

Posterior Circular Stapled GastroJejunostomy After Duodenopancreatectomy

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Rezumat

Gastro-jejunoanastomoza posterioară cu stapler circular după duodenopancreatectomie

Fistulele anastomotice sunt cele mai frecvente și de temut complicații postoperatorii ale duodenopancreatectomiei. Golirea gastrică întârziată (DGE) și recuperarea lentă a tranzitului intestinal sunt elemente importante care contribuie la apariția fistulei pancreatice postoperatorii (PoPF). Lucrarea evaluează 17 cazuri consecutive care au suferit duodenopancreatectomie pentru adenocarcinom pancreatic cu anastomoză pancreatico-jejunală și anastomoză gastrojejunală mecanică cu stapler circular în locul tehnicii standard termino-laterale. Trei pacienți au dezvoltat DGE grad A (unul a asociat PoPF grad B), iar un pacient a necesitat reinserția sondei nazogastrice din cauza unei fistule pancreatice grad B. Incidența generală a DGE a fost de 23,5%. Trei pacienți au dezvoltat fistule pancreatice de grad B care au fost tratate conservator. Doisprezece pacienți au reluat tranzitul intestinal în decurs de 4 zile. Au fost necesare două reintervenții pentru sângerare postoperatorie. Durata medie de spitalizare a fost de 11,5 zile. Pacienții cu DGE au avut o spitalizare medie de 14,5 zile. Nu a existat nicio fistulă de anastomoză digestivă și mortalitatea a fost zero. Prin urmare, considerăm gastrojejunostomia circulară posterioară cu stapler o alternativă tehnică simplă, reproductibilă, sigură pentru evitarea DGE și scăderea riscului de PoPF, a costurilor crescute asociate cu spitalizarea prelungită și la îmbunătățirea calității vieții pacienților postoperator.

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Cuvinte cheie: duodenopancreatectomie, anastomoză circulară gastrojejunală, evacuare gastrică întârziată

Abstract

Anastomotic fistulae are the most common and dreaded postoperative complications of pancreaticoduodenectomy. Delayed gastric emptying (DGE) and slow recovery of bowel function are contributing causes for postoperative pancreatic fistula (PoPF) that should be taken into consideration. The present study evaluates data from 17 consecutive cases that underwent pancreaticoduodenectomy for pancreatic adenocarcinoma with pancreaticojejunal anastomosis and circular stapled mechanical gastrojejunal anastomosis instead of the standard termino-lateral technique. Three patients developed Grade A DGE (one also developed grade B PoPF) and one patient required reinsertion of the nasogastric tube due to Grade B PoPF. Overall, the incidence of DGE was 23.5%. Three patients developed Grade B pancreatic fistulae that were successfully managed conservatively. Twelve patients resumed early bowel movement within 4 days, two reinterventions were required for postoperative bleeding. Mean hospital stay was 11.5 days. Patients with DGE had a mean hospital stay of 14.5 days. No gastrojejunostomy leak was encountered. Mortality was nil. Therefore we consider the posterior circular stapled gastrojejunostomy a simple, reproducible, safe technical alternative for avoiding DGE and consequently help lower the risk of PoPF, increased costs associated with prolonged hospital stay and an improved postoperative quality of life.

Key words: duodenopancreatectomy, circular stapled gastrojejunostomy, delayed gastric emptying

Introduction

Pancreaticoduodenectomy is the keystone for the treatment of pancreatic head cancer and one of the most technically demanding interventions in digestive surgery with risks both during resection and reconstruction.

The reconstruction after pancreaticoduodenectomy requires three anastomoses: pancreatico-digestive, bilio-digestive and gastrojejunostomy (1,2). The order of constructing these anastomoses is determined by the index pancreatico-digestive anastomosis. If pancreaticojejunostomy is to be executed, it will be the first anastomosis performed, followed by the hepaticojejunostomy and gastrojejunostomy. If pancreaticogastrostomy is to be performed it might be preceded by the hepaticojejunostomy, although many surgeons prefer creating the pancreatico-digestive reconstruction first.

