Article published online: 2023-06-29

Endoscopic closure versus surgical revision in the management of gastro-gastric fistula following Roux-en-Y gastric bypass

OPEN ACCESS

Authors

Russell D. Dolan[1], Pichamol Jirapinyo[1], Ethan D. Maahs[1], Christopher C. Thompson[1]

Institutions

1 Division of Gastroenterology, Hepatology and Endoscopy. Brigham and Women's Hospital, Boston, Massachusetts, United States

submitted 17.11.2021

accepted after revision 9.5.2022

Bibliography

Endosc Int Open 2023; 11: E629–E634

DOI 10.1055/a-2037-4764

ISSN 2364-3722

Georg Thieme Verlag KG, Rüdigerstraße 14, 70469 Stuttgart, Germany

Corresponding author

Christopher C. Thompson MD, MSc, AGAF, FACG, FASGE, FJGES, Brigham and Women's Hospital, Division of Gastroenterology, Hepatology and Endoscopy, 75 Francis Street, Boston, MA 02115, United States

Fax: +1-617-525-8740

cthompson@hms.harvard.edu

ABSTRACT

Background and study aims Gastro-gastric fistulae (GGF) occur in 1.3% to 6% of Rouxy-en-Y gastric bypass (RYGB) patients and can be associated with abdominal pain, reflux, weight regain and onset of diabetes. Endoscopic and surgical treatments are available without prior comparisons. The study aim was to compare endoscopic and surgical treatment methods in RYGB patients with GGF.

Patients and methods A retrospective matched cohort study of RYGB patients who underwent endoscopic closure (ENDO) or surgical revision (SURG) for GGF. One-to-one matching was performed based on age, sex, body mass index and weight regain. Patient demographics, GGF size, procedural details, symptoms and treatment-related adverse events (AEs) were collected. A comparison of symptom improvement and treatment-related AEs was performed. Fisher's Exact, *t*-test and Wilcoxon Rank Sum tests were performed.

Results Ninety RYGB patients with GGF (45 ENDO, 45 matched SURG) were included. GGF symptoms included weight regain (80%), gastroesophageal reflux disease (71%) and abdominal pain (67%). At 6 months, the ENDO and SURG groups experienced 0.59% and 5.5% total weight loss (TWL) ($P=0.0002$). At 12 months, the ENDO and SURG groups experienced 1.9% and 6.2% TWL ($P=0.007$). Abdominal pain improved in 12 (52.2%) ENDO and 5 (15.2%) SURG patients at 12 months ($P=0.007$). Diabetes and reflux resolution rates were similar between groups. Treatment-related AEs occurred in four (8.9%) ENDO and 16 (35.6%) SURG patients ($P=0.005$), of which none and eight (17.8%), respectively, were serious ($P=0.006$).

Conclusions Endoscopic GGF treatment produces greater improvement in abdominal pain and fewer overall and serious treatment-related AEs. However, surgical revision appears to yield greater weight loss.

Introduction

Roux-en-Y gastric bypass (RYGB) is one of the most common surgical bariatric procedures performed worldwide [1], with estimates of more than 40,000 cases performed in the United States in 2018 alone [2]. Among available bariatric procedures, RYGB has been associated with the most significant weight reduction and improvement in metabolic parameters, including diabetes mellitus, hypertension and hyperlipidemia [3–5].

Although safe with low morbidity and mortality, RYGB can be associated with the onset of late complications, including the undesirable effect of weight regain [6]. One of the anatomic causes of weight regain is the development of a gastro-gastric fistula (GGF), which develops as an abnormal communication from the gastric pouch and excluded remnant stomach or jejunum near the gastrojejunal anastomosis and occurs in from 1.3% to 6% of operations [7,8]. Predominant symptoms associated with GGF include nausea, vomiting, recurrent or

new onset diabetes, abdominal pain, gastroesophageal reflux disease (GERD) and most commonly, weight gain [7].

