ORIGINAL ARTICLE

Is routine nasogastric tube insertion necessary in pancreaticoduodenectomy?

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Purpose: The necessity of nasogastric decompression after abdominal surgical procedures has been increasingly questioned for several years. Traditionally, nasogastric decompression is a mandatory procedure after classical pancreatico-duodenectomy (PD); however, we still do not know whether or not it is necessary for PD. The present study was designed to assess the clinical benefit of nasogastric decompression after PD. **Methods:** Between July 2004 and May 2007, 41 consecutive patients who underwent PD were enrolled in this study. Eighteen patients were enrolled in the nasogastric tube (NGT) group and 23 patients were enrolled in the no NGT group. **Results:** There were no differences in the demographics, pathology, co-morbid medical conditions, and pre-operative laboratory values between the two groups. In addition, the passage of flatus (P = 0.963) and starting time of oral intake (P = 0.951) were similar in both groups. In the NGT group, 61% of the patients complained of discomfort related to the NGT. Pleural effusions were frequent in the NGT group (P = 0.037); however, other post-operative complications, such as wound dehiscence and anastomotic leakage, occurred similarly in both groups. There was one case of NGT re-insertion in the NGT group. **Conclusion:** Routine nasogastric decompression in patients undergoing PD is not mandatory because it has no clinical advantages and increases patient discomfort.

Key Words: Pancreaticoduodenectomy, Gastrointestinal intubation

INTRODUCTION

Nasogastric decompression is routinely used following most major intra-abdominal surgeries because it has been thought to decrease post-operative ileus, respiratory complications, and the incidence of anastomotic leaks after gastrointestinal surgery [1]. In addition, decompression may help to prevent distension, and thus might lower the risk of wound dehiscence, biliary fistulas, and promote a more rapid return of bowel function. Several recent prospective studies have questioned this practice in patients who have undergone gastrectomies [2,3] and hepatectomies [4]. Indeed, even more authors have concluded that nasogastric decompression is associated with a higher in-

cidence of pulmonary complications; therefore, routine nasogastric decompression is no longer warranted after elective abdominal surgery [5,6].

There are no studies that have determined the effect of nasogastric decompression in patients undergoing PD. Thus, the present study evaluated whether or not nasogastric decompression is necessary in PD patients.

METHODS

Patient demographics

This study was approved by our Institutional Review Board for human investigation of Soonchunhyang University Hospital. From July 2004 to May 2007, 41 consecutive patients who underwent PD were enrolled in this study. After induction of anesthesia, a 16-French nasogastric tube (NGT) was inserted in all patients. In the NGT group, the tube remained in place for continuous drainage until passage of flatus with a suction pressure of 40 to 50 mmHg. In the no NGT group, the tube was removed at the end of surgery.

Surgical technique and post-operative care

The standard, pylorus-preserving resection involved division of the duodenum 2 cm distal to the pylorus with resection of the entire duodenum distal to the transection site, removal of the gallbladder and common bile duct (proximal to the level of the cystic duct junction), resection of the head, neck, and uncinate process of the pancreas (underneath the superior mesenteric vein, lateral from the mesenteric-portal vein axis, and flush with the superior mesenteric artery), and removal of the peri-ampullary tumor. For the standard resection, a distal gastrectomy varying from 20 to 40% was performed. Frozen section was performed routinely at the transection site of the pancreatic remnant in all patients. In the case of a macroscopically-suspicious margin, a frozen section of the margin was also performed.

