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Is circular-stapled gastrojejunostomy anastomosis appropriate for pancreaticoduodenectomy?

Pankreatikoduodenektomi prosedüründe sirküler stapler ile gastrojejunostomi yapılması uygun mudur?

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ABSTRACT

Aim: Pancreaticoduodenectomy is a highly complex procedure that requires surgical experience. Among these is the use of a stapler in the construction of the gastrojejunostomy anastomosis during the procedure. Our study compares the patient outcomes of gastrojejunostomy anastomosis procedures performed manually and with a circular stapler.

Materials and Methods: Our study retrospectively evaluated the data of 44 patients who had undergone pancreaticoduodenectomy performed by the same surgical team between May 2015 and December 2019. The manual gastrojejunostomy anastomosis (n = 32) and stapled (circular stapler 25 millimeter) anastomosis (n=12) patient groups were compared for anastomotic stricture.

Results: Of the 44 patients undergoing pancreaticoduodenectomy, 68.2% were male, the mean age was 62.9±12.1 years and the mean follow-up was 28.2±21.2 months. The rate of gastrojejunostomy stricture was significantly higher in the circular stapler group ($p = 0.017; p < 0.05$).

Conclusion: The increased risk of postoperative pancreatic fistula and anastomotic stricture prevents us from recommending the use of a circular-stapler in the creation of the gastrojejunostomy anastomosis in pancreaticoduodenectomy procedures, as it increases the risk of postoperative pancreatic fistula and anastomotic stricture, and provides no operative time advantage.

Keywords: Anastomotic stricture, gastrojejunostomy, pancreaticoduodenectomy.

ÖZ

Amaç: *Pankreatikoduodenektomi, cerrahi deneyim gerektiren oldukça karmaşık bir işlemdir. İşlem sırasında gastrojejunostomi anastomozunun yapımında stapler kullanılması bunların arasında yer almaktadır. Çalışmamız elle ve sirküler stapler ile yapılan gastrojejunostomi anastomoz işlemlerinin hasta sonuçlarını karşılaştırmaktadır.*

Gereç ve Yöntem: *Çalışmamızda Mayıs 2015 ile Aralık 2019 tarihleri arasında aynı cerrahi ekip tarafından pankreatikoduodenektomi yapılan 44 hastanın verileri geriye dönük olarak değerlendirildi. Gastrojejunostomi anastomozu el ile yapılan hasta grubu ile (n=32) ve anastomozu stapler (25 milimetre sirküler stapler) ile yapılan hasta grubu(n=12) anastomoz darlığı açısından araştırıldı.*

Bulgular: *Pankreatikoduodenektomi yapılan 44 hastanın %68,2'si erkekti, yaş ortalaması 62,9±12,1 yıl ve ortalama takip süresi 28,2±21,2 aydı. Gastrojejunostomi darlığı oranı sirküler stapler grubunda anlamlı derecede yüksekti ($p = 0,017; p < 0,05$).*

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Sonuç: *Pankreatikoduodenektomi prosedüründe gastrojejunostomi anastomozunun sirküler stapler ile yapılmasını, postoperatif pankreas fistülü ve anastomoz darlığı riskini yükseltmesi, ayrıca operasyon süresi açısından da avantaj sağlamaması nedeniyle önermemekteyiz.*

Anahtar Sözcükler: *Anastomoz darlığı, gastrojejunostomi, pankreatikoduodenektomi.*

INTRODUCTION

Pancreaticoduodenectomy (PD) is a procedure that is usually performed on periampullary tumors and more rarely for benign conditions such as chronic pancreatitis and trauma. PD requires time-consuming reconstruction after a major resection that involves the reconstruction of the pancreas, the bile duct, and the gastrointestinal tract, significantly prolonging the operative time (1-2). PD is still associated with high mortality and morbidity rates, and a prolonged operative time is among the reported risk factors (3-4). Various techniques have been suggested to shorten the operative time, among which is the use of a stapler for the creation of the gastrojejunostomy (GJ) anastomosis during the procedure (5). The present study compares the patient outcomes of group who underwent circular-stapled GJ anastomosis (Ethicon Curved İntraluminal Stapler, circular 25 millimeter) (CSA) and the group who underwent manual GJ anastomosis (MA).

