

Hand-sewn versus Stapled Anastomosis for Billroth II Gastrojejunostomy After Distal Gastrectomy: Comparison of Short-term Outcomes

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ABSTRACT

Introduction: Subtotal gastrectomy is usually performed in patients with distal gastric cancer. After distal gastrectomy, which reconstruction method can be used is still controversial. This study evaluated the effect of the stapler and hand-sewn techniques on postoperative results.

Methods: Patients who underwent distal gastrectomy in a single center were evaluated retrospectively in this study. Patients who underwent the Billroth II reconstruction method were analyzed. Hand-sewn and stapled techniques were compared in terms of operative and short-term postoperative outcomes.

Results: Two hundred fourteen patients were included. Most of the patients (66.8%) were male. The median age was 61 years. Billroth-II reconstruction with hand-sewn was performed in 161 (75%) patients, and the double stapler technique was performed in 53 (25%) patients. When the hand-sewn and stapled groups were compared, no difference was found in age, sex, or American Society of Anesthesiology scores. There was no difference in choosing antecolic or retrocolic as the surgical technique ($p=0.19$). A shorter length of hospital stay was detected in the stapled group ($p=0.01$). The overall complication rate was higher in the hand-sewn group (21.7% vs. 7.5%, $p=0.02$). Clavien-Dindo grade 3 and above complications were significantly higher in the hand-sewn group (13.7% vs. 3.8%, $p=0.02$).

Conclusion: Our study showed that the stapler anastomosis technique for Billroth II gastrojejunostomy after distal gastrectomy led to fewer overall complications and shortened hospital stays.

Keywords: Surgical staple, hand-sewn anastomosis, anastomosis technique, Billroth II, gastroenterostomy, gastric cancer

Introduction

Gastric cancer is the fifth most common cancer and the fourth most common cause of cancer-related deaths (1). Today, in most cases, surgical resection is still the only curative treatment option for gastric cancer. Subtotal or distal gastrectomy is frequently applied for patients with gastric cancer in the lower 2/3 of the stomach (2). After distal gastrectomy, Billroth I, Billroth II, and Roux-en-Y reconstruction methods can be used for gastrointestinal anastomosis (3). Postoperative conditions such as delayed gastric emptying, dumping syndrome, reduced food intake, and reflux esophagitis are defined as postgastrectomy syndromes, usually affecting patients' quality of life (4). These reconstruction procedures may cause postgastrectomy syndrome, and all these techniques are still contentious (3). When we think that we have chosen the most suitable reconstruction method for our patient, we must make a second decision: Should we do the anastomosis hand-sewn or stapled? The

most appropriate approach for gastrojejunostomy anastomosis is still controversial (3,5,6).

This study evaluated the effect of the stapler and hand-sewn techniques on postoperative outcomes.

Methods

Patients who underwent subtotal gastrectomy for gastric cancer were retrospectively evaluated between January 2014 and January 2020 at Marmara University Hospital. Local approval was obtained from the Ethics Committee of Marmara University (approval number: 09.2021.1088, date: 08.10.2021).

The demographics, reconstruction procedures, surgical approaches, comorbid diseases, and postoperative complications were analyzed retrospectively. Patients who underwent elective surgery because of gastric cancer in whom radical gastrectomy without multiorgan



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resection were included in the study. Patients who underwent the Roux-en-Y reconstruction method, urgent surgery, multiorgan resection, and palliative surgery were excluded from the study. Two grams of intravenous cefazolin (ciprofloxacin for allergic patients) were administered for prophylaxis. For venous thromboembolism prophylaxis, low molecular weight heparin was given to all patients perioperatively. All patients underwent an open DSG. After resection, the reconstruction technique was performed differently due to surgeon preference. Postoperative complications were graded according to the Clavien-Dindo classification (7).

Surgical procedure

The primary surgeon of the operation decided whether the gastrojejunostomy anastomosis would be performed using the Billroth-II or Roux-en-Y reconstruction technique. Similarly, the primary surgeon determined whether antecolic/retrocolic and stapler/ hand-sewn anastomosis techniques could be applied to the anastomosis. A linear stapler was used for duodenal stump closure in all patients.

We applied a linear stapler (GIA 100 mm Stapler with DST Series, Medtronic, MN, USA) on the lesser curvature side for the transection line in the hand-sewn technique. The greater curvature side was cut by cautery, and hand-sewn anastomosis was performed between the jejunum and the cautery-cut side of the remnant stomach, as follows. The jejunum was brought into the stomach pouch about 12-15 cm from the ligament of Treitz. The antimesenteric aspect of the jejunum was measured, and an area of approximately 5 cm was determined. The first posterior suture line was placed behind this suture line but parallel to it. The jejunum was attached to the gastric pouch with 2-0 black silk seromuscular Lembert sutures placed approximately 5 mm apart. After cutting off the remaining silk tails, the first and last sutures were left long and held with a hemostat. An incision was made with electrocautery along the antimesenteric scratch line in the jejunum. The jejunal mucosa was open and checked for bleeding points. The incision in the jejunum was kept a few millimeters shorter than the diameter of the opening in the gastric pouch. Then, the inner layer of anastomosis was completed with 3-0 vicryl and posterior and anterior all-layer sutures. The anterior layer was completed with a row of interrupted 2-0 black silk seromuscular Lembert sutures. A crown stitch was inserted at the medial margin of the anastomosis (8,9).

