomach and CHD and one to the pancreas separately. In all patients, pancreatojejunostomy anastomosis was performed using two-layer and end-to-end telescopic techniques. Details of this procedure was entailed from our previous article (14).

In group A (with J-tube), limited feeding was started through J-tube on the second postoperative day and the nasogastric tube (NGT) was re-

moved when its secretion was reduced below 30 cc per day.

Oral feeding was started on the fourth day and patients were discharged with a J-tube. Also, in the group without J-tube, NGT was removed on the second or third day based on the amount of secretion; on the fourth or fifth day, limited fluids began, and then a normal diet was started.

All demographic information (age and gender) and clinical findings, including total and direct bilirubin, albumin, lymphocyte and total protein, were all recorded in our data sheaths. Outcomes including biliary leak, POPF, delayed gastric emptying (DGE), surgical site infection (SSI), intra-abdominal infection, NGT removal time, oral diet tolerance time, need for TPN, hospitalization days and mortality rate were recorded. The criteria of POPF and DGE were based on the International Study Group of Pancreatic Surgery (ISGPS) (9, 15).

The mean and standard deviation (SD) was calculated for all numerical data. Also, frequency and percent were calculated. The quantitative variables were compared using the independent Student t-test. Comparison between frequencies were performed using chi-2 statistics. Data were analysed using SPSS software, version 22 (Armonk, NY: IBM Corp.), and P-value of less than 0.05 was considered statistically significant. □

RESULTS

Forty-eight patients were included in the study, of which 28 underwent surgery with J-tube (group A) and 28 without J-tube (group B). Subjects in groups A and B had a mean age of 63±8.86 years and 60.14±9.02 years, respectively. Twenty three (47.9%) patients were females and 25 (52.1%) males. There were no significant differences in either the history of disease (P=0.883) and drug use (P=0.138) or the preoperative laboratory indices between the two groups (Table 1). Table 2 shows patients' type and stage of disease and the surgical approach. There was not significant difference in perioperative clinical findings between the two groups.

In the postoperative period, there were eight (16.7%) cases with leak, of which five (62.5%) in the group without J-tube and three (37.5%) in the J-tube group. Also, six of these patients (75%) had pancreatic cancer – four (66.7%) in the group without J-tube and two (33.3%) in the J-tube group – and two (25%) biliary cancer (one patient in

TABLE 1. Basic demographic and preoperative laboratory indices in the two groups

Variables	Group (%)		P-value
	With JT (n=20)	Without JT (n=28)	
Age	63±8.86	60.14±9.02	0.282
Gender			
Male	14 (70.0%)	11 (39.3%)	0.883
Female	6 (30.0%)	17 (60.7%)	
History of disease			
No	9 (42.86%)	12 (57.14%)	0.883
Yes	11 (40.75%)	16 (59.25%)	
Drug use			
No	6 (30.0%)	14 (70.0%)	0.138
Yes	14 (50.0%)	14 (50.0%)	
Total bilirubin	7.54±9.28	6.29±7.9	0.620
Direct bilirubin	4.52±6.18	4.26±5.45	0.877
Albumin	3.73±0.68	3.94±0.56	0.246
Lymphocyte	2293.57±833.3	1917.5±779.89	0.117
Total protein	6.35±0.72	6.03±0.9	0.202

*P-value was calculated at 95% levels of CI by Chi-2 statistic

TABLE 2. Comparison of disease related factors between the two groups

Variable	Total (n=48)	Group (%)		P-value
		With JT (n=20)	Without JT (n=28)	
Disease type				
Head of pancreas (N%)	30 (62.5)	14 (70.0)	16 (57.1)	0.628
Periampullary tumour (N%)	11 (22.9)	4 (20.0)	7 (25.0)	
Cholangiocarcinoma (N%)	7 (14.5)	2 (10.0)	5 (17.8)	
Surgery type				
Classic, conventional reconstruction (N%)	28 (58.3)	9 (45.0)	19 (67.8)	0.276
Classic, double Roux reconstruction (N%)	15 (31.2)	8 (40.0)	7 (25.0)	
Pylorus-preserving (N%)	5 (10.4)	3 (15.0)	2 (7.1)	
Stage				
T1N0Mx (N%)	2 (4.1)	1 (5.0)	1 (3.5)	0.456
T2N0Mx (N%)	1 (2.0)	1 (5.0)	0 (0.0)	
T2N1Mx (N%)	17 (35.4)	6 (30.0)	11 (39.2)	
T3N0Mx (N%)	13 (27.0)	7 (35.0)	6 (21.4)	
T3N1Mx (N%)	12 (25.0)	5 (25.0)	7 (25.0)	
T3N2Mx (N%)	3 (6.2)	0 (0.0)	3 (10.7)	