The technique of pancreatico-jejunal (PJ) anastomosis was developed by our department and standardized by placing an external pancreatic duct stent for negative suction drainage of pancreatic juice. In summary, an end-

to-side, duct-to-mucosa, 2-layer PJ anastomosis was performed using interrupted fine Mexon sutures. The diameter of the pancreatic duct was measured in every case. A 5-8-French infantile feeding catheter with a single side-hole was inserted into the pancreatic duct. The largest size stent that could be passed into the pancreatic duct was used. Catheter migration was prevented by an anchoring stitch that secured the catheter to the mucosa of the jejunal side of the PJ anastomosis using double absorbable sutures. Care was taken to ensure that there were no side-holes in the part of the catheter in the jejunum. The catheter exited via a small enterotomy in the opposite site of the PJ anastomosis, and was externalized through a stab incision in the anterior abdominal wall. The enterotomy site for exit of the catheter was closed with a purse-string suture, and the serosa around the enterotomy site was sutured to the peritoneum of the abdominal wall. Upon completion of the surgical procedure, negative pressure was applied to the pancreatic tubes using a Jackson-Pratt (JP) bag.

After PJ anastomosis, an end-to-side, single layer, interrupted choledochojejunostomy was performed using the same jejunal loop with an internal stent. A single layer, continuous, hand-sewn antecolic gastrojejunostomy or duodenojejunostomy was then performed. No vagotomies, gastrostomies, or feeding jejunostomies were performed. At the end of the surgery, drains were left in the area of the pancreaticojejunostomy and choledochojejunostomy. One drain was placed anterior to the PJ anastomosis, and another drain was placed posterior to the anastomosis (peri-pancreatic drains).

All patients were managed according to a standard post-operative pathway. All patients received histamine H2 receptor antagonists as prophylaxis against stress ulceration, and octreotide treatment was continued for 7 days. The drain was removed if the amylase concentration was <300 U/L (<twice the serum concentration) and production was <50 mL per day or after post-operative day 10. Patients were allowed sips of water after passage of flatus in the absence of symptoms of nausea or distension. The diet was advanced in the same stepwise fashion in the two groups, from clear liquids to a soft diet as tolerated.

Demographic data, pathology, co-morbid conditions,

pre-operative data, operative variables, and post-operative complications were recorded. Discomfort related to the NGT, expressed subjectively by the patients, was graded as none, moderate, or severe.

Definition of various post-operative complications

Pancreatic fistulas were defined according to the criteria of the International Study Group on pancreatic fistulas [7]. A biliary fistula was diagnosed if there were persistent secretions of bilirubin-rich drainage fluid >50 mL per day or after the 10th post-operative day. Post-operative bleeding was defined as the need for >2 units of red blood cells >24 hours after surgery or re-laparotomy for bleeding. Delayed gastric emptying was defined as gastric stasis requiring nasogastric intubation for >10 days or the inability to tolerate a regular diet on the 14th post-operative day. Lung complications, such as pneumonia, atelectasis, and pleural effusions, were noted based on chest plain films during the post-operative follow-up.

Statistical analysis

We determined the statistical differences in continuous variables by Student's t-test and the Mann-Whitney U-test by checking statistical adequacies. The chi-square test was applied for univariate analysis of categorical data, and the Poisson linear regression model was applied to test the number of events occurring in a fixed period of time between the NGT and no NGT groups. We used R statistical software (version 2.8.0; The R foundation for Statistical Computing). We considered values of P ≤ 0.05 statistically significant.

RESULTS

The study group included 41 patients (23 males and 18 females), and the mean age was 62.0 ± 10.63 years. Eighteen patients were enrolled in the NGT group and 23 patients were enrolled in the no NGT group. The demographics of each group are shown in Table 1, including pathology, co-morbid medical conditions, and previous abdominal surgeries. Pre-operative laboratory data were compared, and there were no significant differences in

