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ORIGINAL ARTICLE

Routine nasogastric suction may be unnecessary after a pancreatic resection

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Abstract

Background: Most surgeons routinely place a nasogastric tube at the time of a pancreatic resection. The goal of the present study was to evaluate the outcome when a pancreatic resection is performed without routine post-operative nasogastric suction.

Methods: One hundred consecutive patients underwent a pancreatic resection (64 a pancreaticoduodenectomy, 98% pylorus sparing and 36 a distal pancreatectomy). In the first cohort (50 patients), a nasogastric tube was routinely placed at the time of surgery and in the second cohort (50 patients) the nasogastric was removed in the operating room. Outcomes for these two cohorts were recorded in a prospective database and compared using the χ^2 or Fisher's exact test and Wilcoxon's rank-sum test.

Results: Demographical, surgical and pathological details were similar between the two cohorts. A post-operative complication occurred in 22 (44%) in each group ($P = 1.000$). There were no statistically significant differences in the frequency or severity of complications, or length of stay between groups. The spectrum of complications experienced by the two cohorts was similar including complications that could potentially be related to the use of nasogastric suction such as delayed gastric emptying, anastomotic leak, wound dehiscence and pneumonia. There was no difference between the two groups in the number of patients who required post-operative nasogastric tube placement (or replacement) [2 (4%) vs. 4 (8%), $P = 0.678$].

Conclusion: It may be safe to place a nasogastric tube post-operatively in a minority of patients after a pancreatic resection and spare the majority the discomfort associated with routine post-operative nasogastric suction.

Keywords

resection < pancreatic neoplasia, outcomes < pancreatic neoplasia

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Introduction

Nasogastric decompression after pancreatic surgery has been a standard practice for decades. Placement of a nasogastric tube is thought to be necessary to prevent gastric distension, vomiting, wound dehiscence, pulmonary complications and to diminish the risk of anastomotic leak, and increase patient comfort. Some clinicians would argue that nasogastric decompression accomplishes none of these goals. In fact, some previous studies provide evidence that avoiding the use of a nasogastric tube actually speeds the return of bowel function, decreases pulmonary complications and is not associated with any increase in anastomotic leak.[1] Use of a nasogastric tube has been proven unnecessary and has greatly diminished in other areas of gastrointestinal surgery such as colon resection. Whether these lessons translate to pancreatic resection is unknown. The goal of the present study was to evaluate the outcome when a pancreatic resection is performed without routine post-operative nasogastric suction.

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Methods

One hundred consecutive patients undergoing a pancreaticoduodenectomy or a distal pancreatectomy were studied. Patients undergoing a central pancreatectomy or enucleation of pancreatic tumours were excluded. In the first cohort ($n = 50$), nasogastric tubes were routinely placed in the operating room after the induction of general anaesthesia and removed in the early post-operative period unless patients complained of severe nausea or had excessive drainage. Nasogastric tubes were typically removed several days after surgery when evidence of bowel function returned. In the second cohort ($n = 50$), nasogastric tubes were placed at the time of surgery during the operation to facilitate exposure but were removed in the operating room at the conclusion of surgery. Nasogastric tubes were placed (or replaced) post-operatively at the discretion of the surgeon in patients who developed severe nausea, gastric distension and/or vomiting.

Outcomes for these two cohorts were recorded in a prospective database and compared using the χ^2/Fisher's exact test for categorical variables, and Wilcoxon's test for continuous variables (median, interquartile range). Data were entered into an institutional review board (IRB)-approved prospective database in real time by a trained data analyst under the supervision of the surgeon. All data were backed up by source documents and accuracy of the data entered into the electronic database was periodically reviewed.

