

Original article

Early jejunojejunostomy obstruction after laparoscopic gastric bypass: case series and treatment algorithm

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Abstract

Background: To review our experience with early jejunojejunostomy obstruction (JJO) at a large academic teaching hospital and provide a management algorithm. Early JJO is a known and often overlooked complication of laparoscopic Roux-en-Y gastric bypass.

Methods: From 2003 to 2007, 1097 patients underwent laparoscopic Roux-en-Y gastric bypass at our institution. Data, including patient demographics, co-morbidities, intraoperative data, peri- and postoperative complications, and outcomes, were prospectively recorded and retrospectively reviewed.

Results: Early post-laparoscopic Roux-en-Y gastric bypass JJO occurred in 13 patients (1.2%). The average time to presentation was 15 days (range 5–27). Patients presented with a combination of nausea, vomiting, and abdominal pain; all underwent computed tomography to confirm the diagnosis. The causes of JJO included dietary noncompliance (46%), anastomotic edema (23%), narrowing of the jejunojejunostomy at surgery (23%), and luminal clot (8%). Management was determined using our proposed treatment algorithm. Three patients (23%) required operative intervention, with the remainder successfully treated conservatively.

Conclusion: From our experience, we propose a treatment algorithm for standardized management of early JJO, reserving reoperation for those who are acutely ill on presentation or those in whom conservative management fails. A review of our series using this algorithm has suggested that most patients can be successfully treated nonoperatively; however, bariatric surgeons must maintain a low threshold for surgical re-intervention in cases in which rapid recovery is not seen. (*Surg Obes Relat Dis* 2009;5:203–207.) © 2009 American Society for Metabolic and Bariatric Surgery. All rights reserved.

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Small bowel obstruction is a known complication of laparoscopic Roux-en-Y gastric bypass (LRYGB). In the published surgical data, the overall reported incidence of small bowel obstruction after LRYGB has been 1.9–7.3% [1]. The second most common cause of small bowel obstruction after LRYGB is obstruction at the jejunojejunostomy, occurring in $\leq 1.8\%$ of antecolic gastric bypass pro-

cedures [2]. Early jejunojejunostomy obstruction (JJO) is a known, but often overlooked, complication of LRYGB. The definition of early JJO has varied among investigators, but it typically includes any clinically significant and radiologically proven partial or complete obstruction at the jejunojejunostomy site occurring within the first 30 postoperative days. These obstructions can sometimes be treated conservatively, and the decision for operative intervention is generally determined by the patient's clinical picture. Just as in all cases of bowel obstruction, any evidence of peritonitis, persistent symptoms, or possibility of compromised bowel are indications for exploration. Early JJO after LRYGB and

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Table 1
Postoperative diet

Stage	Description	Examples
1 (0–3 d): clear liquid diet	Liquids one can read a newspaper through	Water Dilute Gatorade Crystal Light
2 (4–14 d): full liquid diet	Thin liquids one cannot see through	Milk Protein drink Broths
3 (15 d–5 wk): soft diet	Soft and mushy foods	Bananas Overcooked/pureed vegetables Mashed potatoes
4 (\geq 6 wk): solid diet	Regular diet, focusing on low-fat and low-sugar options	Any food allowed; patients are instructed to chew all solid foods thoroughly before swallowing

its management have rarely been reported in published surgical reports. We present a case series of 13 patients, along with a management algorithm to assist in clinical decision-making and to standardize the treatment of patients with early JJO after LRYGB.