A linear cutting stapler was placed on the proximal surgical margin and fired to complete the resection with the double stapler technique. After a complete transection of the stomach, stapled anastomosis was performed between the posterior side of the stomach and jejunum by using a linear stapler (GIA 60 mm Stapler with DST Series, Medtronic, MN, USA).

Statistical Analysis

We performed statistical analyses using the Statistical Package for Social Sciences for Windows Version 20 (SPSS Inc., Chicago, IL, USA). Two-tailed chi-square or Fisher's exact tests were used to compare categorical variables. Independent two-sample t-tests or Mann-Whitney U tests were used to compare ordinal data. After adjusting for potential confounders, regression analyses were used to evaluate the relationship between

demographic characteristics and delayed gastric emptying. P values less than 0.05 were considered statistically significant.

The primary outcome of this study was to compare the short-term outcomes of two different anastomosis techniques in patients who underwent distal gastrectomy. Secondary outcomes are other potential risk factors for postoperative complications.

Results

Two hundred seventy-five patients were evaluated. Twenty-three patients who underwent Roux-en-Y reconstruction methods, 14 patients who underwent an urgent operation, and 11 patients who underwent multi-visceral resection were excluded. In addition, 13 patients were excluded from the assessment because of palliative resection. Two hundred fourteen patients were included in the study; 143 (66.8%) patients were male, and 71 (33.2%) patients were female. The median age was 61 years (32-87). The American Society of Anesthesiology (ASA) scores of the patients were mostly ASA I and ASA II (Table 1).

All patients underwent gastrojejunostomy anastomosis with Billroth-II reconstruction. Billroth-II reconstruction was performed by hand-

Table 1. Demographic and perioperative characteristics of patients

Parameters	n=214 (%)
Age (median-range)	61 (32-87)
Sex	
Female	71 (33.2)
Male	143 (66.8)
ASA scores	
I	68 (31.8)
II	97 (45.3)
III	43 (20.1)
IV	6 (2.3)
Comorbidity	
Diabetes mellitus	33 (15)
Hypertension	68 (32)
Coronary artery disease	33 (15)
Chronic obstructive pulmonary disease	18 (8)
Smoking (present)	133 (46)
Neoadjuvant therapy	11 (5.1)
Anastomosis technique	
Hand-sewn	161 (75.2)
Stapled	53 (24.8)
Clavien-Dindo classification	
No complication	229 (78.6)
Grade 1	21 (7.2)
Grade 2	6 (2)
Grade 3	20 (6.8)
Grade 4	0 (0)
Grade 5	8 (2.7)
Length of stay (median-range)	5 (2-63)

ASA: American Society of Anesthesiology

sewn in 161 (75%) patients. However, the double stapler technique was performed in 53 (25%) patients. Demographic and perioperative characteristics are shown in Table 1.

Patients were divided into hand-sewn and stapled technique groups. When the two groups were compared, no difference was found in age, sex, or ASA scores (Table 2).

When the complications were examined between hand-sewn vs. stapled groups, anastomotic leakage, stump leakage, bleeding, postoperative ileus, delayed gastric emptying, and other (pulmonary) complications occurred in hand-sewn groups 6, 8, 1, 7, 9, and 4 patients, respectively, and occurred in stapled group 0, 0, 1, 3, 0, and 0 patients, respectively. The total of these was evaluated as overall complications, and patients with and without complications were compared; there was no significant difference in sex, ASA score, hypertension, diabetes mellitus, or coronary artery disease. Overall complications were more common in older patients (65 vs. 61 years $p=0.03$) and patients with chronic obstructive pulmonary disease (COPD) (23% vs. 5% $p=0.001$).

The overall complication rate was higher in the hand-sewn group (21.7% vs. 7.5%, $p=0.02$). Clavien-Dindo grade 3 and above complications were significantly higher in the hand-sewn group (13.7% vs. 3.8%, $p=0.02$). There was no difference in choosing antecolic or retrocolic as the

surgical technique ($p=0.19$). While reoperation was more common in the hand-sewn group (7.5%), mortality was observed in 4 (2.5%) patients in this group (Table 2).

The factors affecting the occurrence of total complications were examined. Age, presence of COPD, and hand-sewn anastomosis were evaluated as independent risk factors in the univariate analysis ($p=0.03$, $p=0.001$ and $p=0.02$ respectively). Multivariate analysis showed COPD and hand-sewn anastomosis as significant risk factors for overall complications ($p=0.001$, $p=0.008$, respectively) (Table 3).