Demographical information was obtained from the medical record. A stated past medical history of or presence in the medical record of a history of hypertension, chronic obstructive pulmonary disease, diabetes, coronary artery disease, chronic pancreatitis, or renal insufficiency was recorded. Obesity was defined as a body mass index (BMI) greater than or equal to 30 kg/m^2. Tobacco use was recorded in pack-years (average number of packs smoked per day multiplied by the number of years smoked). The American Society of Anesthesiologists (ASA) score was obtained from the anaesthesia record. Operative time was also obtained from the anaesthesia record and defined as the time from incision to application of the final wound dressing. Estimated intra-operative blood loss (EBL) was obtained from the anaesthesia record, not from the surgeon's operative report. All specimens were submitted to pathological analysis and the diagnosis was recorded.

Operative mortality was defined as any death within 30 days of surgery. All complications within 30 days of the date of surgery were recorded using specific and standardized definitions. Complications were graded in severity using the Common Terminology Criteria for Adverse Events CTCAE (v4.0) (Grade 1–5) unless otherwise stated below. For grading schemes with A, B, C rather than 1 to 5, severity scores were converted to 1 to 3 to calculate median complication severity scores. The median complication severity score was calculated by dividing the sum of all complication severity grades by the number of complications the patient experienced.

Delayed gastric emptying (DGE)

Delayed gastric emptying was defined and graded using the schema proposed by the International Study Group of Pancreatic Surgery (ISGPS).[2] Grade A delayed gastric emptying (DGE) was considered present in patients who required a nasogastric tube between post-operative day (POD) 4 and 7 (including reinsertion for nausea or vomiting after initial removal), or those who failed to tolerate a solid diet by POD 7, but did tolerate a solid diet before POD 14. Grade B DGE was considered present in patients who required a nasogastric tube from POD 8 to 14 (including reinsertion for nausea or vomiting after initial removal) or in patients who could not tolerate solid oral intake by POD 14, but were able to resume a solid oral diet before POD 21. Grade C DGE was considered present in patients who required a nasogastric tube after POD 14 (including reinsertion for nausea or vomiting after initial removal), or in patients who were not able to maintain solid oral intake by POD 21.[1,2]

Anastomotic failure

A pancreatic fistula was defined and graded using the three-tiered definition proposed by the International Study Group on Pancreatic Fistula (ISGPF).[3] Biliary leak was defined as drainage of any volume of fluid clinically consistent with bile (or with a bilirubin concentration greater than the serum value) from operatively or percutaneously placed drains or the wound. Enteric leaks (duodenojejunostomy or gastrojejunostomy) were identified using radiographical contrast studies.

Infectious complications and organ failure

A fever was defined as any recorded temperature greater than or equal to 100.4°F. Wound infection was defined as spontaneous or surgical drainage from the wound with a positive Gram stain or culture. Fluid drained from the abdomen with a positive Gram stain or culture was considered an intra-abdominal abscess. Fluid drained from the abdomen with an amylase concentration >3× the normal serum value (>360 IU/ml) was considered a pancreatic fistula. Two complications were logged if the fluid met both the criteria for an abscess and a fistula. The need for percutaneous abdominal drainage or even reoperation was not counted as a separate additional complication but was used to grade the severity of the complication that was the indication for the procedure (pancreatic fistula, abdominal abscess, etc.). Pneumonia was defined as a positive sputum culture associated with an infiltrate on radiological imaging requiring treatment with antibiotics. *Clostridium difficile* colitis was defined as diarrhoea associated with a positive stool culture for the organism. A urinary tract infection (UTI) was defined as a urine culture with $\geq 10^3$ colony-forming units per millilitre. Acute respiratory distress syndrome (ARDS) was defined as the presence of a $PaO_2/FiO_2 < 200$ mmHg in the presence of bilateral alveolar infiltrates on chest X-ray. Renal failure was defined as the need for dialysis of any duration in patients who did not require dialysis pre-operatively. Urinary

retention was defined as the need to reinsert a Foley catheter at any time during the index admission owing to the inability to void and a distended bladder.