*P-value was calculated at 95% levels of CI by Chi-2 statistic

TABLE 3. Outcomes and complications after surgery

Variables		Total (n=48)	With JT (n=20)	Without JT (n=28)	P-value
Leak (%)	No	40 (83.3%)	17 (85.0%)	23 (82.1%)	0.793
	Yes	8 (16.6%)	3 (15.0%)	5 (17.8%)	
Leak content (%)	Pancreatic	6 (75.0%)	2 (66.6%)	4 (80.0%)	0.673
	Biliary	2 (25.0%)	1 (33.3%)	1 (20.0%)	
DGE (%)	No	37 (77.0%)	14 (70.0%)	23 (82.1%)	0.324
	Yes	11 (23.0%)	6 (30.0%)	5 (17.8%)	
SSI (%)	No	43 (89.5%)	17 (85.0%)	26 (92.8%)	0.340
	Yes	5 (10.5%)	3 (15.0%)	2 (7.2%)	
Intra-abdominal infection managed non-invasively (%)	No	41 (85.4%)	16 (80.0%)	25 (89.2%)	0.369
	Yes	7 (14.6%)	4 (20.0%)	3 (10.8%)	
Intra-abdominal abscess managed by percutaneous drainage (%)	No	44 (91.6%)	17 (85.0%)	27 (96.4%)	0.158
	Yes	4 (8.4%)	3 (15.0%)	1 (3.6%)	
Patients requiring TPN (%)	No	41 (85.4%)	18 (90.0%)	23 (82.1%)	0.447
	Yes	7 (14.6%)	2 (10.0%)	5 (17.8%)	
NGT placement duration (days)		4.47±3.06	5.65±4.79	3.64±1.83	0.088
PO tolerance time (days)		5.80±2.82	6.41±3.87	5.38±2.07	0.327
Hospital stay (days)		14.76±6.33	15.1±6.12	14.53±6.48	0.760
Death (%)	No	39 (81.2%)	16 (80.0%)	23 (82.1%)	0.851
	Yes	9 (18.8%)	4 (20.0%)	5 (17.8%)	

*P-value was calculated at 95% levels of CI by Chi-2 and independent t-test

**P=number of patients; DGE=delayed gastric emptying; SSI=surgical site infection;

TPN=total parenteral nutrition; NGT=nasogastric feeding tube

each group). Two patients had infection in the tube entry site, so the tube was removed. There were 11 (22.9%) patients with DGE, of which five (45.5%) in the group without J-tube and six (54.5%) in the J-tube group. Based on ISGPS, among cases with DGE, five (45.5%) were grade A, four (36.4%) grade B and two (18.1%) grade C.

Other comparisons of outcomes and complications between the two groups are listed in Table 3, which shows no significant inter-group difference in SSI (P=0.340), intra-abdominal infection managed non-invasively (P=0.369), intra-abdominal abscess managed by percutaneous drainage (P=0.158), patients requiring TPN (P=0.447), NGT placement duration (P=0.088), PO tolerance time (P=0.327), hospital stay (P=0.760), and mortality rate (P=0.851). □

DISCUSSION

Jejunal tube placement is one of the most common ways of enteral feeding. However, several

complications associated with this technique have been reported (16). Since the main purpose of this feeding type is to reduce complications after the surgery, the additional complications makes choosing this method challengeable (6). Therefore, it is important to know whether the use of the J-tube placement is effective or not.

In the present study, some basic and demographic variables, which were probably effective on the results, were matched. So, there was no significant difference in these variables, including age, gender, history of diseases and drug use, and clinical factors, between the two groups. On the other hand, factors related to the disease such as the type of cancer and stage of disease did not differ between the two groups. The main findings of the study showed that outcomes and complications of the disease, including DGE, SSI, intra-abdominal infection, percutaneous drainage, duration of NGT and hospitalization length were all higher in the group with J-tube than the group without it. But the frequency of TPN was higher in

the group without J-tube. Of course, these differences were not statistically significant. The frequency of fistula after surgery was also compared in the present study. Thus, leak rate was slightly higher in the group without J-tube, which was not significant. In our study, biliary cases were assessed in addition to pancreatic ones, and the results showed that two of the three patients in the group with J-tube were pancreatic cases and only one was a biliary case, and there was no difference in this regard between the two groups.