MATERIALS and METHODS

Upon the receipt of ethics committee approval (No: HNEAH-KAEK 2021/KK/268), patients who underwent PD in our hospital between June 2015 and December 2019 were identified, and their medical records were evaluated retrospectively. Of the 107 patients identified, 44 patients whose surgeries were performed by the same experienced team [the surgeon-in-chief (MAU) with more than 20 years of surgical experience and his/her team] and with sufficiently complete medical records and follow-ups were included in the study. Accordingly, 32 patients who underwent manual GJ anastomosis (MA) (Group 1) and 12 patients who underwent circular-stapled (circular 25 millimeter) GJ anastomosis (Group 2) were included in the study. Demographic data, complaints, preoperative and perioperative findings, operative times, pancreaticojejunostomy (PJ) techniques, presence of postoperative pancreatic fistula (POPF), pathological staging, complications, recurrence, and the need for adjuvant chemotherapy and radiotherapy were recorded.

Surgical Procedure

The patients were administered prophylactic antibiotic therapy with Ceftriaxone + Metronidazole 30 minutes as routine before the operation. A bilateral subcostal incision was made through which the perioperative pancreatic tissue and pancreatic duct width were assessed, and the most appropriate type of anastomosis was determined. At the reconstruction stage, end-to-end or end-to-side dunking, duct-to-mucosa or simple invagination techniques were used for PJ. Hepaticojejunostomy (HJ) anastomosis was performed by placing single-layer end-to-side and interrupted 4/0 or 5/0 polydioxanone (PDS) sutures. The GJ anastomosis was performed 40–50 cm distal to the HJ anastomosis using the antecolic technique. MA was performed manually in two layers, with the first layer using 3/0 Vicryl and the second layer using 4/0 PDS continuous sutures. CSA was performed using a circular stapler No. 25, which was inserted through the tip of the jejunum that had not yet been anastomosed, the bowel perforator apparatus was brought out 50 cm behind, and the anvil was placed on the posterior surface of the stomach, 3 cm away from the gastric linear incision line. A second layer was fixed on the stapler line using 4/0 PDS continuous sutures. The patients were subcutaneously administered routine octreotide 0.1 mg ampoule (3x2) for seven days postoperatively. The 2016 revision of the International Study Group of Pancreatic Surgery (ISGPS) was used to define and grade POPF (6). GJ anastomotic stricture was diagnosed using the failure of the endoscope to pass through the GJ anastomosis as a criterion during the esophagogastroscopy of symptomatic patients.

Statistical method: Descriptive statistics included mean, standard deviation, median, minimum and maximum variables, frequency and ratio. A Kolmogorov-Smirnov test was used for the assessment of the normality of the variables. An Independent Samples t-test and a Mann-Whitney U test were used to analyze quantitative data. A Chi-square test was used for the analysis of qualitative variables and a Fisher's exact test if the conditions were not met for a Chi-square test.

The analyses were performed using IBM SPSS Statistics (Version 28.0. Armonk, NY: IBM Corp.).

RESULTS

Of the patients, 68.2% were male and the mean age was 62.9±12.1 years. The demographic and clinicopathological characteristics of the groups are presented in Table-1. There were no significant differences between-group differences in terms of age, gender, ASA (American Society of Anesthesiologists) score, mass localization and adjuvant therapy, while the incidence of advanced disease was statistically significantly higher in Group 1. The operative and postoperative characteristics of the groups are presented in Table-2, in which it can be seen that the groups did not differ significantly in terms of PJ technique, operative time, amount of perioperative bleeding and the incidence of postoperative biliary leak, while the incidences of POPF and GJ stricture were statistically significantly higher in Group 2. No significant difference was found in other postoperative complications. The mean follow-up of the patients was 28.2±21.2 months.