The Achilles' heel of these anastomoses is

the pancreatico-digestive anastomosis where the observed rate of leakage is the main factor of morbidity and mortality after pancreaticoduodenectomy (3). Efforts have been made to define postoperative pancreatic fistula (PoPF) in order to better report and manage this complication (4,5). While clinically relevant PoPF are reported to occur in 10% of cases, a quarter of Grade C PoPF are associated with 25% mortality (6,7). Controversy reigns over which of the two types of anastomoses is optimal while many authors suggest that the preference of the surgeon should prevail accounting for experience and case volume as a major criteria in avoiding anastomotic fistulas (8,9).

Another important factor of postoperative morbidity is delayed gastric emptying (DGE) and ileus with slow and unstable response to prokinetic medication (10). The definition of DGE has been also standardized (11). The incidence of DGE is reported to be between

15% and 30% of patients undergoing pancreaticoduodenectomy, with longer hospital stays and increased healthcare costs (12). With the exception of erythromycin, no medication has proven useful in improving patient status related to postoperative ileus and DGE (13). With unclear pathogenesis, delayed gastric emptying is frequently associated with pancreatic fistula/leak or intra-abdominal abscess or infection (14). A high-pressure gradient in the proximal jejunum as a consequence of delayed gastric emptying and ileus may be considered a risk factor for pancreatic fistula.

Surgical Technique

The bilateral subcostal incision (rooftop) is preferred. After the resection is accomplished, careful hemostasis is achieved at the pancreatic stump and hepatic duct. The stomach is resected using diathermy at the distal antrum. The reconstruction begins with the pancreaticojejunostomy using a transmesocolic jejunal loop; this is fashioned directly or as a duct-to-mucosa anastomosis with internal stenting and interrupted sutures. Then the hepaticojejunal anastomosis is performed in a terminolateral manner with interrupted sutures without being keen on a wide distance between the now two completed anastomoses. (*Fig. 1*) The gastrojejunostomy will be placed on the posterior aspect of the stomach approximately 5 cm proximal to the resection line. The anastomosis site on the jejunum is chosen in order to achieve one non-angulated loop between the biliary and digestive anastomoses (*Fig. 2*). A 2 cm longitudinal incision is made strictly on the antimesenteric border of the jejunum through which the anvil of a 25 to 28 mm circular stapler is introduced and the incision is carefully closed with separate sutures with the anvil rod set in place safely (*Fig. 3*). This is important for maintaining the suture site within the stapling site and avoiding double suture points. The stapler is introduced through the gastrotomy and is oriented towards the posterior gastric wall (*Fig. 4*). The stapler device trocar is extended