Although medical management with acid suppression may be utilized to manage some symptoms associated with GGF, a large number of patients require endoscopic or surgical treatment to perform GGF excision or closure [9]. There remains no standard approach to procedural GGF repair, as both endoscopic and surgical (open vs laparoscopic) techniques have demonstrated success [9–11]. Endoscopic GGF treatment has been shown to be safe, with treatment-related adverse events (AEs) reported between 0 % in a study involving eight patients followed between 8 and 46 months [12] and 2.1 % (n = 2) in a study involving 95 patients followed for 18 months [11]. However, despite low risk, durability of symptom resolution and GGF closure has been variable following endoscopy, where 0 % of GGF > 20 mm and 32 % of GGF < 10 mm have been shown to remain closed at an average of 395 days [11]. In contrast, although AE rates have been higher following surgical treatment (25 %), GGF closure has been reported as durable in the majority of patients [9]. However, a direct comparison of symptom amelioration, durable weight loss and treatment-related AEs between endoscopy and surgery has not previously been performed. The current study aimed to compare the efficacy and safety of endoscopic closure and surgical revision of GGF in RYGB patients.

Patients and methods

Study design

This was a retrospective matched cohort study of patients with GGF who underwent endoscopic (ENDO) or surgical (SURG) treatment at two tertiary referral centers. Patients were identified through a systematic patient search using a large Research Patient Data Registry to evaluate patients who received treatment for GGF that was deemed technically successful at the time of the intervention. Institutional Review Board approval was obtained for retrospective review of data used in this study (approval number: 2003P-001597, renewed approval on May 8, 2020).

ENDO patients were matched 1:1 to SURG patients based on age within 5 years, sex, body mass index within 5 kg/m^2 and percentage of weight regain from that lost after initial RYGB within 10 %. Data on patient demographics, GGF size, procedural details, symptoms related to GGF and treatment-related AEs were collected. Data on symptoms of onset or recurrence of diabetes, acid reflux, abdominal pain and weight parameters were extracted. Inclusion criteria included adult patients (> 18 years) with the diagnosis of GGF through prior imaging (upper gastrointestinal series, computed tomography of the abdomen) or esophagogastroduodenoscopy and having undergone GGF repair (endoscopic or surgical). Patients were excluded if they underwent endoscopic or surgical treatment for an alternative diagnosis to GGF.

Measures

A comparison of symptom improvement between ENDO and SURG following GGF treatment at 12 months was evaluated. Specifically, resolution of diabetes, acid reflux, abdominal pain and weight parameters were compared. Weight measurements included weight regain (defined as having gained > 15 % of maximum post-RYGB weight loss), total weight change (lb) and percentage of total weight loss (%TWL) between GGF treatment and end of the follow-up period. Additional comparisons were performed of overall treatment-related AE rates and serious (severe) treatment-related AE rates between groups. Treatment-related AEs were recorded per validated reporting standards. For treatment-related AEs associated with endoscopy, the American Society for Gastrointestinal Endoscopy lexicon was referenced [13]. This reporting system, developed in collaboration with representatives of the National Surgical Quality Improvement Program, has been endorsed by the American College of Surgeons as a reliable surgical AE reporting platform [14, 15].

Statistical analysis

Standard statistical analyses were performed, including a Fisher's exact test used to compare symptom profiles and treatment-related AE rates (categorical variables) and either student's *t*-test or Wilcoxon Rank Sum test used for weight profile comparisons (continuous variables) based on data normality. A kurtosis value < 1 was determined to exhibit adequate normality for comparisons based on sample sizes. Comparisons were considered statistically significant when $P < 0.05$. All statistical analyses were performed using SAS software, version 9.4 (SAS Institute, North Carolina, United States).

Results

A total of 90 RYGB patients with GGF (45 ENDO, 45 matched SURG) were included (▶ **Table 1**). Baseline characteristics were similar between groups. Specifically, the mean (SD) age was 49.7 years (10.3) in the ENDO group compared to 49.2 years (10.2) in the SURG group and both groups contained 37 (82.2%) females. The overall average GGF size was 15 ± 9 mm (14.6 ± 9.4 mm in the ENDO group and 15.9 ± 8.4 mm in the SURG group). The average time between RYGB and GGF treatment was 8.9 ± 5.3 years (9.7 ± 5.7 years in the ENDO group and 8.1 ± 4.8 years in the SURG group). GGF symptoms included new or recurrent onset of diabetes in 11 (25.6 %) and 16 (36.4%), acid reflux in 34 (79.1 %) and 33 (75 %), abdominal pain in 23 (53.5 %) and 33 (75 %) and weight regain in 37 (82.2%) and 35 (77.8 %) in the ENDO and SURG groups, respectively.