Table 1. Demographic and clinicopathological characteristics of groups.

	Group 1 (MA) n: 32 n (%) or mean (±SD)	**Group 2 (CSA) n: 12 n (%) or mean (±SD)**	**p-value**
Age	64,6 ±11,7	58,3 ±12,3	0,127^{t}
Gender			0,113$^{X^2}$
Male	24 (75.0%)	6 (50.0%)	
Female	8 (25.0%)	6 (50.0%)	
ASA Score			0,516$^{X^2}$
I	0 (0.0%)	1 (8.3%)	
II	10 (31.3%)	4 (33.3%)	
III	19 (59.4%)	7 (58.3%)	
IV	3 (9.4%)	0 (0.0%)	
Mass settlement area			
Pancreas	20 (62,5%)	7 (58,3%)	0,800 $^{X^2}$
Ampulla of Vater	8 (25,0%)	1 (8,3%)	0,222$^{X^2}$
Distal common bile duct	3 (9.4%)	2 (16,7%)	0,603$^{X^2}$
Duodenum	0 (0.0%)	1 (8,3%)	0,273$^{X^2}$
Chronic pancreatitis	1 (3.1%)	1 (8,3%)	0,476$^{X^2}$
Pathological Stage			**0,021**$^{X^{2*}}$
0	2 (6,3%)	3 (25,0%)	
I	5 (15,6%)	4 (33,3%)	
II	15 (46,9%)	3 (25,0%)	
III	10 (31,3%)	2 (16,7%)	
Adjuvant therapy			0,095$^{X^2}$
None	15 (46,9%)	9 (75,0%)	
Chemotherapy	11 (34,4%)	2 (16,7%)	
Chemoradiotherapy	6 (18,8%)	1 (8,3%)	

MA:Manual gastrojejunostomy anastomosis;

CSA:circular-stapled gastrojejunostomy anastomosis

ASA: American Society of Anesthesiologists SD:Standard deviation ^{t}: t test; $^{X^2}$: Chi-square test (Fischer test) * :p<0.5

Table-2. Operative and postoperative characteristics of groups.

	Group 1 (MA) n: 32 n (%) or mean (±SD)	Group 2 (CSA) n: 12 n (%) or mean (±SD)	p-value
PJ Technique			
Duct to Mucosa	4 (12,5%)	0 (0.0%)	0,562 $^{X^2}$
End to End Dunking	25(78,1%)	9 (75.0%)	0,826 $^{X^2}$
End to Side dunking	1 (3,1%)	1 (8.3%)	0,476 $^{X^2}$
Simple Invagination	2 (6,3%)	2 (16,7%)	0,297 $^{X^2}$
Operation Duration	370.3 ±96,3	368.3 ±88,3	0,951 ^{t}
Peroperative Bleeding Volume (milliliter)	566,3 ±270,5	487,5 ±357,5	0,436 ^{t}
POPF			**0,015** $^{X^{2*}}$
Biochemical Leak	1 (3,1%)	2 (16,7%)	
Clinically Significant POPF	0 (0.0%)	2 (16,7%)	
POPF B	0 (0.0%)	2 (16,7%)	
POPF C	0 (0.0%)	0 (0.0%)	
Postoperative Biliary Leakage	0 (0.0%)	1 (8.3%)	0,273 $^{X^2}$
GJ anastomotic stenosis	0 (0.0%)	3 (25,0%)	**0,017** $^{X^{2*}}$
Other Postoperative Complications	5 (15,6%)	3 (25,0%)	
Wound Site Infection	2 (6,3%)	1 (8.3%)	1.000 $^{X^2}$
Delayed Gastric Emptying	1 (3,1%)	1 (8.3%)	0.476 ^{X}
Marginal ulcer	2 (6,3%)	0 (0.0%)	1.000 $^{X^2}$
Mortality	1 (3,1%)	0 (0.0%)	1.000 $^{X^2}$

