

Optimal management of delayed gastric emptying after pancreatectomy: An analysis of 1,089 patients

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Purpose. The aim of this study was to determine if early recognition and treatment of delayed gastric emptying (DGE) can augment postoperative outcomes in patients undergoing pancreatectomy.

Methods. The International Study Group of Pancreatic Surgery definition of DGE was used to identify patients at Indiana University Hospital who required supplemental nutrition for DGE after pancreatectomy. Outcomes were compared between those without DGE, those with DGE who received supplemental nutrition within 10 days after pancreatectomy (early intervention), and those treated after 10 days (late intervention).

Results. Between 2007 and 2012, the incidence of DGE was 15% (n = 163/1,089), 45% (n = 73) required supplemental nutrition, including 60% (n = 44/73) in the early intervention and 40% (n = 29/73) in the late intervention groups. Postoperative morbidity (62% vs 41%; P < .01), duration of stay (16 vs 7 days; P < .01), and readmissions (41% vs 17%; P < .01) were greater among those with DGE. The early intervention group resumed a regular diet sooner (day 24 vs 36; P = .05) and were readmitted less often (25% vs 65%; P < .01) than those in the late intervention group. Treatment-related complications occurred in 14% of patients.

Conclusion. Patients with DGE can be managed with acceptable treatment-related morbidity. Outcomes are best when supplemental nutrition is started within 10 days of operation. (Surgery 2014;156:939-48.)

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PARTIAL PANCREATECTOMY for benign and malignant disease of the pancreas has become safer over the past 2 decades owing to advancements in radiographic imaging, operative technique, and critical care.^{1,2} At high-volume centers, pancreatectomy is associated with perioperative morbidity rates as low as 27% and mortality rates of <5%.¹⁻³ Despite these progressive improvements, delayed gastric emptying (DGE) is reported to occur in 14-42% of patients and remains among the most common complications after pancreatectomy.^{1,4} DGE presents a frustrating challenge to the surgical team and leads to patient discomfort, prolonged hospitalization, increased costs, and greater numbers of hospital readmissions.^{5,6}

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Most published reports on DGE focus on operative technique and patient factors associated with the development of postpancreatectomy DGE. Diabetes mellitus, degree of pancreatic parenchymal fibrosis, extent of surgical dissection, and postoperative complications have all been associated with the development of DGE; other factors, such as the type of gastrointestinal reconstruction after pancreatoduodenectomy, are not.^{4,7-12} Understanding these associated factors may help to identify patients at increased risk of developing DGE in the postoperative period, but few studies have focused on the role of early and effective management in improving patient outcomes. The purpose of this study was to gain further insight into the management of DGE and reveal factors important in reducing its clinical burden. In this study, we evaluate the impact of early recognition and treatment of DGE on patient outcomes.

METHODS

Patient population and DGE definitions. The American College of Surgeons-National Surgical Quality Improvement Project is a validated, national program that collects prospectively patient

characteristics, processes of care, and adverse outcomes to evaluate hospital performance with regard to surgical care.¹³ The American College of Surgeons-National Surgical Quality Improvement Project database at Indiana University Hospital was used to identify patients who underwent pancreatoduodenectomy or distal pancreatectomy between January 2007 and December 2012. Outcome data were gathered and analyzed with permission from the Institutional Review Board of Indiana University School of Medicine.

The International Study Group of Pancreatic Surgery definition was used to identify and grade patients who developed DGE after pancreatectomy (Table I).¹⁴ Patients with grade A DGE did not require supplemental nutrition; thus, only patients with grade B or C DGE who were started on supplemental nutrition postoperatively were included. For further comparison, 103 postpancreatectomy patients without DGE were chosen at random and matched with the DGE cohort with respect to age, American Society of Anesthesiologists class, pathology, surgeon, and operation. Patients were placed in 1 of 3 categories for further analysis: Patients without postpancreatectomy DGE (non-DGE), patients with postpancreatectomy DGE who were started on supplemental nutrition (total parenteral nutrition [TPN] or jejunal tube feeding [TF]) on or before postoperative day (POD) 10 (early intervention group), patients with postpancreatectomy DGE who were started on supplemental nutrition after day 10 (late intervention group). Patients were excluded from analysis if the operation was performed emergently or required a multivisceral resection, enteric TF or TPN was administered before the operation, or carried a diagnosis of diabetic gastroparesis.

Postoperative management. The typical postoperative course at our institution includes removal of the nasogastric tube on POD 1, initiation of clear liquids on POD 2, and advancement of diet as tolerated on a case-by-case basis for the remainder of the hospital course. Decisions regarding the placement of jejunal feeding tubes at the time of surgery are based on a constellation of factors such as preoperative body mass loss, and overall nutritional status assessed with biochemical and clinical parameters. Prokinetic agents are initiated on a clinically need basis and not as prophylaxis.

Surgical outcomes. Postoperative parameters, including tolerance of a solid diet, time to passage of stool, duration of NG tube decompression, and NG tube reinsertion, as well as the need for supplemental nutrition, the first day the patient was able to tolerate solid food, and percent weight loss

Table I. Definition of delayed gastric emptying after pancreatic surgery¹⁴

Grade	Nasogastric tube required	Use of prokinetic	Unable to tolerate solid oral intake by POD
A	4–7 days or reinsertion > POD 3	±	7
B	8–14 days or reinsertion > POD 7	+	14
C	>14 days or reinsertion > POD 14	+	21

POD, Postoperative day.

(calculated as the difference between weight on admission and weight on first follow-up visit) were recorded. In addition, DGE and National Surgical Quality Improvement Project recorded adverse events, the incidence of procedure-specific complications were documented through retrospective chart review, and included organ space infection and pancreatic and biliary fistula. Pancreatic fistulas were graded according the International Study Group of Pancreatic Surgery definition.¹⁵ Postoperative duration of hospital stay was recorded in days, and hospital readmissions within 30 days of operation were documented.

Statistics. Continuous variables were expressed as median with range or mean ± standard error of mean and compared using analysis of variance. For significant differences, a post hoc analysis was performed using the Student *t* test for a 2 × 2 comparison. Categorical variables were compared using 2-tailed Fisher's exact and Wilcoxon rank-sum when appropriate. Statistical significance was set at $P \leq .05$.

RESULTS

DGE. From 2007 to 2012, 708 patients underwent pancreatoduodenectomy and 381 underwent distal pancreatectomy. The overall incidence of DGE in 1,089 patients after pancreatectomy was 15% ($n = 163$). Patients who underwent pancreatoduodenectomy more likely to develop DGE (20%, $n = 140/708$) compared with those who underwent distal pancreatectomy (6% [$n = 19/381$]; $P < .001$). Of those with DGE, 45% ($n = 73/163$) were grades B or C and required supplemental nutrition, including 60% ($n = 44/73$) who received nutrition within 10 days (early intervention) and 40% ($n = 29/73$) who received nutrition after 10 days (late intervention). Patient characteristics were similar as presented in Table II. Surgical pathology and the presence of preoperative diabetes mellitus

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