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Original article

Elective laparoscopy for herald symptoms of mesenteric/internal hernia after laparoscopic Roux-en-Y gastric bypass

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Abstract

Background: Mesenteric internal hernia (MIH) is the most common cause of small bowel obstruction (SBO) after laparoscopic Roux-en-Y gastric bypass. Because MIH is a potentially life-threatening complication, we hypothesized that elective repair of MIH before developing acute SBO could decrease morbidity in this population.

Methods: The records of 702 consecutive patients undergoing primary laparoscopic Roux-en-Y gastric bypass from January 2002 and August 2007 were retrospectively reviewed to determine the incidence and etiology of SBO. During the last 9 months of the study, we offered elective laparoscopy to any patient who presented to us with symptoms of intermittent SBO.

Results: Of the 702 patients, 27 (3.8%) developed acute SBO. Of these 27 patients, 15 (55%) had obstruction related to an MIH. Nearly all patients had a typical history of intermittent abdominal pain, nausea, and bloating before developing acute SBO. Elective laparoscopy was offered to 11 patients with symptoms of intermittent SBO. Two patients who refused subsequently underwent operations for acute SBO. MIH was found at elective laparoscopic exploration in all cases. Of the 9 patients undergoing elective surgery, 3 (33%) had small bowel volvulus.

Conclusion: SBO due to MIH after laparoscopic Roux-en-Y gastric bypass is typically preceded by symptoms of intermittent obstruction. Patients who have these herald symptoms should promptly be offered elective laparoscopic exploration. Elective repair of MIH can be performed safely and expeditiously. (Surg Obes Relat Dis 2009;5:144–149.)

Keywords: Bariatric surgery; Mesenteric hernia; Internal hernia; Laparoscopic gastric bypass; Obesity; Gastrointestinal surgery

Morbid obesity is recognized as a significant public health problem. It has been estimated that nearly 25 million Americans are morbidly obese [1]. The number of bariatric operations has increased exponentially during the past decade. It has been estimated that >205,000 bariatric operations were performed in 2007 in the United States alone [2]. It has been postulated that the introduction of laparoscopy to bariatric surgery is responsible for the marked increase in the number of bariatric operations. As laparoscopic Roux-en-Y gastric bypass (LRYGB) increased in popularity, small bowel obstruction (SBO) was recognized as a relatively common, late complication. Because SBO after LRYGB can be catastrophic, early recognition of acute SBO and timely operative intervention is imperative to minimize adverse outcomes. The most common cause of SBO after LRYGB is mesenteric internal hernia (MIH) [3,4]. Our experience in treating SBO after LRYGB has suggested that most patients had several episodes of mild symptoms before their acute presentation. We hypothesized that elective repair of MIH before the development of acute SBO could decrease the morbidity in this population.

Methods

The records of 702 consecutive patients undergoing primary LRYGB from January 2002 through August 2007

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Table 1
Incidence and etiology of acute SBO after LRYGB

Primary etiology of SBO	Operative findings (n)
MIH (15, 55%)	Volvulus (13)
Adhesions (4, 14.8%)	Volvulus (2)
Technical problems at jejunojejunostomy (4, 14.8%)	Kink (2); stricture (2)
Abdominal wall hernia (3, 11%)	Umbilical (2); port site (1)
Intussusception (1, 3.7%)	Volvulus

SBO = small bowel obstruction; LRYGB = laparoscopic Roux-en-Y gastric bypass; MIH = mesenteric internal hernia.

Data in parentheses presented as number of patients followed by percentage of total patients (n = 27).

were retrospectively reviewed to identify patients who had developed SBO. All patients who had undergone LRYGB had qualified for the surgery according to the guidelines of the 1991 Consensus Development Conference on Gastrointestinal Surgery for Severe Obesity [5]. The minimal follow-up was 6 months.