Table 1. Demographics and general considerations of the patients

	NGT group (n = 18)	No NGT group (n = 23)	P-value
Gender			0.4864
Male	9	14	
Female	9	9	
Mean age (yr)	61.22 ± 11.63	62.61 ± 10.01	0.6841
Pathology			0.7445
Pancreatic cancer	3	2	
Bile duct cancer	9	9	
Ampullary cancer	4	8	
IPMN	1	3	
Others	1	1	
Associated medical condition			
Diabetes mellitus	3	3	0.7446
Hypertension	3	5	0.6842
Pulmonary tuberculosis	1	0	0.2524
Liver cirrhosis	0	1	0.3704
Previous abdominal surgery	2	3	0.8512
Laboratory values			
Mean hemoglobin (g/dL)	11.6 ± 1.52	12.2 ± 1.52	0.1891
Mean albumin (g/dL)	3.66 ± 0.50	3.70 ± 0.53	0.8076
Mean AST (U/L)	105.6 ± 89.48	106.4 ± 104.77	0.7525[a]
Mean ALT (U/L)	142.6 ± 138.7	117.9 ± 148.65	0.2586[a]
Mean total bilirubin (mg/dL)	6.3 ± 5.52	5.2 ± 6.00	0.3012[a]
Mean CA19-9 (U/mL)	865.7 ± 1,546.9	141.8 ± 289.8	0.0142[a]

[a] Mann-Whitney U-test was applied, since the data was failed to normality assumption.
NGT, nasogastric tube; IPMN, intraductal papillary mucinous neoplasm; AST, aspartic acid transaminase; ALT, alanine transaminase; CA19-9 carbohydrate antigen 19-9.

each group.

The operative parameters are summarized in Table 2. The types of operation, operative time, blood loss, amount of transfusion, and size of the pancreatic and common bile ducts were not statistically different. There were three cases of combined procedures. A left hepatectomy for an intrahepatic duct stone and a lower anterior resection for rectal cancer were performed in the NGT group, and a right adrenalectomy for a right adrenal mass was performed in the no NGT group. The post-operative courses are summarized in Table 3. The mean duration of time the NGT remained in place was 4.28 ± 3.24 days. The mean hospital stay, time to passage of flatus, and time to start a

Table 2. Parameters related to operation

	NGT group (n = 18)	No NGT group (n = 23)	P-value
Name of operation			0.1848
Whipple's operation	15	16	
PPPD	1	6	
Combined operation	2	1	
Other operative parameters			
Mean operation time (min)	503.3 ± 88.0	528.3 ± 112.52	0.4446
Mean blood loss (mL)	922.2 ± 357.37	1,178.3 ± 506.28	0.1158[a]
Mean P-duct size (mm)	3.77 ± 2.53	4.22 ± 2.26	0.6932[a]
Mean CBD size (mm)	15.1 ± 5.54	15.3 ± 6.52	0.8651
Blood transfusion (unit)	253.9 ± 295.32	185.2 ± 560.66	0.05221[a]

[a]Mann-Whitney U-test was applied, since the data was failed to normality assumption.
NGT, nasogastric tube; PPPD, pylorus preserving pancreatico-duodenectomy; CBD, common bile duct.

Table 3. Postoperative course

	NGT group (n = 18)	No NGT group (n = 23)	P-value
Duration of gastric decompression (day)	4.28 ± 3.24	-	NA
Time to first passage of flatus (day)	4.89 ± 1.32	4.87 ± 1.29	0.978[a]
Time to first oral intake (day)	8.67 ± 5.01	8.74 ± 2.32	0.938[a]
Mean hospital days	26.11 ± 11.7	25.78 ± 9.87	0.838[a]
Discomfort related to the NGT			
None	7 (39)		
Moderate	5 (28)		
Severe	6 (33)		

Values are presented as mean ± SD or number (%).
NGT, nasogastric tube; NA, not available.
[a]Test by Poisson linear regression model.

liquid diet were not statistically different between the two groups. However, 11of 18 patients (61%) complained of discomfort from the NGT tube.