Endoscopic closure methods (▶ **Table 2**) included argon plasma coagulation (APC) with endoscopic suturing (n = 18), APC with endoscopic plication (n = 7), endoscopic submucosal dissection (ESD) with endoscopic suturing (n = 6), APC with endoscopic plication, clips and fibrin glue (n = 2), APC with endoscopic plication and clips (n = 2), endoscopic suturing alone (n = 2), APC with endoscopic plication and glue (n = 2),

▶ **Table 1** Baseline cohort characteristics.

Characteristics	Endoscopy (n = 45)	Surgery (n = 45)
Sex (female) – n (%)	37 (82.2)	37 (82.2)
Age – mean (SD) years	49.7 (10.3)	49.2 (10.2)
Duration between RYGB and revision (years) – mean (SD)	9.7 (5.7)	8.1 (4.8)
Pre-RYGB weight (lb) – mean (SD)	307.4 (63.7)	299.7 (54.0)
Nadir weight (lb)	183.5 (45.4)	171.7 (44.7)
Weight at surgical revision (lb)	227.2 (55.1)	222.0 (56.6)
BMI at surgical revision (kg/m^2)	36.9 (7.5)	36.8 (8.0)
Weight regain (% of maximal weight loss)	36.4 (22.6)	39.6 (25.5)
GGF size (mm)	14.6 (9.4)	15.9 (8.4)
Pre-revision symptoms – n (%)		
▪ Diabetes onset	11 (25.6 %)	16 (36.4 %)
▪ Acid reflux	34 (79.1 %)	33 (75 %)
▪ Abdominal pain	23 (53.5 %)	33 (75 %)
▪ Weight regain	37 (82.2 %)	35 (77.8 %)

Characteristics of Roux-en-Y gastric bypass patients who underwent endoscopic closure or surgical revision of gastro-gastric fistula.
SD, standard deviation; RYGB, Roux-en-Y gastric bypass; GGF, gastro-gastric fistula.

▶ **Table 2** Endoscopic techniques used for fistula closure.

Method of endoscopic treatment	n = 45
APC, suture	18
APC, endoscopic plication	7
ESD, suture	6
APC, endoscopic plication, clips and fibrin glue	2
APC, endoscopic plication and clips	2
Endoscopic suturing alone	2
APC, endoscopic plication, glue	2
Clips alone	2
APC, ESD, suture	1
APC, clips	1
Clips, glue	1
Stent to cover fistula	1

APC, argon plasma coagulation; ESD, endoscopic submucosal dissection. Endoscopic suturing was performed using the Apollo Overstitch device (Apollo Endosurgery, Austin, Texas, United States). Endoscopic plication was performed using the Bard Endocinch device (Bard, Warwick, Rhode Island, United States). Fibrin glue was used for glue.

clips alone (n = 2), APC with ESD and endoscopic suturing (n = 1), APC and clip (n = 1), clips and glue (n = 1) and stent alone (n = 1). Endoscopic suturing was performed using the Apollo Overstitch device (Apollo Endosurgery, Austin, Texas, United States) in an interrupted, running or purse string fashion depending on fistula size and location. Endoscopic Plication was performed using the Bard Endocinch device (Bard, Warwick, Rhode Island, United States). Surgical revision methods included laparoscopic GGF resection (n = 31) or open resection of GGF (n = 14).

At 12 months, both groups experienced similar resolution of diabetes mellitus and improvement in GERD; however, endoscopic revision was associated with more frequent improvement in abdominal pain (▶ **Table 3**). Specifically, resolution of diabetes (among those in which diabetes was present) occurred in one (9.1 %) and one (6.3 %) in the ENDO and SURG groups, respectively (P = 1.0) and reflux symptoms (among those in which they were present) were improved in seven (20.6 %) and two (6.1 %) in the ENDO and SURG groups, respectively (P =

▶ **Table 3** Presence of symptoms associated with gastro-gastric fistula at 1 year.