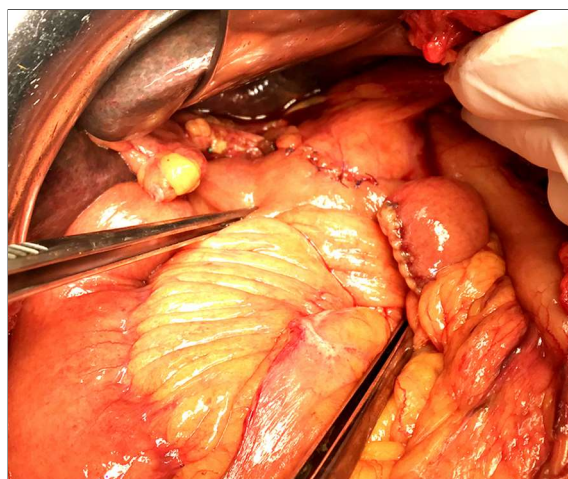


Figure 1. Completed duct-to-mucosa pancreaticojejunostomy

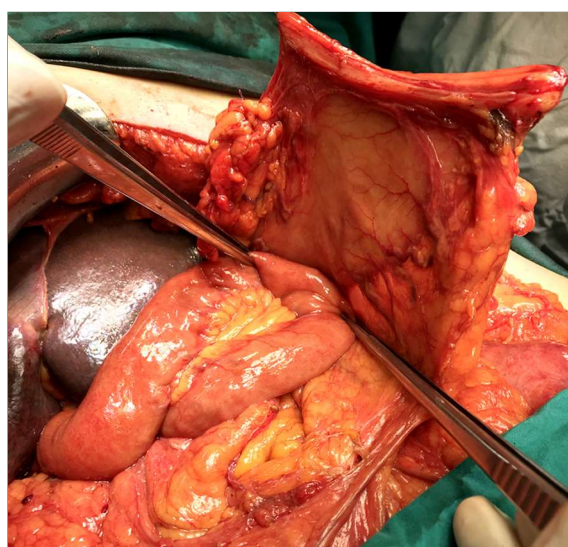


Figure 2. Choosing the anastomosis site

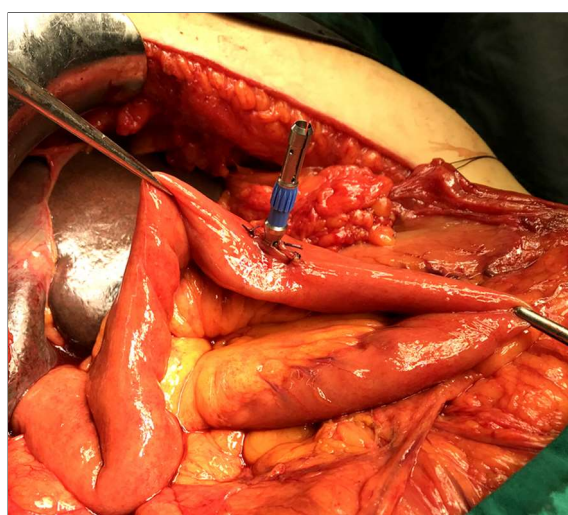


Figure 3. The anvil rod is set in place – enterotomy closed

and the anvil is attached – the stapler should fit comfortably on the posterior gastric wall and the anvil should not slip out of position. During closure of the stapler, the segments are maintained in proper position to prevent the twisting of tissue. After firing the stapler, the circular stapled suture line is inspected through the gastrotomy and possible bleeding points are sutured with 4.0 strands (*Fig. 5*). The staple line may be reinforced with Lembert sutures. The continuity of the jejunum and correct transmesocolic position of the loop are inspected. For early enteral nutrition a naso-jejunal tube is passed approximately 25 cm in the efferent loop. After proper hemostasis, the gastrotomy is closed using a linear stapler; this staple line may also be

reinforced (*Fig. 6*). The anastomotic complex is inspected with special attention to the position of the jejunal loop in order to prevent biliary reflux – this can be achieved with a few suture lines to anchor the jejunum on the posterior gastric wall. The intervention carries on with hemostasis and drainage. An intraoperative aspect of the anastomosis is presented in *Fig. 7* in a male patient (patient no 7 in *Table 1*) that underwent laparoscopic surgery for management of small bowel obstruction due to adhesions in the right iliac fossa.

