



Original article

Reversal of Roux en Y gastric bypass: largest single institution experience

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Abstract

Background: There is a paucity of literature on patients who have undergone reversal of Roux-en-Y gastric bypass (RYGB) to normal anatomy. We present the largest single institution experience with reversal of RYGB for serious chronic complications.

Objective: To describe our experience including indications, outcomes, and complications of RYGB reversal.

Setting: Academic-affiliated private practice.

Methods: Retrospective review of 48 patients who underwent laparoscopic reversal of RYGB between 2012 and 2016.

Results: Ninety-six percent (n = 46) of patients were female, and the mean age was 48.6 (range, 23–72). Indications for reversal of RYGB included marginal ulcer (n = 25, 12 of whom were malnourished and 17 had coexisting substance abuse), malnutrition alone (n = 11), chronic pain and nausea (n = 7), and postprandial hyperinsulinemic hypoglycemia (n = 5). Overall 30-day complication rate was 29% (n = 14), including gastrogastic anastomotic leak (n = 5), sepsis (n = 5), and bleeding requiring transfusion (n = 3). Weight gain after surgery increased in all patients, especially those patients deemed severely malnourished. All patients reported resolution of symptoms leading to reversal of RYGB, although 58% of patients were lost to follow-up at 1 year after surgery.

Conclusions: Laparoscopic reversal of Roux-en-Y gastric bypass is a complex revisional operation that can be safely performed in a select group of patients with serious complications. The main indications for reversal of RYGB included malnutrition with and without recalcitrant marginal ulcers. Weight gain and resolution of malnutrition occurred soon after reversal of gastric bypass. Because the complication rates are high, reversal should be considered only after all salvage attempts have failed. Reversal to normal anatomy carries high morbidity, including sepsis, leaks and bleeding, high reoperative rates, and readmission. Although reversal of RYGB has a role in the treatment of a select group of patients, it should be undertaken by surgeons with considerable experience in RYGB revision. (Surg Obes Relat Dis 2019; ■:1–6.) © 2019 American Society for Bariatric Surgery. Published by Elsevier Inc. All rights reserved.

Keywords:

Reversal; Revisions; Complications; Indications; Gastric bypass

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Roux-en-Y gastric bypass (RYGB) is a frequently performed bariatric procedure in the United States and worldwide. This procedure can produce sustained weight loss and resolution or improvement in obesity-related co-morbidities, such as diabetes and heart disease [1]. A small number of patients develop very challenging complications, such as recalcitrant marginal ulcers, significant protein-calorie malnutrition, unexplained intractable nausea and emesis, ongoing substance abuse, severe vitamin deficiencies, or postprandial hyperinsulinemic hypoglycemia [2–9]. In 2006, Himpens et al. first described laparoscopic reversal of gastric bypass to original anatomy as a potential treatment for reactive hypoglycemia [10]. Since then, reversal of gastric bypass to address these difficult complications has been reported in a number of small series [7,10–20]. We have been aggressive in recommending reversal to normal anatomy for patients with rare but serious chronic complications after RYGB. In this study, we report our large, single-center experience with laparoscopic reversal of RYGB over 4 years. Because of the small number of patients in previously published series, little is known about patients who undergo reversal of gastric bypass. Our goal is to describe the indications for reversal, our laparoscopic technique, and define the short- and medium-term risks and outcomes from the operation.

Methods

After institutional review board approval, we performed a retrospective chart review of a prospectively maintained database. All patients who had undergone laparoscopic reversal of gastric bypass between March 2012 and February 2016 at our high-volume tertiary referral center were identified and included in the study. After informed consent, detailed information, including patients' characteristics and histories at the time of index and reversal operations, and perioperative course and complications were collected. All revisional bariatric patients underwent exhaustive dietary and psychological counseling and were discussed at a team conference before recommending reversal surgery. The recommendation to reverse RYGB was made with the understanding that we could not salvage the RYGB. This included a multitude of clinical factors after thorough assessment of the patient's overall health and history, including reviewing the patient's pattern of complications. In addition, a discussion was generally performed with the patient's primary care physician in assessing the patient's ability to comply with postRYGB recommendations, such as adequate nutrition, self-care, vitamin compliance, maintaining follow-up, or cessation of substance, alcohol, and tobacco use. We assessed malnutrition primarily through clinical assessment of chronicity of weight and muscle mass loss, clinical signs of noncardiogenic peripheral edema, and serum albumin and pre albumin values according to nutritional guidelines [21]. Severe malnutrition was

defined as the patient requiring nutritional supplementation with enteral feeding through gastrostomy tube or total parenteral nutrition (TPN) before reversal surgery.