The post-operative complications are compared in Table 4. There were two PJ leakages (Bassi type B) in each group. Most of the complications occurred with similar incidences, with the exception of pleural effusions. The rate of total lung complications, atelectasis, and pneumonia were not significantly different, but pleural effusions oc-

Table 4. Postoperative complications

	NGT group (n = 18)	No NGT group (n = 23)	P-value
Overall complications	16	20	0.8512
Urinary complications	2	3	0.8510
Lung complications	15	17	0.4696
Atelectasis	13	13	0.3003
Pleural effusion	15	12	0.0368
Pneumonia	2	1	0.4092
Intra-abdominal complications	4	4	0.6895
PJ leakage	2	2	0.7959
CJ leakage	1	2	0.7016
GJ leakage	1	0	0.2524
Intra-abdominal abscess	2	4	0.5723
Delayed gastric emptying	1	0	0.2524
Wound complications	3	10	0.0671
Seroma	3	10	0.0671
Infection	1	2	0.7016
Dehiscence	1	3	0.4226

NGT, nasogastric tube; PJ, pancreatico-jejunostomy; CJ, choledo-cho-jejunostomy; GJ, gastro-jejunostomy.

curred more frequently in the NGT group than the no NGT group (P = 0.037). Delayed gastric emptying occurred in one patient in the NGT group, who underwent NGT re-insertion. Fortunately, there were no mortalities. The intra-abdominal abscess was controlled by percutaneous drainage and each leak was controlled by conservative treatment such as NPO.

DISCUSSION

After Levin [8] introduced nasogastric intubation, and Wangensteen and Paine [9] popularized its use in the treatment of acute intestinal obstruction and post-operative ileus, many surgeons have subscribed to the unproven belief that a NGT is beneficial following most major intra-abdominal procedures and decreases post-operative complications, such as vomiting, wound dehiscence, and anastomotic leaks. Recently, however, several studies have reported opposite results. Some authors have reported that insertion of a NGT had no effect on the return of bowel function, as noted previously for other abdominal procedures [6], and other authors have shown this time to be sig-

nificantly longer in patients with an NGT, probably owing to delayed or decreased ambulation [10]. Also, prospective studies in Taiwan [11] and Korea [3,12] with high-case volumes have also suggested that there is no need for an NGT following gastrectomy for gastric cancer. In our study, there was no difference in the time to passage of flatus and resumption of a liquid diet; thus, NGT had no clinical benefit on the early return of bowel function and early advancement of diet.

In a prospective randomized trial, Pessaux et al. [4] reported that although an NGT was effective in preventing vomiting following hepatic resection, the NGT had no effect on the incidence of nausea and its use was associated with an increased risk of pneumonia. As Cheatham et al. [5] suggested, the interval to first oral intake was significantly less, and the incidence of pulmonary complications and post-operative fevers were significantly lower in patients managed without NGTs, whereas routine nasogastric decompression did not decrease the incidence of any other complications. Other studies [13,14] have shown the presence of an NGT to be an independent risk factor for increased post-operative pulmonary complications; specifically, the NGT may interfere with an effective cough through incomplete closure of the glottis, leading to the accumulation of secretions that increase the risk of atelectasis and infection, and bacteria may be transferred more easily from the oropharynx to the lungs, thus increasing the risk of respiratory infections. In our cases, pleural effusions occurred more frequently in the NGT group more than the no NGT group, but there were no differences in atelectasis or pneumonia and the total incidence of lung complications. Also, it appeared that NGT insertion did not reduce anastomotic leaks and wound complications, such as dehiscence. Although not statistically significant, delayed gastric emptying occurred in one patient in the NGT group who needed re-insertion of the NGT.

Some studies have reported other complications, such as injuries to the larynx [15], esophagitis [16], pharyngitis, otitis, electrolytic losses, aerophagia, or rhinosinusitis [17] induced by NGT insertion. In our cases, 61% of the NGT group patients complained of discomfort due to the NGT and 33% of patients felt severe discomfort related to the NGT.

In conclusion, the routine insertion of a NGT in patients who have undergone a PD has no advantages with respect to post-operative complications and it can increase the post-operative pulmonary complications. Also, it appears that NGT insertion cause patient's discomfort after operation. Therefore, routine NGT insertion needs to be reconsidered in patients who undergo PD.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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