Post-procedure characteristics	Endoscopy (n = 45)	Surgery (n = 45)	*P* value
Diabetes resolution[1] – n (%)	1 (9.1)	1 (6.3)	1.0
GERD improvement[1] – n (%)	7 (20.6)	2 (6.1 %)	0.15
Abdominal pain improvement[1] – n (%)	12 (52.2)	5 (15.2)	0.007
6-month weight change – lb	2.8 (10.4)	10.5 (7.8)	0.0005
6-month %TWL[2] – %	0.59 (5.7)	5.5 (3.9)	0.0002
12-month weight change[2] – lb	4.2 (18.8)	14.1 (14.9)	0.02
12-month %TWL[2] – %	1.9 (6.9)	6.2 (5.2)	0.007

Presented as mean (standard deviation) for normal variables.
†Median (interquartile range) for non-normal variables. Fisher's exact test performed for categorical variables and Wilcoxon Rank Sum test performed for non-normal continuous variables (weight change).
[1] Calculated at 12 months using number of patients with initial symptoms in each cohort as shown in Table 1.
[2] Median (interquartile range) for non-normal variables. Fisher's exact test performed for categorical variables and Wilcoxon Rank Sum test performed for non-normal continuous variables (weight change).

▶ **Table 4** Treatment-related adverse events over 12-month follow-up duration.

Treatment-related adverse events	Endoscopy (n = 45)	Surgery (n = 45)	*P* value
Overall treatment-related adverse events – n (%)	4 (8.9)	16 (35.6)	0.005
▪ Marginal ulceration	3 (6.7)	0	
▪ Abdominal pain	1 (2.2)	3 (6.7)	
▪ Gastrointestinal leak	0	4 (8.9)	
▪ Abscess	0	3 (6.7)	
▪ Gastrointestinal bleeding	0	1 (2.2)	
▪ Small bowel obstruction	0	1 (2.2)	
▪ Gastrojejunal anastomotic stricture	0	1 (2.2)	
▪ Abdominal hernia	0	3 (6.7)	
Serious treatment-related adverse events – n (%)	0	8 (17.8)	0.006

Treatment-related adverse events observed during the 12-month follow-up duration following treatment for gastro-gastric fistula.

0.15). Abdominal pain improved in 12 (52.2%) ENDO and five (15.2%) SURG patients at 12 months ($P = 0.007$).

At 6 months, 35 (78%) of the ENDO group and 40 (89%) of the SURG group stopped gaining weight ($P = 0.23$) with the ENDO and SURG groups experiencing 0.59% and 5.5% total weight loss (TWL) ($P = 0.0002$), respectively (▶ **Table 3**). At 12 months, 59% of the ENDO group and 93% of the SURG group stopped gaining weight ($P = 0.007$) with the ENDO and SURG groups experiencing 1.9% and 6.2% TWL ($P = 0.007$), respectively.

Treatment-related AEs occurred in four (8.9%) ENDO and 16 (35.6%) SURG patients ($P = 0.005$) (▶ **Table 4**). Among treatment-related AEs, none and eight (17.8%) were serious (severe) in the ENDO and SURG groups, respectively ($P = 0.006$). Treatment-related SAEs in the SURG group included leak (4), abdominal hernia (3), abscess (3), severe abdominal pain (3), gastrointestinal bleeding (1), small bowel obstruction (1) and gastrojejunal anastomotic stricture (1). Among AEs, the open surgical technique was associated with three abdominal hernias, two leaks, one severe abdominal pain and one small bowel obstruction. The remainder of AEs in the surgical group occurred using the laparoscopic technique.

Discussion

GGF is an uncommon late complication following RYGB; however, it is associated with undesirable symptoms of recurrence or onset of diabetes, abdominal pain, acid reflux and weight regain [7]. Subsequently, repair through either endoscopic or surgical approaches is often required. The present study is currently the largest study directly comparing the efficacy and safety of endoscopic to surgical treatment of GGF in RYGB patients.

The endoscopic approach was associated with similar rates of diabetes and GERD improvement, higher rates of abdominal pain improvement, but with a lower AE rate compared to surgical revision. The difference in abdominal pain may at least be in part due to differences in AE rates, particularly given that only severe treatment-related AEs occurred within the surgical group. In addition, the endoscopic approach avoids the need for de novo incisions that are required with the surgical approach, reducing additional potential pain sources.