Methods

Our surgical technique for performing LRYGBs at our institution is as follows. Before the incision, a prophylactic anticoagulant and antibiotic are administered, and a 32F orogastric tube (Allergan, Irvine, CA) is placed. The trocars are then inserted using an optical trocar for initial placement in the left upper quadrant. The gastric pouch is created using a pars flaccida approach in which the lesser sac is entered through the lesser omentum at its thinnest portion, typically over the caudate lobe. This area of the lesser omentum is divided to the edge of the lesser curve, after which the pouch is created using blue linear 60-mm staplers (Autosuture, Mansfield, MA). The gastrojejunal anastomosis is created using the full length of a blue linear 45-mm stapler (Autosuture) over the orogastric tube. The Roux limb is then created and brought up in an antecolic and antegastric fashion. The Roux limb length is dictated by the preoperative body mass index (BMI). For a BMI <50 kg/m², a 100-cm Roux limb is created, and for a BMI >50 kg/m², a 150-cm limb is created. The jejunojejunostomy is then created in a side-to-side fashion using a white linear 60-mm stapler (Autosuture). The remaining defect is closed with sequential tangential firings of a white linear 45-mm stapler (Autosuture). A nonabsorbable anti-obstruction suture is placed at the jejunojejunostomy. The gastrojejunal anastomosis is tested for leaks with methylene blue dye, and a drain is placed.

Postoperatively, the patients begin with a clear liquid diet on postoperative day 1. Routine upper gastrointestinal studies are not performed [3]. Patients are generally discharged home on postoperative day 2, after removal of the surgical drain. All patients are instructed to maintain a full liquid diet for 15 days after discharge and then to advance to soft foods

for the next 6 weeks. A full explanation of our postoperative diet instructions is provided in Table 1.

With approval from the institutional review board, a comprehensive prospective database was established and has been continually maintained. The data recorded included patient demographics, co-morbidities, operative techniques, perioperative events, complications, and follow-up information. The latter was obtained through clinic visits, as well as mail, telephone, facsimile, and, most recently, Web-based surveys. A retrospective review of this database was used to identify the patients in this series. The records for these patients were reviewed to note the presenting symptoms, laboratory values, imaging study results, treatment details, and outcomes.

Results

Early JJOs developed in 13 (1.2%) of 1097 patients who had undergone LRYGB from January 2003 to December 2007. Their average age was 44 years (range 27–55), their average BMI was 48 kg/m² (range 42–60), and 12 were women (92%). The mean interval for development of early JJO was 15 days (range 5–27). The causes of JJO included dietary noncompliance (46%), anastomotic edema (23%), narrowing of the jejunojejunostomy at surgery (23%), and luminal clot (8%). On presentation, 11 patients had nausea and vomiting/retching, and 7 complained of abdominal pain. All patients underwent computed tomography (CT) of the abdomen and pelvis with oral and intravenous contrast at presentation. Of the 13 patients, 10 (77%) were treated conservatively and 3 (23%) required operative intervention. No deaths resulted from early JJO in this series.

The 3 patients requiring reoperation underwent laparoscopic exploration with the creation of a new jejunojejunostomy between the distal Roux limb and proximal common channel to bypass the narrowed jejunojejunostomy, which was not resected. None of these patients had biliopancreatic limb or gastric remnant dilation, and none required bowel resection. One patient was taken to the operating room at presentation because of severe pain, persistent retching, and tachycardia. Conservative management failed in the other 2

patients, who were taken to the operating room on hospital days 3 and 7. One patient required postoperative admission to the intensive care unit for intra-abdominal sepsis, which was treated with broad-spectrum intravenous antibiotics, and was ultimately discharged on postoperative day 14. The other 2 patients were discharged on postoperative days 5 and 6 without complications.

Ten patients were treated conservatively with hospital admission, rehydration, bowel rest, and serial abdominal examinations. The average length of stay for this group was 1.9 days (range 1–4), and no patient required admission to the intensive care unit. Our treatment algorithm is summarized in Figure 1.

Discussion

The overall reported incidence of small bowel obstruction after LRYGB is 1.9–7.3% [1,2], with a greater incidence reported after the laparoscopic approach than after open gastric bypass [2]. The etiology and timing of small bowel obstruction also differs between the 2 approaches, with obstructions manifesting earlier and more often be-

cause of jejunojejunostomy complications in laparoscopic cases compared with resulting from adhesions after open gastric bypass [1,2,4–6].