Our technique for laparoscopic RYGB and reversal of RYGB to normal anatomy was standardized, as previously described by Higa et al. [3]. Adhesions between liver and gastric pouch and gastrojejunostomy were divided to identify the Roux limb, gastric pouch, and gastric remnant. Measurements of Roux, biliopancreatic, and common channel limbs were performed and the decision to either resect the Roux limb or to anastomose it in continuity to the biliopancreatic limb was based on the total length of the small bowel and malnutrition status. The proximal Roux limb was divided at the gastrojejunostomy and the fundus of the bypassed stomach was resected selectively if a modified sleeve was performed for those patients with postprandial hyperinsulinemic hypoglycemia. The gastric pouch outlet is then aligned to the lesser curvature of the bypassed stomach as described by Himpens et al. [22]. A majority of the gastrogastrostomy anastomosis were handsewn in a single layer, end to side anastomosis with absorbable suture over a 34 French lavage tube. The integrity of the anastomosis and pylorus was then examined with endoscopy. In our experience, patients can experience delayed gastric emptying, presumably from vagal nerve disruption, and the pylorus is examined for stenosis. If stenotic, then a Heineke-Mikulicz pyloroplasty was performed similar to the description for treatment of gastroparesis [23,24]. A drain was usually placed adjacent to the gastrogastrostomy. A feeding jejunostomy was placed if the patient had severe malnutrition. Postoperatively, patients were generally started on clear liquids immediately. Standard postoperative follow-up was at 1 week, then at regular intervals. Clinical outcomes included weight, nutritional status based on labs, and postoperative complications. Data for age and body mass index (BMI) are presented as mean \pm standard deviation.

Results

Forty-eight patients underwent reversal of RYGB from 2012 to 2016. During the same period, 2009 laparoscopic gastric bypass procedures and 449 RYGB revisions, including reversals, were performed at our institution. In the RYGB reversal group, 46 were female (96%), with mean age of 48.6 years (range, 23–72). A majority of the patients (73%) had their index RYGB procedure performed outside of our institution, where half of the patients (54%) had an open index RYGB procedure. Duration of time from index RYGB procedure to reversal surgery was 9.6 years (range, 3 mo–25 yr). All cases were performed laparoscopically with an average operative time of 129.8 minutes (range, 46–485 min) and with a majority (92%) of the operations performed by a single surgeon.

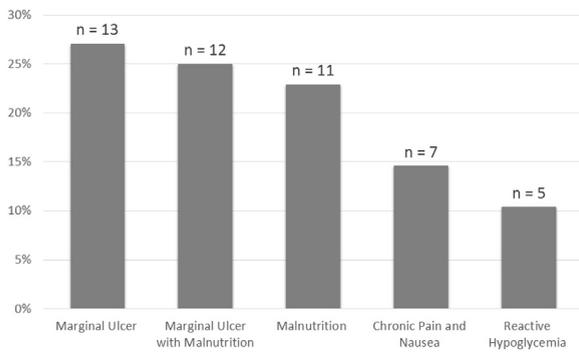


Fig. 1. Indications for reversal.

Indications for reversal (Fig. 1)

Recalcitrant marginal ulcers

In patients with marginal ulcers, 68% (17 of 25) of patients also had concurrent substance, alcohol, or tobacco abuse. Forty percent (10 of 25) of those with marginal ulcers had prior operations relating to perforation for their marginal ulcers. Two patients had gastrogastic fistula and malnutrition; however, etiologies of recalcitrant marginal ulcers were not found in 6 patients. After reversal, no further marginal ulcers were found.

Malnutrition

A majority of the patients with marginal ulcers (12/17) also had some degree of malnutrition. This was also found in 48% (23 of 48) of all reversal patients. Although the average BMI before reversal was 26.4 kg/m² (range, 16.5–59.1), 11 of these patients were deemed severely malnourished. After reversal, weight increased in all patients after reversal of gastric bypass as seen in Table 1.