All patients had undergone antecolic, antegastric LRYGB performed with the assistance of fellows. The Roux limb length varied from 80 to 150 cm, according to preoperative body mass index (BMI). After transecting the jejunum, the underlying mesentery was divided flush with the Roux limb for a distance of 1.5–2.0 cm. The jejunojejunostomy was stapled side to side. The resulting enterotomy was closed transversely with linear staplers. Several interrupted anti-obstruction stitches of 2-0 silk were placed to align the jejunojejunostomy and prevent kinking. These stitches were extended into the mesentery of the biliopancreatic limb to close a portion of the jejunojejunostomy defect in the first 625 cases. During the last 18 months of the study, this closure was extended to the root of the mesentery of the Roux limb using a continuous 2-0 silk suture. The details of our technique of LRYGB have been previously published [6,7].

During the last 9 months of the study, we identified patients who presented to the office with intermittent symptoms of abdominal pain, bloating, and nausea suggestive of SBO. Elective laparoscopic exploration was recommended for these patients. Elective laparoscopic exploration with repair of the MIH was performed using 4 trocar incisions. The Roux limb was identified and traced to the jejunojejunostomy. At that point, the orientation of the biliopancreatic (BP) limb and common channel was identified. The MIH was repaired using interrupted 2-0 silk sutures that approximated the cut edge of the BP limb mesentery to the mesentery of the Roux limb.

Results

Of the 702 patients who had undergone LRYGB, 27 (3.8%) developed acute SBO. The etiology of SBO in these 27 patients is listed in Table 1. MIH was the most common cause of acute SBO, accounting for 15 (55%) of the 27 cases. All MIHs occurred at the jejunojejunostomy defect. Technical factors were responsible for 4 cases of SBO, including 2 cases of kinking of the Roux limb at the jejunojejunostomy and 2 anastomotic strictures. The 2 kinks at the jejunojejunostomy were associated with narrowing of the lumen of the bowel caused by the stapled closure of the enterotomy. In each case, misalignment of the closure was associated with an unusually small-caliber lumen. Both of the strictures resulted in nearly complete obstruction of the BP limb. One patient was readmitted with nausea, vomiting, and abdominal pain on the fourth postoperative day. The other patient had vague abdominal pain, bloating, and intermittent diarrhea for >3 months. In each case, the diagnosis was made by computed tomography (CT) scanning, which showed marked dilation of the excluded stomach, duodenum, and BP limb. Both patients were treated by performing a second jejunojejunostomy that bypassed the stricture. The 3 abdominal wall hernias included 1 Richter's hernia at a trocar site and 2 incarcerated umbilical hernias. Idiopathic small bowel intussusception was responsible for SBO in 1 patient. All 27 patients required operation. No patient was successfully treated by tube decompression.

For the entire series of 27 patients, the mean and median interval between LRYGB and acute SBO was 18 months (range 1 day to 39 months). Patients with acute SBO caused by MIH presented at mean and median interval of 20 and 19 months (range 5 days to 39 months), respectively. In contrast, patients with other causes of acute SBO presented earlier, with a mean and median interval between LRYGB and SBO of 7.5 months and 7 days (range 1 day to 37 months), respectively. Of the 21 operations performed at our medical center, 18 were begun laparoscopically. Of these 18 operations, 5 (24%) were converted to open procedures because the volvulus could not be safely reduced using minimally invasive techniques. An open approach was used in all the operations performed at other institutions. The open approach was chosen for the remaining 3 patients because of an incarcerated abdominal wall hernia in 2 patients and obvious peritonitis in 1 patient.

The postoperative complications that developed after acute SBO are listed in Table 2. Of the 27 patients with SBO, 8 (29.7%) developed early postoperative complications, including 2 deaths (8.7%) from septic shock. One of

Table 2
Complications after operation for acute SBO

Complication (n)	Etiology of obstruction
Sepsis (3)	MIH/volvulus for all 3
Wound infection (2)	Umbilical hernia in 1; adhesions/volvulus in 1
Recurrent SBO (1)	MIH/volvulus
Death (2)	Intussusception/volvulus in 1; incarcerated umbilical hernia in 1

Abbreviations as in Table 1.

