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Original article

Feeding patients with preoperative symptoms of gastric outlet obstruction after pancreatoduodenectomy: Early oral or routine nasojejunal tube feeding?☆

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ABSTRACT

Background: Early oral feeding is currently considered the optimal routine feeding strategy after pancreatoduodenectomy (PD). Some have suggested that patients with preoperative symptoms of gastric outlet obstruction (GOO) who undergo PD have such a high risk of developing delayed gastric emptying that these patients should rather receive routine postoperative tube feeding. The aim of this study was to determine whether clinical outcomes after PD in these patients differ between postoperative early oral feeding and routine tube feeding.

Methods: We analyzed a consecutive multicenter cohort of patients with preoperative symptoms of GOO undergoing PD (2010–2013). Patients were categorized into two groups based on the applied postoperative feeding strategy (dependent on their center's routine strategy): early oral feeding or routine nasojejunal tube feeding.

Results: Of 497 patients undergoing PD, 83 (17%) suffered from preoperative symptoms of GOO. 49 patients received early oral feeding and 29 patients received routine tube feeding. Time to resumption of adequate oral intake (primary outcome; 14 vs. 12 days, $p = 0.61$) did not differ between these two feeding strategies. Furthermore, overall complications and length of stay were similar in both groups. Of the patients receiving early oral feeding, 24 (49%) ultimately required postoperative tube feeding. In patients with an uncomplicated postoperative course, early oral feeding was associated with shorter time to adequate oral intake (8 vs. 12 days, $p = 0.008$) and shorter hospital stay (9 vs. 13 days, $p < 0.001$).

Conclusion: Also in patients with preoperative symptoms of GOO, early oral feeding can be considered the routine feeding strategy after PD.

Introduction

Early oral feeding is currently considered the optimal routine feeding strategy after pancreatoduodenectomy (PD), in line with the enhanced recovery after surgery (ERAS) guidelines [1–6]. However, approximately 30–50% of these patients require nutritional support in the postoperative period, mainly due to delayed gastric emptying (DGE) [6,7]. Intraoperative placement of a nasojejunal feeding tube may therefore be beneficial for these patients to prevent malnutrition in the first postoperative week, which is known to be associated with increased morbidity, mortality, length of hospital stay and costs [8–10]. It also avoids the burden of postoperative feeding tube placement.

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Routine intraoperative feeding tube placement in all patients undergoing PD is, however, associated with a prolonged length of hospital stay as compared to early oral feeding and has no impact on complication rates [4,6]. Furthermore, up to 36% of these tubes dislodge within the first postoperative week and need to be replaced during the course of DGE [11,12]. Nonetheless, some subgroups of patients have such a high risk of developing DGE that routine intraoperative nasojejunal feeding tube placement in these subgroups may still be indicated [7,13,14]. For example, gastric outlet obstruction (GOO) occurs in up to 5–25% of patients with pancreatic or periampullary cancer [7,15–19], and has been previously associated with a threefold increased risk of DGE after PD [7]. Since symptoms of GOO lead to inadequate oral intake, preoperative nutritional interventions are usually undertaken to improve the nutritional status and reduce the negative impact on morbidity and mortality [20–23]. It is, however, unclear whether patients with preoperative symptoms of GOO can be managed according to the current standard (early oral feeding) or should receive routine nasojejunal tube feeding.

The aim of this study was therefore to determine whether clinical outcomes after PD in these patients differ between early oral feeding and routine postoperative tube feeding.

Methods

Patients

We analyzed a consecutive cohort of 497 patients undergoing PD between January 2010 and December 2013, who were identified from the prospectively maintained databases of three tertiary referral centers; the Academic Medical Center Amsterdam, VU University Medical Center Amsterdam and University Medical Center Utrecht. Included were all patients with preoperative symptoms of GOO. A subset of these patients (n = 24) has been described in a previous study [6]. Patients receiving a feeding jejunostomy were excluded, because they represent a highly selected malnourished subgroup of patients. Patients were categorized into two groups based on the applied postoperative feeding strategy: early oral feeding (with on-demand tube feeding) or routine nasojejunal tube feeding. The choice of feeding strategy depended on the center's routine strategy at that time (early oral feeding in one center and routine tube feeding in one other, whereas the third center changed strategies from tube feeding to early oral feeding halfway the study period).