Albumin and protein levels increased after reversal for all patients

The mean prereversal albumin level of 2.87 g/dL ± .70 improved to 3.83 g/dL ± .38, and mean prereversal protein level of 5.78 g/dL ± .78 increased to 7.18 g/dL ± .72 at 3 months after reversal. For those with moderate to severe malnutrition, mean albumin level improved from 2.51 g/dL ± .63 to 3.70 g/dL ± .37, and mean protein level increased from 5.75 g/dL ± .82 to 7.30 g/dL ± .71 at 3 months after reversal. Patients with severe malnutrition received TPN or enteral tube feeds for 1 to 6 months in the perioperative period. Percentage of weight gain in this subgroup is higher than those patients with and without mild to moderate malnutrition as seen in Table 1.

Postprandial hyperinsulinemic hypoglycemia

Five patients had intractable, postprandial hyperinsulinemic hypoglycemia despite dietary and medical therapy. Two patients had BMI greater than 50 kg/m² with weight recidivism owing to excessive snacking and were potential candidates for conversion to sleeve gastrectomy and duodenal switch. Postprandial hyperinsulinemic hypoglycemia resolved in all patients after reversal.

Other indications

Other reasons for reversal of RYGB included chronic abdominal pain and persistent nausea and vomiting of unclear etiology. Three of our 2900 primary patients (0.1%) were treated by reversal to normal anatomy within 6 months after RYGB. Each of these struggled early with frequent readmissions, endoscopies, and explorations after the primary procedure without an identifiable anatomic source. Patients also had buyer's remorse and after reversal, symptoms were resolved. Thus, psychological intolerance was deemed the primary reason for reversal in this small subgroup with early reversal because the team felt in retrospect the patient was not psychologically ready for the changes after RYGB.

Table 1
Weight change after reversal

Outcome	All reversal patients (n)	Severely malnourished patients* (n)	All reversal patients % weight gain [†]	Severely malnourished patients* % weight gain [†]	All reversal patients Δ BMI [‡]	Severely malnourished patients* Δ BMI [‡]
Preoperative BMI	26.4 (48)	24.1 (11)				
30 d	(43)	(10)	3.0	16.2	0.3	2.9
3 mo	(35)	(9)	6.6	19.4	1.1	3.5
6 mo	(30)	(9)	11.9	30.6	2.1	5.3
1 yr	(27)	(9)	20.7	36.5	4.1	6.2
2 yr	(22)	(7)	23.9	40.4	4.8	6.3
3 yr	(10)	(5)	27.9	25.2	5.2	3.8
4 yr	(1)	(1)	61.7	61.7	10.0	10.0

BMI = body mass index.

* Severe malnutrition was defined as the patient requiring nutritional supplementation with enteral feeding through gastrostomy tube or total parenteral nutrition before reversal surgery.

[†] Percentage weight gain was calculated as weight change at each interval divided by pre-reversal weight × 100.

[‡] Change in BMI (ΔBMI) was calculated as: ΔBMI = (Initial BMI) – (Postop BMI).

Table 2
Postoperative complications

Outcome	n (%)
30-d complications	14 (29)
Anastomotic leak	5 (10)
Sepsis	5 (10)
Bleeding requiring transfusion	3 (6)
Bleeding requiring reoperation	1 (2)
Deep venous thrombosis	2 (4)
Obstruction	2 (4)
30-d reoperation	7 (15)
30-d readmission	13 (27)
Persistent nausea	6 (13)
Unexplained abdominal pain	4 (8)
Narcotic withdrawal or overdose	2 (4)
Clostridium difficile associated diarrhea	1 (2)
30-d intervention rate (EGD)	3 (6)
30-d mortality rate	1 (2)
3-yr mortality rate	3 (6)

EGD = esophagogastroduodenoscopy.

Postoperative Course

Mean length of stay after reversal surgery was 8.13 days \pm 9.2, (range, 1–50 d). Thirty-day complications are described in Table 2. The most common complication was an anastomotic leak at the gastrogastrostomy anastomotic leak, resulting in sepsis (n = 5). Management of the leak depended on the patient's clinical picture, timing, and the severity of the leak. Three patients underwent laparoscopic reoperations with drainage and omental patching of the gastrogastrostomy leak if the leak was inadequately controlled. Two of these patients also had intraoperative assisted endoscopic clipping and oversewing of the leak site. One reoperation also included placement of a feeding jejunostomy tube after gastrogastrostomy leak. The other 2 patients had leaks resolved with drainage tubes and bowel rest after several weeks.