One patient who presented with MIH and volvulus developed acute adhesive obstruction within first 10 days postoperatively.

the patients who died had had a perforation proximal to an acutely incarcerated umbilical hernia that was repaired during LRYGB. The second patient who died was a pregnant woman in whom the clinical diagnosis of SBO was not clear cut. The radiologists were unwilling to perform abdominal CT. Plain radiography that shielded the pelvis showed an "ileus pattern." Her condition deteriorated approximately 12 hours after admission, and she promptly underwent exploratory laparoscopy. Three other patients had prolonged intensive care unit stays after emergency operations for SBO at other hospitals. All 3 patients required resection of ischemic bowel.

During the last 9 months of the study, we identified 11 patients who had had intermittent symptoms of abdominal pain, bloating, and nausea suggestive of transient SBO. Elective laparoscopic exploration was recommended for these patients. Two patients with these "herald symptoms" refused surgery and later underwent emergent surgery for SBO. All 11 patients had an MIH. Small bowel volvulus was found in 4 of these 11 patients, including 3 of the 9 who underwent elective exploration. The dimensions of the jejunojejunostomy defect were similar among the 9 elective cases at 3–6 cm in length, with a slightly smaller transverse measurement. The length of stay after elective laparoscopic exploration and MIH repair was 1 day for all patients. The 9 elective patients resumed oral intake on the evening of the operation. No complications developed after elective laparoscopy.

Discussion

The reported incidence of SBO after LRYGB has been 0.7–9% [8]. In contrast, the frequency of SBO after open RYGB has been 1–2% [9]. SBO after open RYGB is usually due to adhesions, but SBO after LRYGB is most commonly due to MIH. The increased incidence of SBO after LRYGB is likely due to the difficulty in both visualizing and closing the mesenteric spaces [8]. The greater mobility of the small bowel because of the paucity of adhesions after laparoscopic surgery might also contribute to the greater incidence of SBO [10]. The symptoms of intermittent SBO can occur when bowel becomes trapped in the MIH defect. Complete closed loop obstruction results when the bowel becomes incarcerated within the hernia defect.

The relationship between the etiology of SBO and the mean time to presentation might account for the wide range in the reported incidence of SBO after LRYGB. Studies with follow-up times of <12 months might not have accounted for all cases of MIH-related SBO, because many of these patients present >18 months postoperatively. In our series, patients with acute SBO caused by MIH presented at a mean interval of 20 months after LRYGB. Conversely, acute SBO resulting from other causes developed almost 3 times earlier at a mean of 7.5 months postoperatively. The rate of 1-year follow-up for our LRYGB patients was in the range of 75% (6). Although it is possible that ≥ 1 of our patients underwent surgery for acute SBO without our knowledge, we were notified of all 6 patients who had undergone surgery for SBO at other medical centers within a few days of the procedure. When our patients have presented initially at other hospitals, the usual pattern has been a telephone call from the emergency room physician requesting that we accept the patient in transfer. Thus, we believe that the follow-up of those with acute SBO in the present series of 702 patients was virtually complete.

Successful weight loss can also contribute to MIH-related SBO. Patients achieving a $>50\%$ excess weight loss have a greater incidence of SBO due to MIH [3]. The greater incidence of SBO in the most successful patients might occur as a consequence of the "melting of the mesenteric fat," which leads to reopening or enlargement of the jejunojejunostomy defect. The mean BMI in our 15 patients who developed acute SBO owing to MIH was 28.2 kg/m^2, including 7 patients with a normal BMI of ≤ 25.0 kg/m^2 and only 4 with a BMI ≥ 30 kg/m^2.