MA:Manual gastrojejunostomy anastomosis;

CSA: circular-stapled gastrojejunostomy anastomosis

PJ: Pancreaticojejunostomy; POPF: postoperative pancreatic fistula; GJ: Gastrojejunostomy; SD: Standard deviation; ^{t}: t test; $^{X^2}$: Chi-square test (Fischer test); * :p<0.5

DISCUSSION

The reconstruction of the gastrointestinal tract using a stapler is a widely accepted technique during gastric and colorectal surgery, although few studies to date have evaluated the use of a stapler in PD (7-8). The first studies of this subject identified in literature belong to a Japanese group, who reported a lower incidence of delayed gastric emptying (DGE) in the stapled gastro/duodenojejunostomy anastomosis (linear or circular) group than the group who underwent manual anastomosis during a Roux-en-Y reconstruction (9-10). A subsequent prospective randomized controlled study by Sakamoto et al. compared the incidence of DGE in circular-stapled anastomosis and manual anastomosis patient groups with pyloric preserving PD but found no significant difference (11). A meta-analysis by Hajibandeh, S et al. reported the incidence of DGE to be lower in the stapled anastomosis group than in the manual anastomosis group, but the incidence of anastomotic bleeding to be higher. The same meta-analysis revealed no statistically significant difference in the rates of POPF, anastomotic leak or mortality (12). Our study, in turn, found no statistical difference in the incidence of DGE, while the rates of POPF and anastomotic stricture were significantly higher in the SA group. These differences in the data in literature may be attributed to other technical differences in the reconstruction. The study by Sato N. et al., which was the most similar to ours in terms of the reconstruction technique, compared 19 SA cases and 19 manual anastomosis cases, and revealed a shorter reconstruction time and less perioperative bleeding in the SA group, but no difference in the incidences of DGE, POPF and other complications (5). The same study reported no difference in the total operative time between the groups, and contrary to expectations, our study also established no significant difference in the total operative time between the groups.

The most remarkable finding of our study was the high incidence of anastomotic stricture in the SA group. This aspect of stapled anastomosis has not been evaluated or reported on before in PD-related literature. Studies evaluating stapled anastomoses usually focus on surgery for morbid obesity, and according to such studies, the incidence of stricture increases after manual anastomosis, linear-stapled and circular-stapled anastomoses, respectively. The reported incidence of stricture ranged from 0% and 31% for circular-stapled anastomosis (13-16).

Anastomotic tension, anastomotic leak, damage from exposure to acid and submucosal hematoma are blamed for the development of anastomotic stricture (17-18). No anastomotic stricture occurred in the manual anastomosis group in the present study, while the rate was 25% in the SA group, which can be considered a significant disadvantage of SA. The fact that the stage was significantly higher in patients in the MA group who underwent manual anastomosis in the postoperative pathological staging was considered coincidental.

A success rate of up to 75% has been reported for endoscopic dilatation for the treatment of anastomotic stricture, and very few patients may require surgery due to failure or complications of endoscopic dilatation treatment (19). In the present study, one of the three patients with a GJ stricture was treated with repeated endoscopic dilatation and did not require surgery, while the other two patients were surgically treated with anastomosis revision due to endoscopic treatment failure. The primary limitations of the study include its retrospective design, the low number of patients and the lack of endoscopically recorded anastomosis diameters.

CONCLUSION

We do not recommend circular-stapled gastrojejunostomy anastomosis over manual anastomosis for PD due to the high risk of postoperative pancreatic fistula and anastomotic stricture, and the lack of any operative time advantage.

Conflict of interest: No conflict of interest was declared by the authors.

Informed Consent: Retrospective study.

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