Thirty-day reoperation rates also included trocar site hernia (n = 1), small bowel obstruction and volvulus around an ileostomy (n = 1), and resection of in situ Roux limb for persistent nausea and unexplained abdominal pain (n = 1). Readmission after surgery includes those 30-day complications listed in Table 2. One patient died 10 days after surgery at another facility with cause of death listed as cardiac arrest. Three additional patients died within 3 years after surgery as a result of food asphyxiation and cardiac arrest, intracranial hemorrhage after ground level fall, and cardiac arrest in a patient with a history of multiple admissions for alcohol-related delirium tremens.

Follow-up

Average postoperative follow-up time was 1.02 \pm .95 years (range, 9 d–3 yr). Fifteen patients (33%) were lost to follow-up after 6 months. These included 4 out of 11

patients who were severely malnourished before surgery. Fifty-eight percent (26 of 45) failed to follow up after 1 year. This data is consistent with a high incidence of noncompliance that seems related to the reason for reversal.

Discussion

Roux-en-Y gastric bypass has been a mainstay of bariatric surgery for several decades. Although it currently makes up less than 20% of the total number of bariatric procedures performed in the United States, bariatric surgeons will continue to follow up and care for the large number of patients who have undergone this procedure [25]. The management of some rare, long-term complications of RYGB are a significant challenge to the bariatric surgeon [26]. Protein calorie malnutrition, recalcitrant marginal ulcers, postprandial hyperinsulinemic hypoglycemia, and RYGB intolerance owing to persistent nausea and vomiting are uncommon complications but each requires a significant amount of time and resources to manage. For a very small group of patients, reversal of RYGB remains the only viable option after medical and surgical means have been exhausted. The previously reported cases of RYGB reversal of gastric bypass [7,10–20] have contained somewhat small samples for meaningful interpretation. Our study provides the largest, single-center experience with reversal of gastric bypass to examine the indications, the perioperative complications, and postoperative outcomes of this select group of patients. Reversal of gastric bypass is dramatic, with the potential for weight recidivism and risk of recurrence or exacerbation of obesity related comorbidities. Broolin emphasized that improved patient education and close follow-up might avoid the need for reversal in one-half of the patients [12]. Follow-up is undoubtedly paramount to the success of bariatric surgery; however, a number of patients may lose bariatric surgery coverage or fail to follow up with their surgeon until they have developed serious complications.

We recognize reversal of RYGB as a major operation reserved for the management of severe conditions or complications of gastric bypass. During the reported 4-year period, RYGB reversal comprised only 9.6% of revisional operations at our center, which serves as a regional, tertiary referral center for patients with complications of bariatric surgery. In fact, most of these patients had undergone RYGB at outside institutions 10 to 15 years before our evaluation. This suggests many of our patients had several years of issues relating to RYGB because most reversals were performed for some degree of malnutrition. Malnutrition after RYGB is rare but can be difficult to manage. Reversal of gastric bypass has been shown to reverse malnutrition in several case reports [13–15,17,18,20], although perioperative TPN or enteral tube feeding are often required. Twenty-three percent of our patients had a feeding tube placed to address

malnutrition. Patients who were deemed severely malnourished required up to 6 months of perioperative, supplemental parenteral nutrition or enteral feeding.

A majority of our patients (52%) had chronic marginal ulcers, where the incidence of marginal ulcers in primary RYGB has been reported at 1% to 16% [4,6,27]. Chronic marginal ulcers are difficult to manage because ulcers can perforate or persist despite adequate therapy of proton pump inhibitors and cessation of predisposing factors. In some studies, 17% to 22% of patients with marginal ulcers ultimately required revision of gastrojejunostomy [4,27]. In fact, almost half of our reversal patients with chronic marginal ulcers had previously undergone surgery for perforated ulcers. One patient had undergone ulcer-related surgery 3 times. In addition, there was a high association with substance abuse (including alcohol or tobacco use) with a low possibility of cessation after multiple attempts at therapy. This factored heavily in the decision for reversal of RYGB instead of gastrojejunostomy revision. A small number of patients underwent RYGB reversal as treatment for postprandial hyperinsulinemic hypoglycemia that did not respond to dietary modifications and medical therapy. Prior studies have reported successful treatment of this syndrome through RYGB [7,9,22,28]. It is important to note that subsequent to this report, our protocol has changed in dealing with this entity. We now mandate in-hospital documentation of symptomatic hypoglycemic episodes. Since making this change, all patients previously thought to require reversal have demonstrated that dietary modification alone can eliminate postprandial hypoglycemia as a reason for reversal.