Results

Seeking better gastric emptying, we moved

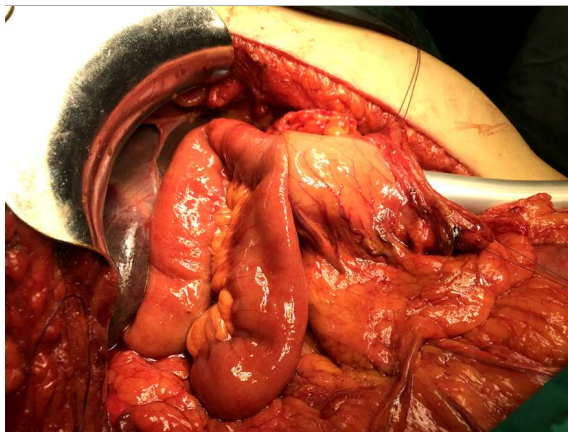


Figure 4. Stapler closure

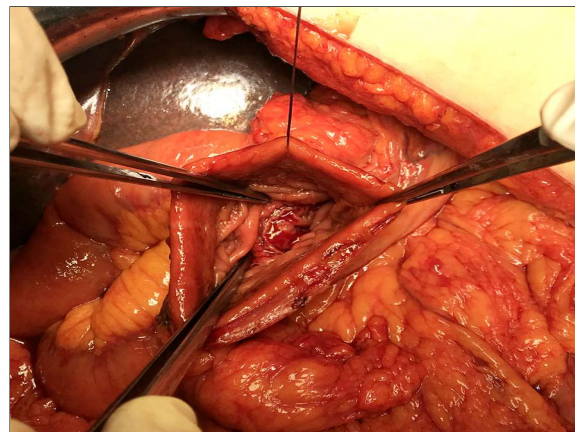


Figure 5. Inspecting the staple line

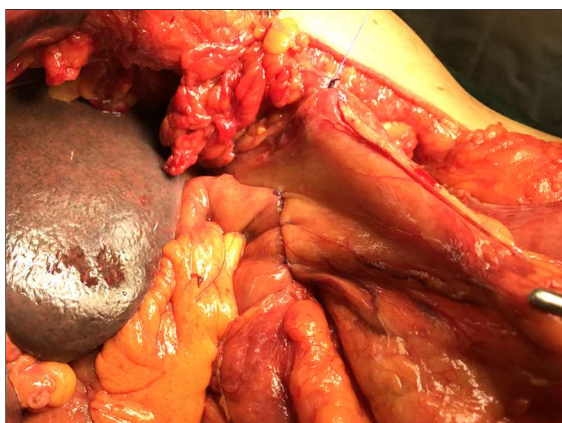


Figure 6. Completed posterior circular stapled gastroJejunostomy

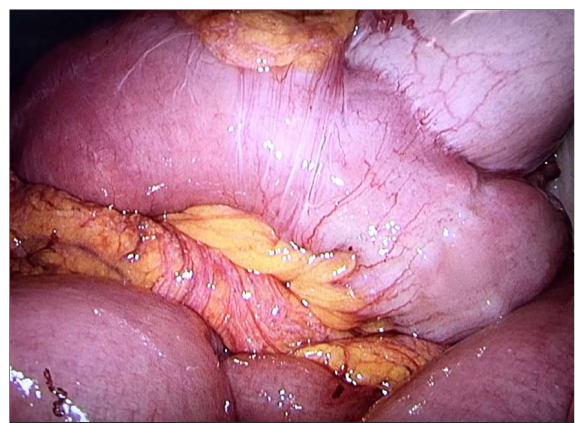


Figure 7. The posterior circular stapled gastrojejunostomy 7 months post-duodenopancreatectomy – laparoscopic management of small bowel obstruction due to adhesions in the right iliac fossa

Table 1. Patient details

Nr.	Sex, Age (Y)	DGE	PoPF	Reintervention	Events	Hospital Stay
1	F, 67	-	-	-	-	8
2	M, 58	-	-	-	-	7
3	F, 47	-	-	-	-	8
4	M, 63	-	Biochemical leak	-	C. Difficile Colitis	15
5	F, 71	Grade B	Grade B	-	SARS-CoV 2 Infection	23
6	M, 55	-	-	POD 2 Hemostasis	-	10
7	M, 73	-	-	-	-	9
8	F, 66	-	-	-	-	9
9	F, 53	Grade A	-	-	-	11
10	F, 69	-	-	-	-	9
11	F, 73	-	Grade B	POD 3 Hemostasis	Lateral Portal Resection	15
12	M, 58	-	-	-	-	8
13	M, 68	Grade A Reinsertion of NG tube in po day 4	Grade B	-	Portal resection with anastomosis	13
14	F, 65	Grade A	-	-	-	11
15	M, 45	-	-	-	-	13
16	F, 61	-	-	-	-	9
17	F, 54	-	-	Postop Renal Failure	-	18

from the traditional terminolateral gastrojejunostomy when performing either pancreaticogastrostomy or pancreaticojejunostomy to posterior circular stapled gastrojejunostomy.

Since February 2020, 17 consecutive patients underwent duodenopancreatectomy with the previously-described digestive reconstruction technique in the Surgery Department of Elias Hospital. The mean age of the patients was 61.52 years (range 45-73) and the sex ratio was F:M=1,43. All patients underwent extensive preoperative diagnostic work-up and 15 patients had biopsy proven pancreatic adenocarcinoma prior to surgery. Intraoperative exploration confirmed resectable tumors in all cases and two patients required portal resections. Final pathology reports confirmed malignant disease in all 17 patients. The reconstruction employed in all surgeries consisted of tutored duct-to-mucosa pancreaticojejunostomy, terminolateral hepaticojejunostomy and posterior circular stapled gastrojejunostomy using 25 to 28 mm Covidien™ EEA circular staplers, depending on the caliber of the jejunum. Patient details are listed in *Table 1*.