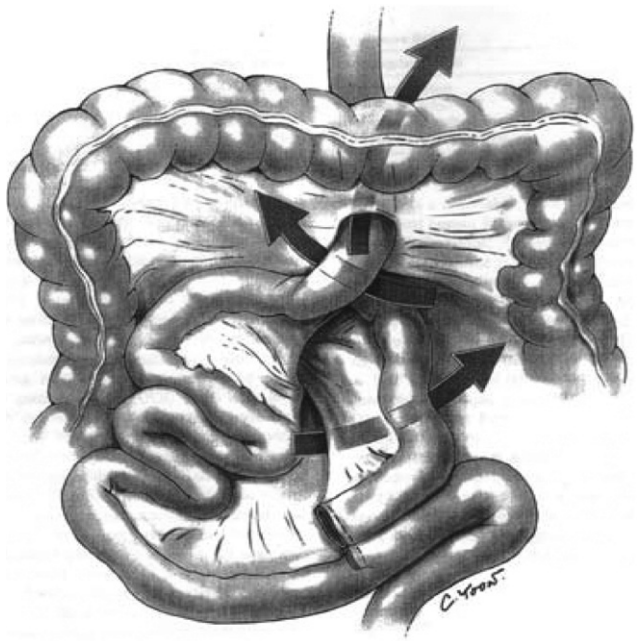
The mean percentage of excess weight loss was 78.7% (range 40–105%). All but 1 patient had lost $\geq 50\%$ of their excess weight. In contrast, the mean postoperative BMI at 12 months in our first 438 consecutive patients (including 8 patients in the SBO/MIH group) was 32.3 kg/m^2, with a corresponding mean percentage of excess weight loss of 67% (6).

Considerable controversy exists among bariatric surgeons regarding the relationship between MIH and the position of the Roux limb in LRYGB (Figs. 1 and 2). Although no consensus has been reached regarding the position of the Roux limb and the incidence of MIH after LRYGB, the preponderance of clinical data suggests that the retrocolic position is associated with a greater incidence of SBO [3,10–13]. Petersen's space was initially described in patients who had undergone retrocolic Roux-en-Y reconstruction. In antecolic LRYGB, the space between the mesentery of the Roux limb and transverse mesocolon (Petersen's space) and the defect at jejunojejunostomy are not separated anatomically. Moreover, in our LRYGB technique, the jejunojejunostomy typically rests on the transverse colon; thus, according to the precise anatomic definition, Petersen's defect does not exist. The anatomic descriptions of MIH after LRYGB in published studies have been both inconsistent and confusing. All MIHs in the present series occurred at the jejunojejunostomy defect.

The need for routine closure of mesenteric defects has also been a controversial topic in bariatric surgery. Some studies have reported a lower incidence of MIH after closing the mesentery [4,12], and others have reported no difference in the incidence of MIH after closure versus nonclosure of defects during LRYGB [8]. In our initial 625 cases, we did not completely close the jejunojejunostomy defect. However, during the last 18 months of the study, we extended our previous closure using a continuous 2-0 silk

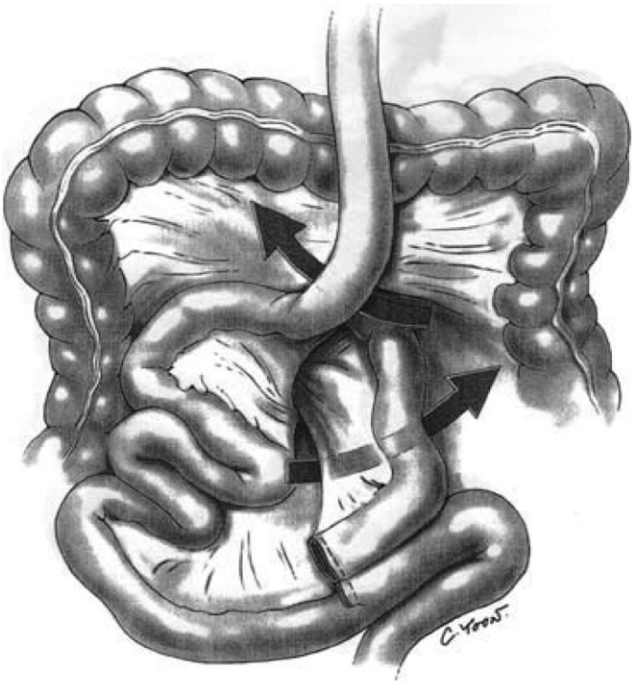
suture that began at the root of the Roux limb mesentery and approximated the cut edge of the mesentery of the BP limb to the mesentery of the Roux limb. This running suture was then tied to the most proximal anti-obstruction stitch, thus completely obliterating the jejunojejunostomy space. No cases of SBO due to MIH have occurred since the modification of our technique 18 months previously. Although longer follow-up is required to determine whether this technical modification will reduce or eliminate SBO caused by MIH, the absence of SBO caused by MIH after 18 months suggests that complete closure of the jejunojejunostomy defect is beneficial after antecolic LRYGB.