Our findings are similar to those reported by other authors. A study conducted by Gerritsen *et al* (17) evaluated the complications and effectiveness of J-tube placement after pancreaticoduodenectomy, and concluded that each of the examined methods had some complications and none of them was superior to the other. Their results confirmed our findings, as we have also concluded that the presence or absence of J-tube had no effect on the complications. In a study by Zhu *et al* (18), in line with the results of previous studies and our study, complications and effects of nasojejunal and J-tube placement methods were evaluated and compared in patients undergoing pancreaticoduodenectomy; the authors concluded that nasojejunal feeding was safer than J-tube placement and was associated with only minor complications. Nasojejunal feeding can significantly reduce the incidence of delayed gastric emptying and postoperative hospital stay. A review study by Gerritsen *et al* (5) assessed five feeding methods after pancreatoduodenectomy, including oral diet, enteral nutrition through nasojejunal tube, gastrojejunostomy tube, J-tube placement, and complete parenteral nutrition. The mean of hospitalization length in oral diet and gastrojejunostomy tube was lower than other groups. Also, normal feeding intake in oral diet was faster than other groups. Their conclusion was that an oral diet may be considered an appropriate feeding strategy after pancreatoduodenectomy and there was no difference between this method and other methods including J-tube placement. Their results were also confirmed by other studies (2, 13, 19-21).

In our study, frequency of DGE in the group with J-tube was slightly higher than the group without J-tube. Also, this difference was not significant, but grade c DGE (severe DGE) was higher in the group with J-tube placement; DGE is not a

fatal complication, but it sometimes leads to significant prolongation of hospitalization and increased hospital costs. It has been reported that DGE was affected by several factors, including gastric dysrhythmias due to intra-abdominal complications, gastric atony after duodenal resection in response to a decrease in motilin levels, and pylorospasm secondary to vagotomy (16). Therefore, it is very important to pay attention to it.

Intestinal obstruction is a potentially fatal, although rare, complication of J-tube placement (17). In a series of patients undergoing laparotomy for complex upper abdominal procedures, jejunostomy resulted in 34 complications related to the tube in 29 patients. Obstruction or displacement was the most common complication, which occurred in 15 patients. The most serious complication was intestinal necrosis in three patients, which led to the death of two patients. Intestinal obstruction and volvulus were reported in three patients, which led to death in one case and intra-abdominal infection in the other three patients. Also, in other 1788 patients with J-tube, the rate of obstruction and intra-abdominal infection was 0.3% and 0.8%, respectively (22). On the other hand, in parenteral feeding the increased risk of infection also well known. A meta-analysis study by Braunschweig *et al* (23), combining 27 randomized controlled trials, found that the risk of infections was significantly increased compared with enteral feeding.

Several large studies described good results with a normal oral diet after pancreatoduodenectomy. Yermilov *et al* (24) found that hospitalization length was significantly lower in the normal diet group. Martignoni *et al* (25) also stated that, in addition to increasing the duration of hospitalization, the prevalence of DGE in patients with enteral was higher than in those with normal nutrition. In the present study, the duration of hospitalization was slightly higher in the group with J-tube feeding, which was not significant. Unlike these studies, two other studies show that enteral nutrition is better than "standard care". In a randomized controlled trial by Mack *et al* (26), hospitalization length was reduced with gastrojejunostomy tube feeding compared with standard care after pancreatoduodenectomy. However, it should be noted that the mentioned study did not provide a definition of standard care and it was not clear what kind of care was intended. Baradi *et al* (12) found that enteral nutrition was associated

with less use of TPN and less readmission and complications. Also, the hospitalization length was not different between the enteral and normal feeding groups. However, most of the studies in line with the present study did not find any difference between the J-tube placement method and other methods in terms of complications. Even like the present study, where we reported a small quantum of some complications, other studies also concluded that there were more complications of this surgical technique. □

CONCLUSION

J-tube placement after PD for pancreatic cancer may be associated with increased postoperative complications. In the present study, we concluded there was no difference between performing and not performing the J-tube placement method in terms of complications and consequences. □

Conflicts of interest: none declared.