Discussion

There are various anastomosis techniques defined for distal gastrectomy. These have been compared in the literature, but different results have been found regarding postoperative outcomes (10). Billroth II anastomosis is frequently performed because of its simplicity and low risk of anastomotic tension, but it can cause biliary reflux gastritis, esophagitis, or dumping syndrome (11). Mechanical staplers have been used for gastrointestinal surgery for almost 50 years and are now widely used during open or laparoscopic gastrectomy for gastric cancer. Many studies did not show a significant difference in the occurrence of suture failure between hand suturing and mechanical stapling (12-14).

Table 2. Comparison of hand-sewn and stapled groups

Parameters	Hand-sewn technique (n=161) (%)	Stapled technique, (n=53) (%)	p-value
Age (years, SD)	62 (12)	61 (11.4)	0.7
Sex			
Female	58 (36)	13 (25)	0.12
Male	103 (64)	40 (75)	
ASA scores			
I	53 (33)	15 (28)	0.7
II	70 (43)	27 (51)	
III	34 (21)	9 (17)	
IV	4 (3)	2 (4)	
Comorbidity			
Diabetes mellitus	26	7	0.6
Hypertension	52	16	0.71
Coronary artery disease	28	5	0.2
Chronic obstructive pulmonary disease	10	8	0.05
Antecolic	86 (55.5)	24 (45.3)	0.19
Retrocolic	69 (44.5)	29 (54.7)	
Duration of operation (minutes)	120	121	0.8
Overall complications			
Present	25 (21.7)	4 (7.5)	0.02
Clavien-Dindo classification			
Grade 3 and above	22 (13.7)	2 (3.8)	0.02
Reoperation	12 (7.5)	1 (1.9)	0.14
Length of hospital stay (days, mean)	6.6	5.0	0.01
Mortality	4 (2.5)	0	0.22

ASA: American Society of Anesthesiology, SD: Standard deviation

Table 3. Univariate and multivariate regression analyses for risk factors for overall complications

Variables	Univariate			Multivariate		
	HR	95% CI	p-value	HR	95% CI	p-value
Age	1.034	1.002-1.067	0.03	1.026	0.993-1.060	0.12
COPD	0.181	0.066-0.492	0.001	0.125	0.03-0.407	0.001
Anastomosis type	3.403	1.143-10.07	0.02	5.365	1.56-18.41	0.008
Sex	0.75	0.35-1.66	0.46			
ASA score	0.68	0.11-4.22	0.37			

ASA: American Society of Anesthesiology, COPD: Chronic Obstructive Pulmonary Disease, CI: Confidence interval, HR: Hazard ratio

Some studies suggest that the stapled anastomosis technique is shorter than hand-sewn anastomosis and affects surgical outcomes by shortening the operation time. Additionally, some studies do not show a time difference between the two techniques (6,15). In this study, we found that the hand-sewn or stapled technique did not affect the duration of surgery. We did not compare the two methods, particularly in terms of anastomosis time, but based on our experience, we can say that there is a minimal difference. We think that the duration of hand-sewn anastomosis depends on surgical experience; therefore, it did not make a difference in operation time in our study.

Postoperative anastomotic leakage is associated with increased morbidity and mortality. There are studies in the literature reporting different results in terms of anastomotic leakage compared with hand-sewn and stapled techniques (5,6,13,14). In our study, we found a more anastomotic and stump leakage in the hand-sewn group. Stapling anastomosis is thought to prevent anastomotic edema or stenosis and facilitate easier drainage of food contents (16). In line with this, we found a lower delayed gastric emptying rate in the stapled technique group. Although we could not find a difference when we examined the complication rates one by one, looking at the overall complications and classifying according to Clavien-Dindo, the hand-sewn group had significantly higher rates. Simultaneously, this high complication rate in the hand-sewn group did not affect reoperation or mortality rates.

Contrary to many studies, we found a shorter length of hospital stays in the stapled group (12,13,17). We think this is due to the prolonged length of hospital stay due to complications in the hand-sewn group.

Study Limitations

Our study had several limitations. It is a single-center and low-volume study. This study is a retrospective analysis, so selection bias cannot be eliminated. We analyzed the data for one surgical method, but different surgeons performed the surgeries. The power of statistical evaluation may have been influenced by the proportion of patients between the two groups with different numbers. The gastrojejunostomy time was not recorded for all patients. This study reported only short-term results; further analysis is needed to determine long-term outcomes.

Conclusion

There are various anastomosis techniques defined for distal gastrectomy. Our study showed that the stapler anastomosis technique for Billroth II gastrojejunostomy after distal gastrectomy led to fewer overall complications and shortened hospital stays. However, prospective

randomized studies with many patients are needed to determine which complications are particularly affected by the anastomosis technique.

Ethics Committee Approval: Local approval was obtained from the Ethics Committee of Marmara University (approval number: 09.2021.1088, date: 08.10.2021).

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