Cardiovascular complications

Arrhythmia was defined as any new (not present pre-operatively) cardiac rhythm other than sinus requiring any medical intervention or transfer to a monitored bed. A myocardial infarction (MI) was defined as two or more of the following: chest pain, EKG changes, and/or cardiac enzyme elevation and fall consistent with MI. A post-operative haemorrhage was defined as a need to return to the operating room or post-operative radiological intervention for haemorrhage, or post-operative gastrointestinal bleeding documented by endoscopy. Thromboembolic complications included a deep venous thrombosis (DVT), pulmonary embolus (PE), or embolic cerebrovascular accident (CVA).

Length of hospital stay

Length of hospital stay (LOS) was calculated from the day of surgery through and including the day of discharge during the index admission. Return to the ICU after discharge to the regular hospital ward was not considered a complication but was used to grade the severity of the reason for return to the ICU (arrhythmia, etc.). Readmission was defined as an admission to any hospital for ≥24 h for any reason within 30 days after surgery. Readmission was not considered as an independent additional complication but was used to grade the severity of the complication that was the reason for readmission.

Results

One hundred consecutive patients undergoing a pancreatic resection from January 2008 to September 2010 were studied. In the first cohort (n = 50), operated between January 2008 and April 2009, nasogastric tubes were removed post-operatively when the patient denied nausea and output was minimal. In the second cohort (n = 50), operated between May 2009 and September 2010, nasogastric tubes were removed in the operating room at the conclusion of the procedure. The two cohorts were very similar in all other respects. Patients who had a pancreaticoduodenectomy (n = 64) or a distal pancreatectomy (n = 36) were included in the study and there was no difference between the two cohorts in the type of resection (31 Whipples vs. 33; 19 distal pancreatectomy vs. 17, P = 0.677). There were also no statistically significant differences in age (64 vs. 60, P = 0.201), gender (48% male vs. 40%, P = 0.420), race (94% Caucasian vs. 96%, P = 1.000) or ethnicity (0% Hispanic vs. 10%. P = 0.056) between the two cohorts. There were no clinically significant differences in the comorbidities or pre-operative labs between the two cohorts except for a greater incidence of hypertension [14 (28%) vs. 27 (54%), P = 0.008] among the group without nasogastric suction. Although there was a slightly larger number of patients with cystic lesions and a slightly smaller number with cancer in the group without nasogastric suction, there were no statistically significant differences between the two cohorts in the indication for resection. Patients in the group without nasogastric suction had significantly less estimated intra-operative blood loss [400 ml (200–700) vs. 250 ml (150–500), P = 0.008]. In patients who had a pancreaticoduodenectomy, a pylorus-preserving resection was performed in 98% of the cases. In all of these cases, the enteric anastomosis (duodenojejunostomy) was constructed with an outer layer of 3–0 silk Lembert sutures and an inner running layer of 3–0 polydioxanone absorbable sutures (PDS) taking care not to narrow the outlet at the efferent limb.

Eliminating the routine use of nasogastric suction resulted in no difference in morbidity or mortality between the two cohorts (Table 1). There was no difference in the severity grades of complications or the frequency of complications. The spectrum of complications experienced by the two cohorts was similar including complications that could potentially be related to the use of nasogastric suction such as delayed gastric emptying, anastomotic leak, wound infection, wound dehiscence and pneumonia. Only six patients required insertion of a nasogastric tube after surgery [2 (4%) vs. 4 (8%), P = 0.678]. There were no complications from insertion of a nasogastric tube post-operatively. There was no difference between the two cohorts in the time required for patients to tolerate a liquid or solid diet. Elimination of the routine use of nasogastric suction was not associated with any decrease in the LOS.

Discussion

Although the routine use of nasogastric suction has diminished recently in gastrointestinal surgery, the high incidence of delayed gastric emptying associated with pancreatic resection, particularly a pancreaticoduodenectomy, has discouraged many surgeons from abandoning this practice. This prospective cohort study was not able to demonstrate any difference in the outcome after a pancreatic resection with and without the routine use of post-operative nasogastric decompression.

