Does antecolic reconstruction decrease delayed gastric emptying after pancreatoduodenectomy?

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Abstract

Delayed gastric emptying (DGE) is a frequent complication after pylorus-preserving pancreatoduodenectomy (PpPD). Kawai and colleagues proposed pylorus-resecting pancreatoduodenectomy (PrPD) with antecolic gastrojejunostomy to obviate DGE occurring after PpPD. Here we debate the reported differences in the prevalence of DGE in antecolic and retrocolic gastro/duodeno-jejunostomies after PrPD and PpPD, respectively. We concluded that the route of the gastro/duodeno-jejunal anastomosis does not have an influence on the prevalence of DGE or on the postoperative development of DGE after pancreatoduodenectomy (PD).

Key words: Antecolic reconstruction; Retrocolic reconstruction; Pancreatoduodenectomy; Pylorus-preserving pancreatoduodenectomy; Delayed gastric emptying

INVITED COMMENTARY ON HOT ARTICLES

Delayed gastric emptying (DGE) is a major cause of early morbidity following pancreatoduodenectomy (PD). Although it has been recently reported that pylorus-preserving pancreatoduodenectomy (PpPD) and classical Whipple's PD are equal operations regarding the postoperative development of DGE[1], the occurrence of this complication is usually considered to be associated with PpPD. DGE after PpPD was first described by Warshaw et al[2] in 1985. DGE implies a state of postoperative gastroparesis and gastric stasis for which prolonged gastric drainage is necessary with delay to return to solid food intake. However, the pathogenesis of DGE is still unclear. Postoperative decrease in plasma motilin stimulation after duodenal resection[3], devascularization and denervation of the pylorus with subsequent pylorospasm in PpPD[4] and other operative factors such as the route of gastro-
duodeno-enteric reconstruction (antecolic vs retrocolic)\(^{[8]}\) and the type of reconstructive technique (Billroth I vs Billroth II reconstruction)\(^{[7]}\) may contribute to the occurrence of DGE. Moreover, intra-abdominal postoperative complications such as pancreatic fistula, peripancreatic collections, intraabdominal abscess or postoperative pancreatitis may increase the prevalence of DGE\(^{[8-13]}\). The reported prevalence of DGE after pancreatic surgery is remarkably variable due to different adopted definitions of DGE\(^{[10,14,15]}\). In fact, a consensus definition of DGE based on the impact on the clinical course and on postoperative management was proposed by the International Study Group of Pancreatic Surgery only in 2007\(^{[16]}\). Kawai et al\(^{[17]}\) reported a prospective randomized controlled trial (RCT) on the prevalence of DGE in pylorus-preserving pancreaticoduodenectomy (PPD) vs PpPD. The authors proposed PrPD, in which the stomach is nearly entirely preserved and divided just adjacent to the pyloric ring, to obviate DGE occurring after PpPD and avoid the impairment of nutritional status occurring after classical Whipple’s PD. They highlighted that the results of their RCT significantly favored PrPD over PpPD, considering the prevalence of DGE (4.5% vs 17.2%): in these procedures an antecolic gastro- or duodeno-jejunal reconstruction was adopted\(^{[18]}\).

A recent RCT comparing the occurrence of DGE after subtotal stomach-preserving pancreaticoduodenectomy in pancreaticogastrostomy with retrocolic gastro-jejunal anastomosis reconstruction and in pancreaticogastrostomy with antecolic gastro-jejunal reconstruction concluded that antecolic reconstruction, and not retrocolic reconstruction, decreases DGE prevalence. However, in this study, Billroth I (retrocolic) reconstructions were compared with Billroth II (antecolic) reconstructions\(^{[19]}\). After subtotal stomach-preserving pancreaticoduodenectomy with pancreaticogastrostomy, Oida et al\(^{[20,21]}\) considered retrocolic gastrojejunal reconstruction preferable to antecolic reconstruction for preventing DGE because pancreaticogastric anastomosis is located behind the stomach and the retrocolic route in gastroenteric reconstruction enables the gastric contents to easily reach the jejunum. In the study by Eshuis et al\(^{[22]}\), DGE was more frequent in retrocolic reconstructions, but in multivariable analysis no association between the route of reconstruction and DGE was found.