Treatment-related AEs occurred four-fold more frequently in the surgical repair (n = 16; 35.6%) as compared to endoscopic (n = 4; 8.9%) group and serious (severe) treatment-related AEs only occurred in the surgery group. The observed complications differed between groups and likely related to procedural approach, which may have contributed to the magnitude of weight loss in either group, particularly the surgical group based on the character of treatment-associated AEs. Marginal ulceration (3) and severe abdominal pain (1) were observed in the endoscopic repair group, which may be the result of localized tissue ischemia from tissue approximation. An increased rate of surgical complications following surgical repair is expected given the invasive nature in comparison, particularly when using the open surgical approach. Leak (4), abdominal hernia (3), abscess (3), severe abdominal pain (3), gastrointestinal bleeding (1), small bowel obstruction (1) and gastrojejunal anastomotic stricture (1) observed were similar to previous studies [9]. Furthermore, these treatment-related AEs may have contributed to the greater amount of weight loss seen in the surgical group at 6 and 12 months.

The magnitude of weight loss achieved over 1 year following surgical GGF repair in this study (14.1 lb; 6.4 kg) is also similar to prior studies evaluating surgical GGF repair (13.7 lb; 6.0 kg) [16]. This may be partially attributable to fistula size (15 ± 9mm) being more amenable to surgical repair, as prior studies have demonstrated GGF size < 10 mm diameter is associated with better outcomes following endoscopic repair [11]. A notable limitation historically with endoscopic intervention is instrument size, which is restricted to allow passage through the transoral approach. This requires utilization of a variety of smal-

ler-scale methods to achieve fistula repair, such as endoscopic clipping, fibrin glue or gastroplication [11, 17]. Notably, although the present study incorporated a variety of repair methods including combinations of APC, ESD, gastroplication, endoscopic suturing, clips, fibrin glue and stent, there were no statistically significant differences in symptom resolution or weight changes when stratifying by endoscopic suturing and other repair methods. This lends credence to the individualized approach that should be pursued when endoscopically treating GGF, as they can vary in size and location. Although an algorithmic approach toward treating GGF is desired, the variable characteristics (i. e. size, number, tissue quality and location) of GGFs requires an individualized approach to treatment, particularly as new devices emerge. In contrast, surgical repair allows the introduction of larger instruments to permit GGF repair with staple closure [18], excision [9], RYGB/gastrojejunal anastomosis revision or partial gastrectomy [19], where ultimately fistula resection may provide a more definitive treatment.

There are a few limitations to the present study. This was a retrospective cohort study and, therefore, despite controlling for patient characteristics, residual confounding remains possible. The patient population was also limited to two large tertiary referral centers within a single region, limiting generalizability of results. However, this likely reflects routine practice as referral to expert centers is common. In addition, longer duration of follow-up would provide greater insight into the durability of GGF treatment in either group, most notably that of weight trends, as GGF often leads to weight gain.

Conclusions

In conclusion, endoscopic repair of GGF results in clinically and statistically fewer overall and serious treatment-related AEs and greater resolution of abdominal pain when compared to surgical repair. In contrast, surgical revision appears to yield greater weight loss at 1 year.

Competing interests

Dr. Jirapinyo has received research support from Apollo Endosurgery and Fractyl and served as a consultant for Endogastric Solutions. Dr. Thompson is a consultant and has received research support from Apollo Endosurgery, received research support from Aspire Bariatrics, been a General Partner with BlueFlame Healthcare Venture Fund, served as a consultant for and received research support from Boston Scientific, been a consultant for Covidien/Medtronic, is a founder, consultant and board member for Enterasense Ltd and Envision Endoscopy, has received an institutional research grant from ERBE, is a consultant/advisory board member for Fractyl, has served as a consultant for and received a research grant from FujiFilm, is a consultant for and has received an institutional research grant from GI Dynamics, is a founder, board member and has an ownership interest in GI Windows, is a consultant and has received an institutional research grant from Lumendi, is a consultant and has received research support from Olympus/Spiration, and has served as a consultant and advisory board member and received an institutional research grant from USGI Medical.