As with any procedure in medicine, the placement of a nasogastric tube is not without potential complications. Some of the complications are associated with the actual placement of the tube. These include inadvertent placement into the tracheobronchial tree and potentially pneumothorax, bleeding from a traumatic insertion and, rarely, perforation of the nasopharynx or oesophagus sometimes secondary to an oesophageal diverticulum or other anatomic anomaly. All of these potential complications are, of course, not avoided by limiting the use of the nasogastric tube during the operation. After successful placement of a nasogastric tube, other complications may be experienced by the patient during its use such as gastric trauma and subsequent bleeding from suction injury. Patients may develop pressure necrosis of the nasal cartilage from improper taping of the tube. Irritation from the tube can cause pharyngitis, sinusitis or otitis from obstruction of the eustacian tube. Patients with nasogastric

Table 1 Outcome of pancreatic resection with and without NGT

Overall morbidity and mortality	**NGT (*n* = 50)**	**No NGT (*n* = 50)**	***P*-value**
30-day mortality	0 (0%)	1 (2%)	1.000
Severity of Complications			
No. of patients with any complication ≥ Grade III	6 (12%)	5 (10%)	0.749
No. of patients with any complication ≥ Grade II	8 (16%)	12 (24%)	0.317
No. of patients with any complication	22 (44%)	22 (44%)	1.000
Median complication severity grade	0 (0–1)	0 (0–1)	0.903
Median complication severity grade among patients with complications	1 (1–3)	2 (1–3)	0.687
Frequency of complications (any grade)			
No. of patients with one complication	15 (30%)	16 (32%)	1.000
No. of patients with two complications	4 (8%)	3 (6%)	
No. of patients with three complications	2 (4%)	3 (6%)	
No. of patients with four complications	1 (2%)	0 (0%)	
Potential NGT-related complications	**NGT (*n* = 50)**	**No NGT (*n* = 50)**	***P*-value**
Delayed gastric emptying (any grade)	7 (14%)	6 (12%)	0.766
Grade A	3 (6%)	6 (12%)	0.207
Grade B	2 (4%)	0 (0%)	
Grade C	2 (4%)	0 (0%)	
Wound infection	5 (10%)	1 (2%)	0.204
Wound dehiscence	0	0	
Pancreatic fistula (Grade B/C)	3 (6%)	5 (10%)	0.715
Biliary leak	0	0	
Enteric leak	0	0	
Pneumonia	0	0	
Management of NGT and diet	**NGT (*n* = 50)**	**No NGT (*n* = 50)**	***P*-value**
Median post-operative day NGT removed	2 (1–2)	NA	NA
No. of patients post-operative NGT (re)insertion required	2 (4%)	4 (8%)	0.678
Median post-operative day clear liquids tolerated	4 (3–5)	4 (4–5)	0.779
Median post-operative day solid oral intake tolerated	5 (5–6)	5 (4–6)	0.810
Length of stay	**NGT (*n* = 50)**	**No NGT (*n* = 50)**	***P*-value**
All patients	7 (6–8)	7 (6–8)	0.301
Without complication	7 (6–7)	7 (6–7)	0.351
With complication	7 (6–8)	7 (6–8)	0.648

NGT, nasogastric tube.

tubes in place have been shown to be at risk for aspiration and pneumonia owing to interference with the function of the epiglottis. Although many of these complications are rare, most patients with a nasogastric tube will admit to at least mild discomfort because of its presence. In this series, there were no misplaced nasogastric tubes or pressure necrosis of the nasal cartilage. Although we did not document cases of pharyngitis or otitis, this is common and certainly occurred.