The complication rate of RYGB reversal is significant. Revisional bariatric surgery carries much higher complication rates than primary procedures [29]. Although the leak rate for primary RYGB is very small, .2% in a long-term study of RYGB patients by Kothari et al. [2], our gastrogastroic anastomotic leak rate was 10%. This is presumably related to the compromised blood supply after dissection and mobilization of the gastric pouch and remnant. In addition, there may be chronic inflammation from the recalcitrant marginal ulcers that may also influence this high leak rate or some degree of malnutrition impairing healing. This leak rate may be reflective of the severity of the complications of this subset of RYGB patients. Our complication rate of 29% for reversal of RYGB is comparable to other revisional procedures. One study reported a 9-fold increase in leak rates of revision surgery, nearly doubling the length of stay compared with primary bariatric procedures [29]. However, there is great variation in the types of revisional bariatric surgery reported in published literature; therefore, it is difficult to compare different revisions at this time. Because of the severity of illness requiring reversal, the complexity of the surgery, and the inherent risks of complication with the operation, reversal of RYGB should be performed by surgeons with experience

and technical competence in complex, revisional bariatric procedures. In addition, hospital resources must be available to manage potential perioperative complications. Nevertheless, multiple reports have described reversal of gastric bypass as a safe and judicious treatment of severe RYGB complications [14,16–18,20,22]. The 1 mortality within 30 days was suspected to be cardiac related because the postoperative course appeared to be without complications. The other 3 mortalities occurred well after their reversal surgery and were deemed not to be related to perioperative complications. It is obvious that one must consider the severity of the complication when assessing the risk-to-benefit ratio. To conclude that reversal of RYGB is “safe” is necessarily relative to the status quo.

Despite months to years of failed medical or surgical management of RYGB complications, reversal of RYGB resulted in resolution of almost all of the patients' preoperative complications. Weight regain was expected and nutrition parameters improved significantly within 3 months after reversal. On average, excess weight gain of 21% was seen at 1 year after reversal. Moon et al. also reported that almost half of their reversal patients gained weight [14]. A systematic review by Shoar et al. reported 28.8% postreversal weight regain [18]. The incidence of diabetes after reversal of RYGB is unknown but may be related to decrease of glucagonlike peptide-1 contributing to insulin resistance [6,30]. Owing to lack of long-term follow-up in our patients, the recurrence of obesity related comorbidities or incidence of postreversal gastroesophageal reflux is not known. Long-term outcomes for our study of RYGB reversal is limited owing to poor follow-up after surgery. More than half of the patients failed to show at follow-up appointments, despite preoperative discussion of potential issues resulting from reversal of RYGB. Many of the patients in our study also had a history of failing to follow up with their primary bariatric surgeons after their index operation; therefore, poor follow-up after resolution of their complication is not surprising.

Limitations of the study include the retrospective nature of the review. Although this is the largest, single center report of patients undergoing reversal of RYGB, the small sample size and poor long-term follow-up also limits the study.

Conclusions

Laparoscopic reversal of Roux-en Y gastric bypass is a complex operation that can be safely performed in a select group of patients, albeit with risk of serious complications. The main indications for reversal include malnutrition with and without marginal ulcers, which are effectively addressed by the reversal. The average time from primary gastric bypass to reversal is approximately 9 years, and postoperative follow-up remains challenging. Weight gain and improvement in nutrition are seen soon after reversal, but

long-term data are limited with low follow-up rates. Postoperative complications are higher than primary gastric bypass with acceptable risks and low mortality. Reversal of gastric bypass should be performed by surgeons with technical competence and resources available to manage perioperative complications.

Disclosures

The authors have no commercial associations that might be a conflict of interest in relation to this article.

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