Obstruction at the jejunojejunostomy site is a potential source of morbidity, occurring in $\leq 1.8\%$ of patients after antecolic Roux-en-Y gastric bypass [2]. Cho et al. [7] reported early JJO in .4% of patients, with a mean interval to presentation of 10.4 days (range 3–27). In other series, all patients with early JJO presented within 14 days after surgery [6]. We found a similar incidence of JJO of 1.2%, with an average interval to presentation of 15 days.

The diagnosis of early JJO after LRYGB begins with the recognition of clinical signs and symptoms that vary among individual patients, with the level of obstruction at the jejunojejunostomy often resulting in different clinical manifestations [1]. A patient with an obstruction proximal to the common lumen will present with nausea, vomiting, and abdominal cramps because ingested food decompresses from the Roux limb into the mouth [1]. With the exception of gastrogastric fistula, bilious vomiting indicates obstruction at or beyond the level of the jejunojejunostomy until proven otherwise [2]. Obstruction distal to the common lumen of the jejunojejunostomy can decompress into the excluded stomach and will manifest as fullness, tachycardia, nausea, repeated retching/dry heaving without volume of effluent, hiccups, and shoulder pain [1]. Obstruction of the biliopancreatic limb proximal to the common lumen will result in isolated dilation of the excluded stomach with fluid but not air [1]. Patients with obstruction resulting from intraluminal blood clots most commonly present with tachycardia and a sense of impending doom [4].

The exact knowledge of the postbypass anatomy and careful interpretation of the imaging studies are essential [2]. CT imaging with oral and intravenous contrast is crucial to the treatment of these patients [8]. The CT appearance of JJO is one of dilation of the Roux limb or biliopancreatic limb, or both, possibly with gastric remnant distension and retrograde passage of contrast into the biliopancreatic limb [9]. CT is more accurate for detecting partial small bowel obstruction than Gastrografin studies or plain abdominal radiographs [7,10] and is the only modality that can accurately distinguish dilation of the afferent (biliopancreatic) limb and gastric remnant [9].

Early obstructions at the jejunojejunostomy can be caused by technical problems such as kinking, narrowing, or acute angulation of the anastomosis [7,9,10]. Other causes include edema, stenosis, ischemia, and staple line bleeding, with subsequent formation of an intraluminal blood clot [5,10]. The latter can be exacerbated by the use of perioperative heparin [4]. Early small bowel obstructions at other locations usually result from edema or technical problems with the Roux limb [1,7,9].

As outlined in our series, dietary noncompliance is a major cause of early JJO. The patients in our series who were diagnosed with early JJO secondary to dietary non-

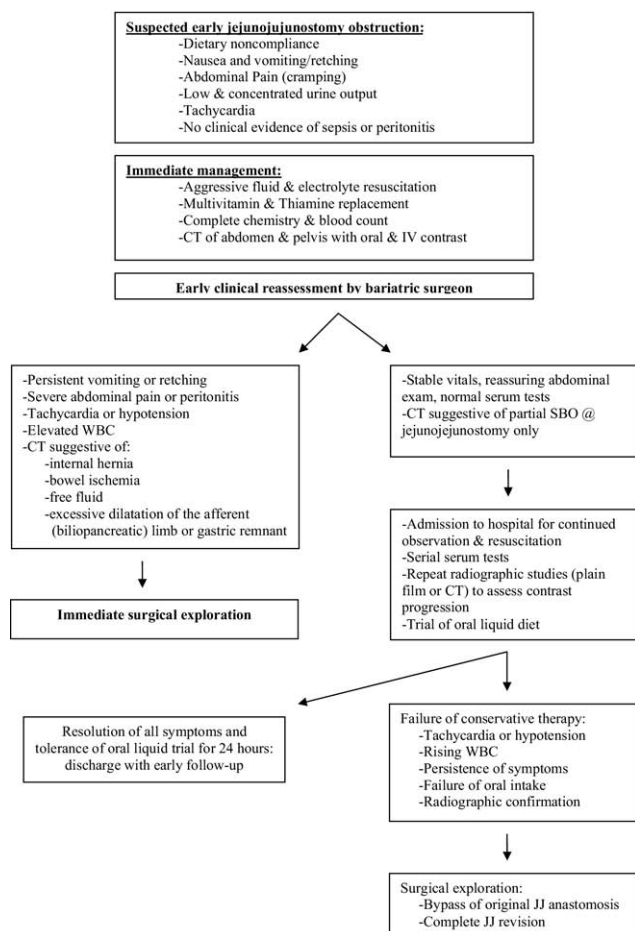


Fig. 1. Treatment algorithm.