There are special risks associated with a pancreatic resection that have been used to argue in favour of routine postoperative nasogastric suction. In the setting of a pancreaticoduodenectomy, there is a duodenojejunostomy or gastrojejunostomy. Some surgeons fear that without nasogastric suction in the post-operative period, the stomach will become distended placing tension on the anastomosis leading to disruption and leak. Some surgeons place the tube through the enteric anastomosis and into the afferent limb to keep it decompressed to avoid tension on the biliary and pancreatic anastomoses for the same reason. When a leak does occur, this can lead to a profound ileus and even in the absence of a leak the literature suggests that many patients have delayed gastric emptying after a pancreatic resection. In the setting of a distal pancreatectomy, the short gastric vessels have usually been ligated. Some surgeons prefer to keep the stomach decompressed to avoid a perceived increased risk of bleeding from these vessels in the early post-operative period. For these reasons, many surgeons still insist on nasogastric decompression after a pancreatic

resection. The present study does not provide any data to support these arguments. In this series, we did not observe any enteric or biliary leaks and there was no statistically significant difference in the incidence of pancreatic fistulae with or without the use of nasogastric suction [3 (6%) vs. 5 (10%), $P = 0.715$]. Among the five patients with a pancreatic fistula, only one required post-operative nasogastric tube insertion and this was uneventful.

To our knowledge, there are no reports in the literature specifically addressing the issue of pancreatic resection without routine nasogastric decompression. However, there are numerous studies in other gastrointestinal operations providing data to suggest safety and perhaps better outcomes with this approach. Most general surgeons are aware of the literature on colon resection without the use of nasogastric tubes which began to appear in the 1980s. These data now include large randomized prospective trials. Most of the data indicates no increase in morbidity such as pneumonia, wound infections, anastomotic leak and an incisional hernia. Some of the studies support an earlier return of bowel function and shortened length of hospital stay with the elimination of nasogastric tubes.[4–7]

These findings in colon surgery have been extended to operations of the more proximal gastrointestinal tract including a gastrectomy.[8–10] In contrast to the literature in colon surgery, randomized prospective trials evaluating gastric and small-intestine surgery have more consistently demonstrated earlier return of intestinal function and an associated decreased length of stay without routine nasogastric suction. All of the evidence regarding gastrointestinal surgery without routine nasogastric decompression suggests no increase in morbidity. Our results, taken in the context of the available literature, suggest that a pancreas resection without routine nasogastric decompression should be safe.

The present study was performed at a single institution and all cases were performed by one surgeon which ensured relatively uniform treatment of all patients in both cohorts in every aspect of care other than post-operative nasogastric suction. It may also be argued that this is an inherent weakness of the study because it may not be valid to extrapolate these results to other institutions and surgeons. For example, differences in technique such as the manner in which the enteric anastomosis is performed may influence results. In addition, although this study was completed over a relatively short time span, there may be an evolution of technique or learning curve with time. For example, there was an increased use of laparoscopic techniques for a distal pancreatectomy in the latter cohort. Other strengths of the study design are the prospective data collection to ensure capture of all complications which avoids under-reporting, a complication severity grading system for a more sophisticated analysis and independent auditing with cross referencing against source documents to ensure accuracy of the data. However, the design of the present study also introduces inherent weaknesses such as potential differences between groups that would have been controlled for with a randomized prospective study design. Our data suggest that there were few differences between the two cohorts with the exception of the use of post-operative nasogastric suction. Finally, although 100 pancreatic resections is a reasonable size series to study, only 64 of the cases were Whipple procedures, and patients who underwent a distal pancreatectomy were also included. The outcome with the two procedures may differ. With a sample size of 100 cases, large differences in the main outcome variable (i.e. a 20% increase in the overall complication rate) would be required for us to have detected a statistically significant difference. This may have resulted in a Type II error.

Conclusion

This retrospective cohort study suggests that it may be safe to place a nasogastric tube post-operatively in the minority of patients who develop delayed gastric emptying after a pancreatic resection and spare the majority the discomfort and potential complications associated with routine post-operative nasogastric suction.

Conflicts of interest

None declared.

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