Gastric outlet obstruction

GOO was defined according to a previously validated definition (Table 1) [7]. Standardized outpatient clinic letters and discharge letters were screened for the presence of these symptoms. If neither the presence nor the absence of the symptoms was specifically mentioned, they were scored as being absent.

Table 1
Definition of gastric outlet obstruction [7].

- Two or more of the following preoperative symptoms:	Vomiting Dysphagia Nausea Loss of appetite Postprandial complaints (abdominal pain, early satiation or bloating)
- Present at the time of diagnosis or during the work-up to surgery	
- Not relieved by preoperative biliary drainage (i.e. related to obstructive jaundice)	

Early oral feeding

Patients receiving early oral feeding were started on a liquid diet on day 0 (day of surgery), and advanced to solid food from day 2 and a regular diet from day 3 if tolerated. The consulting dietitian evaluated oral intake. If indicated, oral nutritional supplements (Nutridrink Protein; NV Nutricia, the Netherlands) were initiated on day 2, and continued after discharge. If oral intake was considered to be inadequate (<50% of the daily-required caloric intake) on postoperative day 7, a nasojejunal feeding tube was placed endoscopically.

Routine postoperative tube feeding

Enteral nutrition was delivered via a nasojejunal feeding tube, which was placed intraoperatively in the efferent jejunal limb. Enteral nutrition was started in the morning on postoperative day 1 and increased to the amount advised by the consulting dietitian over the following hours to days as tolerated. In case of dislodgement of the tube, replacement was only performed when oral intake was expected to remain inadequate during the following days. Oral intake was started and advanced as tolerated. Enteral nutrition was discontinued and the feeding tube was removed when oral intake was adequate according to the dietitian or treating physician (>50% of the daily-required caloric intake with an upward trend).

Perioperative management

Patients who suffered from preoperative malnutrition were referred to a dietitian and started on preoperative nutritional support (i.e. oral nutritional supplements or (par)enteral nutrition depending on digestive symptoms and severity of malnutrition). Preoperative malnutrition was defined as a body mass index (BMI) of <18.5 kg/m^2 and/or severe preoperative weight loss (i.e. unintentional weight loss of ≥10% of body weight within 6 months or ≥5% of body weight within 1 month prior to presentation at the outpatient clinic).

PD was performed either pylorus preserving or as classic Whipple by teams specialized in hepato-pancreato-biliary surgery. Reconstruction consisted of a jejunal loop with an end-to-side pancreaticojejunostomy, hepaticojejunostomy, and ante- or retrocolic duodenojejunostomy (pylorus-preserving PD) or gastrojejunostomy (Whipple procedure).

Postoperative parenteral nutrition was only indicated when enteral feeding was unsuccessful or contraindicated. Patients were discharged when they had achieved autonomous activity or returned to their preoperative level of activity, oral intake was adequate (or home enteral nutrition was arranged) and there were no signs of local or systemic complications.

Outcomes

Primary outcome was the time to resumption of adequate oral intake. Oral intake was defined to be adequate when it exceeded 50% of the daily-required caloric intake with an upward trend, or when reported as adequate by the treating physician or dietitian. Secondary outcomes were time to solid intake, (par)enteral nutrition use, duration of (par)enteral nutrition, pancreatic fistula, DGE, post-pancreatectomy hemorrhage, other complications (surgical, general or feeding related), length of hospital stay, readmission within 30 days after discharge and in-hospital mortality. Postoperative pancreatic fistula, DGE and post-pancreatectomy hemorrhage were defined according to International Study Group of Pancreatic Surgery definitions [24–26]. Chyle leaks were defined as

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