Funding

National Institutes of Health P30 DK034854,T32 DK007533

References

[1] Rosenthal RJ, Szomstein S, Kennedy CI et al. Laparoscopic surgery for morbid obesity: 1,001 consecutive bariatric operations performed at The Bariatric Institute, Cleveland Clinic Florida. Obes Surg 2006; 16: 119–124

[2] American Society of Metabolic and Bariartic Surgery. Estimate of Bariatric Surgery Numbers, 2011–2020. https://asmbs.org/resources/estimate-of-bariatric-surgery-numbers

[3] Robert M, Espalieu P, Pelascini E et al. Efficacy and safety of one anastomosis gastric bypass versus Roux-en-Y gastric bypass for obesity (YOMEGA): a multicentre, randomised, open-label, non-inferiority trial. Lancet 2019; 393: 1299–1309

[4] Hayoz C, Hermann T, Raptis DA et al. Comparison of metabolic outcomes in patients undergoing laparoscopic Roux-en-Y gastric bypass versus sleeve gastrectomy – a systematic review and meta-analysis of randomised controlled trials. Swiss Med Wkly 2018; 148: w14633

[5] Lager CJ, Esfandiari NH, Luo Y et al. Metabolic Parameters, weight loss, and comorbidities 4 years after Roux-en-Y Gastric bypass and sleeve gastrectomy. Obes Surg 2018; 28: 3415–3423

[6] Griffith PS, Birch DW, Sharma AM et al. Managing complications associated with laparoscopic Roux-en-Y gastric bypass for morbid obesity. Can J Surg 2012; 55: 329–336

[7] Yao DC, Stellato TA, Schuster MM et al. Gastrogastric fistula following Roux-en-Y bypass is attributed to both surgical technique and experience. Am J Surg 2010; 199: 382–385; discussion 385–386

[8] Cucchi SG, Pories WJ, MacDonald KG et al. Gastrogastric fistulas. A complication of divided gastric bypass surgery. Ann Surg 1995; 221: 387–391

[9] Tucker ON, Szomstein S, Rosenthal RJ. Surgical management of gastro-gastric fistula after divided laparoscopic Roux-en-Y gastric bypass for morbid obesity. J Gastrointest Surg 2007; 11: 1673–1679

[10] Chahine E, Kassir R, Dirani M et al. Surgical management of gastro-gastric fistula after roux-en-y gastric bypass: 10-year experience. Obes Surg 2018; 28: 939–944

[11] Fernandez-Esparrach G, Lautz DB, Thompson CC. Endoscopic repair of gastrogastric fistula after Roux-en-Y gastric bypass: a less-invasive approach. Surg Obes Relat Dis 2010; 6: 282–288

[12] Bhardwaj A, Cooney RN, Wehrman A et al. Endoscopic repair of small symptomatic gastrogastric fistulas after gastric bypass surgery: a single center experience. Obes Surg 2010; 20: 1090–1095

[13] Cotton PB, Eisen GM, Aabakken L et al. A lexicon for endoscopic adverse events: report of an ASGE workshop. Gastrointest Endosc 2010; 71: 446–454

[14] Ko CY, Hall BL, Hart AJ et al. The American College of Surgeons National Surgical Quality Improvement Program: achieving better and safer surgery. Jt Comm J Qual Patient Saf 2015; 41: 199–204

[15] American College of Surgeons. National Surgical Quality Improvement Program. https://www.facs.org/quality-programs/data-and-registries/acs-nsqip/

[16] O'Brien CS, Wang G, McGinty J et al. Effects of gastrogastric fistula repair on weight loss and gut hormone levels. Obes Surg 2013; 23: 1294–1301

[17] Merrifield BF, Lautz D, Thompson CC. Endoscopic repair of gastric leaks after Roux-en-Y gastric bypass: a less invasive approach. Gastrointest Endosc 2006; 63: 710–714

[18] Júnior WS, Pitanga CK, Borges CN et al. Treatment of gastrogastric fistula after Roux-en-Y gastric bypass: surgery combined with gastroscopy. Obes Surg 2007; 17: 836–838

[19] Ribeiro-Parenti L, De Courville G, Daikha A et al. Classification, surgical management and outcomes of patients with gastrogastric fistula after Roux-En-Y gastric bypass. Surg Obes Relat Dis 2017; 13: 243–248