compliance all gave a history of dietary indiscretion, with the onset of symptoms occurring within 10 minutes thereafter. All resolved with bowel rest and resumption of a clear liquid diet. Three patients reported eating raw or undercooked vegetables, one consumed a chicken breast, another reported eating shrimp and broccoli, and one ate fried chicken with mashed potatoes and cherry pie. Similar to other Bariatric Surgery Centers of Excellence, our program includes extensive preoperative dietary education to ensure an adequate understanding of the mandatory changes and restrictions and to improve compliance. Despite this, patient noncompliance continues to be our primary reason for early readmission to the hospital.

Edema is another common cause of early JJO. Obstruction from edema tends to be partial and temporary, responding to conservative measures in nearly all cases [7]. The patients in our series with anastomotic edema presented with no history of dietary indiscretion, and all were found on CT to have a partial small bowel obstruction due to narrowing at the jejunojejunostomy. These patients had improvement with conservative management that allowed the edema to resolve.

None of the patients in our series were found to have significant dilation of the biliopancreatic limb or gastric remnant. Traditionally, these patients were taken urgently for surgical intervention because this region cannot be decompressed by passage of a nasogastric tube, and acute gastric dilation can lead to necrosis, with subsequent perforation and peritonitis [11]. However, several recent case reports have demonstrated that for nontechnical or self-limited etiologies (e.g., edema, dietary indiscretion) of gastric remnant dilation, percutaneous placement of a gastrostomy tube by interventional radiology to decompress the gastric remnant is effective and avoids the necessity of reoperation [11–13].

Several technical modifications have been cited in published studies for the prevention of early JJO after LRYGB. These have included the triple staple technique, handsewn closure of the jejunojejunostomy defect, use of an anti-obstruction suture, closing all mesenteric defects, and the use of hemostatic staple line reinforcements. Madan and Frantzides [14] advocated the triple staple technique, with an extended stapled jejunojejunostomy both proximally and distally and transverse closure of the jejunojejunostomy defect. They reported that construction of the jejunojejunostomy using the triple stapling technique is expeditious, safe, and associated with minimal complications [15]. Koppman et al. [10] also advocated this bidirectional firing technique for the creation of the jejunojejunostomy if staples are to be used and cited an 18-fold increase in jejunojejunostomy stenosis with unidirectional stapling over a handsewn anastomosis (.7% versus .4%). Others have advocated handsewn closure of the jejunojejunostomy defect, although some have reported leaks and anastomotic dehiscence, especially

with the use of absorbable sutures [15]. The use of an anti-obstruction nonabsorbable suture has been widely advocated in published bariatric reports [16]. This was originally described as placing a single nonabsorbable suture at the jejunojejunostomy to bring the 2 limbs into anatomic alignment. Closure of all mesenteric defects has also been cited as a method to decrease the incidence of early JJO, particularly if the retrocolic approach were used [6]. The use of preoperative prophylactic anticoagulation with LRYGB can increase the risk of developing hemobezoars, which can contribute to the development of early JJO in this group of patients. The use of hemostatic re-enforcement at the staple lines might decrease the possibility of obstruction by blood clots [4].

Although some investigators have asserted that all early small bowel obstructions occurring after LRYGB require operative intervention [7,9], we found that the treatment of patients with early JJO using our algorithm has resulted in a low incidence of reoperation, without negative laparoscopic findings and no increase in morbidity or mortality. When reoperation becomes necessary, some have asserted that an open operative approach to management of early JJO is the best option [4]. We have found that early laparoscopic revision is a safe and effective alternative to open reoperation.