After PD, Billroth I reconstruction is considered to have a higher incidence of DGE than Billroth II reconstruction\(^{[3]}\), but Billroth I is considered to be a more physiologic procedure than Billroth II because Billroth I preserves the proximal jejunum in the alimentary circuit and maintains the hormonal stimuli on the remnant pancreas\(^{[23]}\). In evaluation of the prevalence of DGE in antecolic and retrocolic reconstruction in gastro- and duodeno-jejunal anastomosis after classical Whipple’s PD and PpPD, respectively, the two compared procedures should differ only in the manner in which the jejunum is brought up in respect to the transverse colon. Kawai participated in a previously reported prospective RCT in which the adopted reconstructive procedures after PpPD were different only regarding the route; i.e., antecolic or retrocolic, for Billroth II type duodeno-jejunal anastomosis. The prevalence of DGE was significantly lower in the antecolic duodeno-jejunal anastomosis group than in the retrocolic duodeno-jejunal anastomosis group\(^{[6]}\). However, another recent RCT showed no difference in the prevalence of DGE between antecolic and retrocolic gastro/duodeno-jejunal anastomosis following classical Whipple’s PD/PpPD after standardization of both the antecolic and retrocolic types of Billroth II gastro/duodeno-jejunal anastomosis with respect to the distance from the hepatico-jejunostomy and angulation of the jejunal loop. In this study, the occurrence of DGE was not affected by the type of performed PD; i.e., classical Whipple’s PD vs PpPD, or the type of adopted reconstruction of the gastro/duodeno-jejunal anastomosis; i.e., antecolic vs retrocolic\(^{[23]}\). Ueno et al\(^{[26]}\) indicated that the transient torsion or angulation in the reconstruction of the alimentary tract is the main cause of DGE after PpPD. Several methods were proposed to promote the alimentary transit from the stomach through the jejunal loop, such as alignment of the stomach contour to avoid angulation of the jejunal loop distally to the duodeno-jejunal anastomosis in a Billroth II type of reconstructive procedure\(^{[25]}\), and straight antecolic duodeno-jejunal anastomosis twisting the jejunum 30° counterclockwise to preserve the potency of the effenter jejunum and placing the stomach in the left subcolic fossa to straighten it in a Billroth II type of reconstruction\(^{[25]}\). In the RCT by Chi-jiwa et al\(^{[23]}\), no significant difference in the prevalence of DGE was found between retrocolic vertically performed duodenojejunalostomy and antecolic duodenojejunos-tomy (Table 1).