Presence of bowel movements, removal of

the nasogastric tube and solid oral intake by postoperative day 4 was obtained in 12 cases. Three patients (17,65%) developed Grade A delayed gastric emptying and one patient required reinsertion of the nasogastric tube due to Grade B pancreatic fistula that was managed conservatively, and was considered to have Grade B DGE (5.88%). Overall, the incidence of DGE was 23.5%. Three patients developed Grade B pancreatic fistula that did not require surgical reinterventions and were successfully managed conservatively. A 63 years old male patient developed biochemical leak in the setting of *Clostridioides difficile* colitis in the 6th postoperative day, but did not progress to Grade B PoPF; a 71 years old female developed pancreatic fistula in the 8th in the setting of SARS-CoV 2 infection but with moderate lung damage according to repeat CT scans. A third patient required surgical reintervention for bleeding in the 3rd postoperative day and we suspect that due to aggressive manipulation of the anastomotic complex he consequently developed a pancreatic fistula – Grade B. As expected, we did not encounter leakage from none of the

posterior stapled gastrojejunal anastomoses. Two reinterventions were required for postoperative bleeding and prolonged stay in the ICU for hemodialysis and supportive measures was necessary for one patient who developed acute renal failure in the second postoperative day. Mean hospital stay was 11.5 days (range 7-23 days). Patients with DGE had a mean hospital stay of 14.5 days, two of whom also were diagnosed with PoPF. No gastrojejunostomy leak was encountered. Mortality was nil.

Discussion

Despite several improvements in surgical technique and acute medical care and although mortality has decreased significantly, pancreaticoduodenectomy is still associated with significant morbidity.

Delayed gastric emptying is one aspect that warrants further study for prevention measures, because so far pathogenesis remains elusive and several proposals for surgical improvements have not been proven effective in controlled trials. Considering that the mere diagnosis of malignancy increases the risk of anastomotic fistula, not to mention its incrementation if other chronic afflictions are associated, we sought out to find a solution for DGE associated morbidity.

Our proposed technique is simple and reproducible but has higher costs due to the use of a circular stapler and can be employed only if pancreatic texture and surgeon preference allow safe pancreaticojejunostomy. The arguments for our technique variant are manifold: first of all, the anastomosis is placed on the posterior gastric wall thus it allows gravitational flow of the bolus; secondly, circular stapling generates a predictable and constant diameter of the anastomosis in case of edema or inflammation; lastly, this montage prevents mucosal prolapse (and its possible occlusive effects), a more frequent issue in latero-lateral anastomoses. Intraluminal visualization of the anastomosis allows inspection and prevention of intraluminal hemorrhage, yet another cause for post-duodenopancreatectomy morbidity (15). Bile reflux is

yet to be evaluated during follow-up.

We started using this technique exclusively in our General Surgery Department since February 2020 which unfortunately coincided with the global pandemic of SARS-CoV-2. One of our patients developed the disease and so did two of the authors of the paper consecutively. Mortality was nil in the studied patients. None developed leakage of the described gastrojejunostomy. Delayed gastric emptying was recorded in 4 cases: 3 Grade A DGE, one patient developed Grade B DGE and required the reinsertion of the nasogastric tube, becoming clinically relevant. The other patients resumed oral liquid and solid diet starting from POD 4 without hindrance. In two cases DGE was observed alongside PoPF, which raises the question if DGE might not always be a sign of PoPF as previously thought, but perhaps an ailment induced through other pathways. Fortunately, all cases with PoPF were managed conservatively and in one case the biochemical leak did not progress to Grade B PoPF.

So far, no technique alteration has proven useful in avoiding DGE. In randomized controlled trials, the antecolic route had similar DGE rates as the retrocolic route of gastrojejunostomy (16). The type of pancreatic anastomosis did not influence morbidity rates associated with DGE either (17). Adding a Braun enteroenterostomy did not yield better outcomes for DGE (18). We propose a simpler technical alternative for avoiding DGE and although the number of patients enrolled in the present paper is relatively small, it is important to underline that all of them benefitted from this novel surgical variant and we think larger randomized studies might further prove its usefulness.

Conclusion

The posterior stapled gastrojejunostomy after duodenopancreatectomy is a safe, swift and reproducible anastomosis. Although more costly it does shorten operative time. In larger studies, it might prove very useful in avoiding clinically relevant DGE and also PoPF.

Conflict of Interest

The authors declare that they have no conflict of interests.

Ethics Approval

This article conforms to the ethical norms and standards in the Declaration of Helsinki. The included patients have understood the information given regarding the planned treatment course and the patients' freely-given written informed consent was obtained. The study was approved by the local ethics committee - approval statement number 8046/22.11.2021.

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