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REFERENCES

1. **Warshaw AL, Thayer SP.** Pancreaticoduodenectomy. *J Gastrointest Surg* 2004;8:733-741.
2. **Waliye HE, Wright GP, McCarthy C, et al.** Utility of feeding jejunostomy tubes in pancreaticoduodenectomy. *Am J Surg* 2017;213:530-533.
3. **Wang L, Tian Z, Liu Y.** Nasoenteric tube versus jejunostomy for enteral nutrition feeding following major upper gastrointestinal operations: a meta-analysis. *Asia Pac J Clin Nutr* 2017;26:20-26.
4. **Buscemi S, Damiano G, Palumbo VD, Spinelli G, Ficarella S, Monte GL, et al.** Enteral nutrition in pancreaticoduodenectomy: a literature review. *Nutrients* 2015;7(5):3154-65.
5. **Gerritsen A, Besselink MG, Gouma DJ, et al.** Systematic review of five feeding routes after pancreaticoduodenectomy. *Br J Surg* 2013;100:589-598; discussion 99.
6. **Bozzetti F, Braga M, Gianotti L, et al.** Postoperative enteral versus parenteral nutrition in malnourished patients with gastrointestinal cancer: a randomised multicentre trial. *The Lancet* 2001;358:1487-1492.
7. **Jeejeebhoy KN.** Enteral nutrition versus parenteral nutrition—the risks and benefits. *Nat Clin Pract Gastroenterol Hepatol* 2007;4:260-265.
8. **Mazaki T, Ebisawa K.** Enteral versus parenteral nutrition after gastrointestinal surgery: a systematic review and meta-analysis of randomized controlled trials in the English literature. *J Gastrointest Surg* 2008;12:739-755.
9. **Mezhir JJ.** Management of complications following pancreatic resection: An evidence-based approach. *J Surg Oncol* 2013;107:58-66.
10. **Nappo G, Perinel J, El Bechwaty M, Adham M.** The standardization of pancreaticoduodenectomy: where are we? *Pancreas* 2016;45:493-502.
11. **Parmar AD, Sheffield KM, Vargas GM, et al.** Factors associated with delayed gastric emptying after pancreaticoduodenectomy. *HPB* 2013;15:763-772.
12. **Baradi H, Walsh RM, Henderson JM, et al.** Postoperative jejunal feeding and outcome of pancreaticoduodenectomy. *J Gastrointest Surg* 2004;8:428-433.
13. **Padussis JC, Zani S, Blazer DG, et al.** Feeding jejunostomy during Whipple is associated with increased morbidity. *J Surg Res* 2014;187:361-366.
14. **Afsharfard A, Gholizadeh B, Azimi B, et al.** Outcomes and Complications of Double Roux Loop Reconstruction in Pancreaticoduodenectomy: A Single Center Experience. *International Journal of Cancer Management* 2019;12(6).
15. **Bassi C, Marchegiani G, Dervenis C, et al.** The 2016 update of the International Study Group (ISGPS) definition and grading of postoperative pancreatic fistula: 11 years after. *Surgery* 2017;161:584-591.
16. **Ryan AM, Rowley SP, Healy LA, et al.** Post-oesophagectomy early enteral nutrition via a needle catheter jejunostomy: 8-year experience at a specialist unit. *Clin Nutr* 2006;25:386-393.
17. **Gerritsen A, Besselink MG, Cieslak KP, et al.** Efficacy and complications of nasojejunal, jejunostomy and parenteral feeding after pancreaticoduodenectomy. *J Gastrointest Surg* 2012;16:1144-1151.
18. **Zhu X, Wu Y, Qiu Y, et al.** Comparative analysis of the efficacy and complications of nasojejunal and jejunostomy on patients undergoing pancreaticoduodenectomy. *J Parent Enter Nutr* 2014;38:996-1002.
19. **Abu-Hilal M, Hemandas AK, McPhail M, et al.** A comparative analysis of safety and efficacy of different methods of tube placement for enteral feeding following major pancreatic resection. A non-randomized study. *JOP* 2010;11:8-13.
20. **Li A, Shah R, Han X, et al.** Pancreaticoduodenectomy and placement of operative enteral access: Better or worse? *Am J Surg* 2019;217:458-462.
21. **Nussbaum DP, Zani S, Penne K, et al.** Feeding jejunostomy tube placement in patients undergoing pancreaticoduodenectomy: an ongoing dilemma. *J Gastrointest Surg* 2014;18:1752-1759.
22. **Myers JG, Page CP, Stewart RM, et al.** Complications of needle catheter jejunostomy in 2,022 consecutive applications. *Am J Surg* 1995;170:547-551.
23. **Braunschweig CL, Levy P, Sheean PM, Wang X.** Enteral compared with parenteral nutrition: a meta-analysis. *Am J Clin Nutr* 2001;74:534-542.
24. **Yermilov I, Jain S, Sekeris E, et al.** Utilization of parenteral nutrition following pancreaticoduodenectomy: is routine jejunostomy tube placement warranted? *Dig Dis Sci* 2009;54:1582-1588.
25. **Martignoni ME, Friess H, Sell F, et al.** Enteral nutrition prolongs delayed gastric emptying in patients after Whipple resection. *Am J Surg* 2000;180:18-23.
26. **Mack LA, Kalkanos IG, Livingstone AS, et al.** Gastric decompression and enteral feeding through a double-lumen gastrojejunostomy tube improves outcomes after pancreaticoduodenectomy. *Ann Surg* 2004;240:845-851.