Regarding the resection method, Kawai et al\(^{[17,18]}\) highlighted that PrPD preserves the capacity of the stomach and obviates to pylorospasm, denervation and devascularization of the pylorus ring, which can occur in PpPD, and demonstrated that PrPD decreases the incidence of DGE in respect to PpPD. Recently, these surgical procedures of subtotal stomach-preserving (or pylorus-preserving) pancreaticoduodenectomies have been adopted in surgical treatments of malignant tumors of the periampullary region and of the head of the pancreas. Our group has been adopting subtotal stomach-preserving pancreaticoduodenectomy since 1995 for several considerations. After pancreaticoduodenectomy, gastric preservation favors adequate weight gain due to higher caloric intake; moreover, and most of all, normal acid secretion acts as a physiologic stimulus promoting the intestinal secretion of secretin and CCK-PZ, as well as the subsequent stimulation of pancreatic exocrine secretion with better digestion of protein and fat (weight gain). Lastly, preservation of the stomach with resection of the pylorus favors better gastric emptying\(^{[28,29]}\). Regarding the impact of the reconstructive method on DGE, we think that the route of the gastro/duodeno-jejunal anastomosis with respect to the transverse colon (antecolic or retrocolic) or the type of reconstruction performed (Billroth I or Billroth II procedure) are not truly responsible for the differences in the prevalence of DGE after PD. We believe
that, after a PD, the impact of reconstructive methods on DGE is related mostly to the angulation or torsion of the reconstruction of the gastro-duodeno-jejunostomy because all the reported modified procedures associated with lower DGEs in Billroth I as well Billroth II types of reconstruction, are related to the reconstructive anatomy of the alimentary circuit and are aimed to facilitate the outflow of the ingests from the gastric/duodenal remnant. An antecolic gastro-duodeno-jejunostomy can favor a straight construction and gastric emptying by gravity in a Billroth II reconstruction after PD or PpPD\textsuperscript{24} as well as a retrocolic Billroth II gastrojejunostomy after a subtotal stomach-preserving pancreaticoduodenectomy with pancreaticogastrostomy reconstruction can favor the transit of the gastric contents towards the jejunum in consequence of the retrogastric site of pancreaticogastrostomy\textsuperscript{20,21}. A Billroth II reconstruction can avoid the jejunal angulation produced by a Billroth I procedure in which the anastomosis of the proximal jejunum to the gastric/duodenal stump is performed at first, followed by pancreatic-jejunostomy and hepatico-jejunostomy\textsuperscript{22} (or by hepatico-jejunostomy in a case in which a pancreaticogastrostomy is carried out).

According to the ISGPS clinical criteria\textsuperscript{16}, we have recently reported a prevalence of 8.9% (8 cases) of grade A DGE and 1.1% (1 case) of grade C DGE in a series of 89 subtotal stomach-preserving PD followed by Roux-en-Y retrocolic reconstruction with anastomosis of the isolated Roux limb (i.e., first jejunal loop) to the stomach and single Roux limb (i.e., second jejunal loop) to the pancreatic stump and hepatic duct\textsuperscript{30} (Figure 1).

We chose anastomosing the isolated proximal jejunum to the gastric remnant because, after removal of the duodenal source of CCK and secretin, preservation of the first jejunal loop in the reconstruction of the alimentary circuit maintains the physiologic jejunal secretion of secretin and CCK-PZ subsequent to alimentary transit and can compensate (at least in part) for the abolished duodenal hormonal release\textsuperscript{29}. Then, the anastomosis of the isolated first jejunal loop to the gastric remnant, although retrocolic, avoided any angulation and torsion allowing the outflow of the gastric contents by gravity through a “straight route” (Figure 2). It is widely known that postoperative complications are related to the occurrence of DGE. Therefore, controlling the prevalence

![First jejunal loop](image1.png)

**Figure 1** Retrocolic gastro-jejunal anastomosis in Roux-en-y reconstruction after subtotal stomach-preserving pancreaticoduodenectomy. M: Mesocolic window; GJ: Gastro-jejunal anastomosis. Dashed line indicates the level of jejunal division.
of other postoperative complications can contribute to reduce the occurrence of DGE. Postoperative pancreatic fistula occurred in seven patients (7.8%) of our series. Six cases of grade A fistula resolved spontaneously and in only one grade B fistula was percutaneous drainage necessary. Postoperative hemorrhage occurred in two of 89 (2.2%) patients, biliary fistula in eight (8.9%) patients and acute pancreatitis in one (1.1%). One patient with pre-existing stenosis of the hepatic artery developed thrombosis of the hepatic artery.

In conclusion, PrPD may contribute to a decrease in the prevalence of DGE due to pylorospasm, denervation and devascularization of the pylorus ring, which may occur after PpPD. A “straight” route, not necessarily an “antecolic” route, may obviate to the prevalence of DGE due to torsion or angulation in the reconstruction of the alimentary tract.

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