Conclusion

Early small bowel obstruction at the jejunojejunostomy is a known complication of Roux-en-Y gastric bypass, with the diagnosis determined by the clinical presentation and CT findings. We have proposed the use of a treatment algorithm for standardized management of early JJO, reserving reoperation for those who are acutely ill on presentation or in whom conservative management fails. A review of our series using this algorithm suggested that most patients can be successfully treated nonoperatively; however, bariatric surgeons must maintain a low threshold for surgical reintervention in cases in which rapid recovery is not seen.

Disclosures

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

References

- [1] Nelson L, Gonzales R, Haines K, Gallagher S, Murr M. Spectrum and treatment of small bowel obstruction after Roux-en-Y gastric bypass. *Surg Obes Relat Dis* 2006;2:337–83.
- [2] Husain S, Ahmed A, Johnson J, Boss T, O'Malley W. Small-bowel obstruction after laparoscopic Roux-en-Y gastric bypass: etiology, diagnosis, and management. *Arch Surg* 2007;142:988–93.

- [3] White S, Han SH, Lewis C, et al. Selective approach to use of upper gastroesophageal imaging study after laparoscopic Roux-en-Y gastric bypass. *Surg Obes Relat Dis* 2008;4:122–5.
- [4] Awais O, Raftopoulos I, Luketich J, Courcoulas A. Acute, complete proximal small bowel obstruction after laparoscopic gastric bypass due to intraluminal blood clot formation. *Surg Obes Relat Dis* 2005; 1:418–23.
- [5] Elder K, Wolfe B. Bariatric Surgery: a review of procedures and outcomes. *Gastroenterology* 2007;132:2253–71.
- [6] Nguyen N, Huerta S, Gelfand D, Stevens M, Jim J. Bowel obstruction after laparoscopic Roux-en-Y gastric bypass. *Obes Surg* 2004;14: 190–6.
- [7] Cho M, Carrodegua L, Pinto D, et al. Diagnosis and management of partial small bowel obstruction after laparoscopic antecolic antegastric Roux-en-Y gastric bypass for morbid obesity. *J Am Coll Surg* 2006;202:262–8.
- [8] Jones K. Biliopancreatic limb obstruction in gastric bypass at or proximal to the jejunojejunostomy: a potentially deadly, catastrophic event. *Obes Surg* 1996;6:485–93.
- [9] Hwang R, Swartz D, Felix E. Causes of small bowel obstruction after laparoscopic gastric bypass. *Surg Endosc* 2004;18:1631–5.
- [10] Koppman J, Li C, Gandas A. Small bowel obstruction after laparoscopic Roux-en-Y gastric bypass: a review of 9,527 patients. *J Am Coll Surg* 2008;206:571–84.
- [11] López-Tomassetti Fernández EM, Arteaga González I, Diaz-Luis H, Carrillo Pallares A. Obstruction of the bypassed stomach treated with percutaneous drainage: an alternative treatment for selected cases. *Obes Surg* 2008;18:233–6.
- [12] Hamoui N, Crookes PF, Kaufman HS. Percutaneous gastric drainage as a treatment for small bowel obstruction after gastric bypass. *Obes Surg* 2007;17:1411–2.
- [13] Noshier JL, Bodner LJ, Girgis WS, Brodin R, Siegel RL, Gribbin C. Percutaneous gastrostomy for treating dilatation of the bypassed stomach after bariatric surgery for morbid obesity. *AJR Am J Roentgenol* 2004;183:1431–5.
- [14] Madan A, Frantzides C. Triple-stapling technique for jejunojejunostomy in laparoscopic gastric bypass. *Arch Surg* 2003;138:1029–32.
- [15] Frantzides C, Zeni T, Madan A, Zografakis J, Moore R, Laguna L. Laparoscopic Roux-en-Y gastric bypass utilizing the triple stapling technique. *JLS* 2006;10:176–9.
- [16] Brodin R. The antiobstruction stitch in stapled Roux-en-Y enteroenterostomy. *Am J Surg* 1995;169:355–7.