The preoperative diagnosis of MIH is difficult [2,3,8,10]. In cases of incomplete or intermittent obstruction, the findings on plain films and CT are usually negative. Likewise, blood tests are typically noncontributory. In acute SBO, the CT findings of MIH typically show dilated small bowel proximal to the blockage and cessation of progression of oral contrast distal to the obstruction site. Volvulus on CT is characterized by a swirled appearance of the mesenteric fat and blood vessels at the site of torsion, with localized congestion and edema of the involved mesentery (Fig. 3) [14].



Adapted from E. DeMaria et al. Surgery for Obesity and Related Diseases 2005; 1: 543-548.

Figure 1. Potential sites of MIH after retrocolic RYGB are the mesocolic defect, Peterson's space, and the jejunojejunostomy defect (arrows).



Adapted from E. DeMaria et al. Surgery for Obesity and Related Diseases 2005; 1: 543-548.

Figure 2. Potential sites of MIH after antecolic RYGB are the jejunojejunostomy defect and Peterson's space (arrows).

A thorough history is paramount in making the diagnosis of MIH. Our experience with acute SBO after LRYGB has suggested that virtually all patients had herald symptoms before presentation. The onset of abdominal pain is usually sudden and not associated with eating. These symptoms are quite distinct from the typical symptoms of marginal ulcer and cholecystitis. All the patients who underwent surgery at our medical center had had ≥1 episodes of colicky or sharp epigastric pain associated with nausea and bloating before developing acute SBO. Emesis before acute SBO was uncommon. Some patients reported improvement of pain when lying on their right side. Because the symptoms of intermittent SBO can result from prolapse of the small bowel into the jejunojejunostomy defect, pain relief after lying in the right recumbent position could stem from the dislodgement of the bowel from the MIH defect. Patients' complaints of intermittent abdominal pain, nausea, and bloating should not be dismissed after routine workup fails to yield a diagnosis.

The technical problems that were responsible for SBO in 5 of our patients might have been preventable. Although the potential for developing SBO was recognized during the

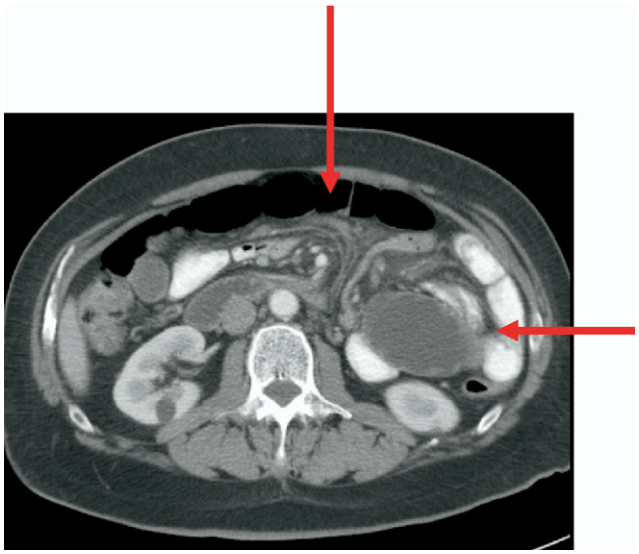


Figure 3. CT image showing SBO caused by incarcerated MIH. Arrows depict swirled appearance of mesentery and dilated small bowel.

LRYGB in each case of kinking, the remedial adjustments, including reclosure of the enterotomy with sutures in 1 case and reorientation of the "anti-obstruction" sutures in the other, were inadequate. The best remedy would have involved performing another jejunojejunostomy that bypassed the potentially obstructing anastomosis. The 2 umbilical hernias that caused SBO were repaired with heavy Prolene sutures during LRYGB. Both repairs failed during the first 48 hours postoperatively, resulting in incarceration of a loop of small bowel. Resection was required in both patients. Perforation of the bowel proximal to the obstruction resulted in diffuse peritonitis in 1 patient who died of septic shock 2 days later. The trocar site hernia that resulted in SBO occurred at a 10-mm port site of 1 patient with an unusually thick layer of subcutaneous fat. The peritoneal aspect of the trocar site was enlarged during repeated attempts to maintain the trocar within the abdominal cavity. This site was not closed at the conclusion of LRYGB. As a result of this experience, we now enlarge our laparoscopic incisions and use more sutures to achieve a secure closure of abdominal wall hernias during LRYGB. We attempt to avoid the use of mesh in repairing these hernias.

An element of delay was present in virtually all the patients who developed severe complications after surgery for SBO. The 3 patients who required prolonged stays in the intensive care unit were treated by other surgeons at other medical centers. The interval between admission and surgery was >48 hours in each case. Each patient required bowel resection for a strangulated MIH. The 2 deaths occurred at our medical center. The patient with intussusception was the first patient who developed SBO in our series of LRYGB. She was 2 months pregnant when she presented to another hospital's emergency room with acute abdominal pain. Our radiologist refused to perform a CT scan and plain abdominal radiographs that included the pelvis. Because the diagnosis of SBO was not clear, she was given a "trial" of tube decompression and observation. Although she underwent surgery shortly after her condition deteriorated, her bowel had perforated. Within the next several hours, she developed septic shock and died shortly thereafter.

The nearly 30% morbidity rate for acute SBO in the present series was greater than that reported in most published reports of SBO after LRYGB [9,12]. The so-called learning curve likely played a role in that 7 of the first 14 patients who were treated for acute SBO developed perioperative complications compared with only 1 of the remaining 13 patients. That all 27 of our patients with acute SBO required surgery strongly suggests that a nonoperative trial of tube decompression is contraindicated in patients who develop SBO after LRYGB. Conversely, no morbidity occurred in patients undergoing elective laparoscopic MIH repair at our medical center. Patients can tolerate a liquid diet on the day of surgery. Although we have kept our patients overnight, this operation probably could be a same-day procedure.

Conclusion

MIH was recognized in 26 (3.7%) of the 702 patients in this series, including 11 patients who underwent elective laparoscopy. SBO due to MIH after LRYGB is typically preceded by herald symptoms of intermittent obstruction. Because radiologic testing is almost invariably negative, an extensive diagnostic evaluation is not recommended. Patients who have these herald symptoms should promptly be offered elective laparoscopic exploration and MIH repair when necessary. This operation can be performed safely without morbidity. Because SBO due to MIH is a potentially life-threatening complication, we believe that elective repair of MIH would decrease the morbidity in this population.

Disclosures

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

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Editorial comment

Laparoscopy for cramping peri-umbilical pains

The results of this study strongly support my belief that any patient who, after Roux-en-Y gastric bypass or biliopancreatic diversion with or without duodenal switch, develops cramping periumbilical pain should undergo abdominal exploration for the presence of an internal hernia defect. The great advantage of laparoscopic bariatric surgery is that so few adhesions develop that laparoscopic re-exploration is usually really minimally invasive and, if negative, not a big deal. However, if repeat laparoscopy reveals a hernia defect, the procedure could be life-saving and consistent with the principles of preventive medicine. Even if the initial bariatric procedure was open, the patient should undergo repeat exploration if they have intermittent small bowel obstructive symptoms, although these patients might be more likely to have obstruction secondary to adhesions. I am speaking from personal experience, as we had a patient a number of years ago who I had seen on 2 occasions who complained of occasional periumbilical cramping pains but who was fine when I saw her. Several months later, she had developed a full-blown small bowel obstruction; however, the surgeon in the rural community in which she lived refused to operate because he did not do bariatric surgery. By the time she was transferred to our center, she was in intractable septic shock from the necrotic intestine and died. Cramping periumbilical pains should be an alarm. This is a situation in which the patient should be considered to have an internal hernia until proved otherwise.

Disclosures

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

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