Endoscopic findings and their clinical correlations in patients with symptoms after gastric bypass surgery

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Background: The aim of this study was to describe the endoscopic findings in patients with upper GI symptoms after Roux-en-Y gastric bypass surgery and to correlate clinical features with endoscopic findings.

Methods: Patients with symptoms after Roux-en-Y gastric bypass referred for endoscopy were studied. Endoscopy was performed in standard fashion with a 9.8-mm diameter endoscope.

Results: Forty-nine patients underwent a total of 69 upper endoscopy procedures between January 2001 and February 2003. The most common endoscopic findings were the following: normal postsurgical anatomy (21 patients, 43%), marginal ulcer (13 patients, 27%), stomal stenosis (9 patients [19%), including 5 with a concomitant marginal ulcer), and staple-line dehiscence (8 patients [16%), including one with a marginal ulcer). Abdominal pain was the most common symptom (26 patients, 53%) and was more frequent among patients with a normal endoscopy compared with those with an abnormal endoscopy ($p = 0.04$). Stomal stenosis was present in 39% of patients with nausea, vomiting, or dysphagia; it was not present in any patient without these symptoms ($p = 0.001$).

Fifteen percent of procedures performed within the first 6 postoperative months were normal, compared with 53% of those performed beyond 6 months ($p = 0.02$). There was no complication of endoscopy.

Conclusions: Among patients with symptoms after Roux-en-Y gastric bypass presenting for endoscopy, normal post-surgical anatomy was the most common finding. Marginal ulcer was the most common abnormality. Presentation with abdominal pain and performance of endoscopy beyond the 6th post-operative month were predictive of a normal endoscopy, and lack of nausea, vomiting, and dysphagia predicted the absence of stomal stenosis. (Gastrointest Endosc 2003; 58:859-66.)

Obesity has reached epidemic levels in the United States, affecting more than 30% of the adult population. The prevalence of obesity has been rising steadily, resulting in significant chronic health problems and nearly 300,000 deaths annually in the United States alone. Obesity and its associated health problems have substantial economic consequences for the United States health care system; in 1995, the total (direct and indirect) costs attributable to obesity were estimated at $99 billion, a figure that certainly is higher now. In general, non-surgical treatments achieve only limited and relatively short-term weight reduction. For selected patients, surgical therapy, referred to as bariatric surgery, is the most effective treatment modality and has been recognized by a National Institutes of Health Consensus Panel as the only successful long-term treatment for morbid obesity. There are several different bariatric procedures: jejunooileal bypass, biliopancreatic diversion, stapled gastoplasty, gastric banding, and gastric bypass. These are categorized as procedures resulting in gastric restriction, intestinal malabsorption, or a combination of both, as occurs with the gastric bypass. The Roux-en-Y gastric bypass (RYGBP), the procedure most commonly performed, has been shown to achieve significant, long-term weight loss in the majority of patients. It now is considered the reference standard of the operations for morbid obesity. Gastric bypass surgery is now being performed by using laparoscopic techniques, which has reduced the length of hospitalization and the time to return to full activity, and is associated with fewer postoperative wound infections and incisional hernias.

Although RYGBP achieves successful outcomes in the majority of patients in terms of weight reduction and improvement in comorbid conditions, many patients develop untoward postoperative upper GI (UGI) symptoms. These are often difficult to interpret clinically and frequently require investigation,
including upper endoscopy. The primary aim of this study was to describe the endoscopic findings in a cohort of patients with symptoms that developed after RYGBP and to correlate clinical features, such as presenting symptoms and time of presentation, with endoscopic findings. Secondary aims were to assess the yield of barium contrast UGI radiography and the effect of therapeutic endoscopic procedures in a subset of patients.

PATIENTS AND METHODS

All adult patients referred for endoscopic evaluation of UGI symptoms at any time after RYGBP were included in the study. All were under the care of a bariatric surgeon (R.A.F.) with extensive experience. The standard operation performed was a gastric bypass with a small (50-75 mL) pouch that is stapled and divided from the bypassed stomach (complete transection), a sutured gastrojejunal anastomosis, and a retrogastric, retrocolic jejunal limb 60 to 120 cm in length. One procedure was performed laparoscopically and included a stapled anastomosis and a 100-cm limb. For 10 of the 49 patients in the study, data were reviewed retrospectively; for the remaining 39 patients, presenting symptoms, endoscopic findings, and response to endoscopic therapy were noted prospectively. Exclusion criteria for patients enrolled prospectively were the inability to tolerate a complete endoscopic examination and the refusal to participate in the study.

Patients underwent conventional upper endoscopy by using a standard 9.8-mm diameter videoendoscope. Retrograde endoscopy of the bypassed stomach and duodenum was not performed routinely. When indicated, biopsy specimens of the gastric pouch were obtained. Suture material at the gastrojejunal anastomosis and mild, focal erythema of the gastric pouch were considered normal findings. All other findings were considered abnormal. Marginal ulcer(s)/erosions were defined as mucosal disruption of any depth occurring at or near the gastrojejunal anastomosis. Staple-line dehiscence was defined as any disruption of the barrier between the gastric pouch and bypassed stomach, including gastrogastric fistulas. Stomal stenosis was defined by resistance to passage of the 9.8-mm endoscope through the gastrojejunal anastomosis. In patients with stomal stenosis, dilation was performed by using “through-the-scope” (TTS) esophageal balloon dilation catheters (Microvasive Endoscopy, Boston Scientific Corp., Natick, Mass.). The maximum diameter of the balloon used was at the discretion of the endoscopist. All patients gave informed consent for the procedures. For the prospective portion of the study, patients gave informed consent for participation. The study was authorized by the institutional review board of our medical center.

Patient symptoms before and after endoscopy were determined from medical records (retrospective portion) or collected prospectively during the course of routine clinical care by the bariatric surgeon. Specific outcome measures included the presence or absence of UGI symptoms after therapeutic endoscopy and complications of endoscopy. All pertinent barium contrast radiographic studies were reviewed and correlated with the endoscopic findings.

Statistical analysis

Patients with normal and abnormal endoscopic findings were compared with regard to age, gender, time between surgery and endoscopy, and presenting symptoms. Categorical variables were analyzed by using the Fisher exact test, and continuous variables were analyzed with the Wilcoxon rank-sum test. Positive and negative predictive values with 95% confidence intervals for particular presenting symptoms were calculated by Exact methods. All tests were two-sided, with a p value of less than 0.05 considered significant. Analyses were performed by using statistical software (SAS version 8.2; SAS Institute, Inc., Cary, N.C.).

RESULTS

A total of 49 patients (42 women [86%], 7 men; median age 45 years, range 24-65 years) underwent a total of 69 upper endoscopy procedures between

Table 1. Comparison of patient characteristics and presenting symptoms

<table>
<thead>
<tr>
<th>Patient characteristic/symptom</th>
<th>Normal endoscopy (n = 21)</th>
<th>Abnormal endoscopy (n = 28)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender ratio (f:m)</td>
<td>21:0</td>
<td>21:7</td>
<td>0.015</td>
</tr>
<tr>
<td>Median age</td>
<td>45 y (24-54)</td>
<td>46 y (28-65)</td>
<td>0.15</td>
</tr>
<tr>
<td>Median interval from surgery to endoscopy</td>
<td>115 wk (6-703)</td>
<td>44.5 wk (5-631)</td>
<td>0.09</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>15 (71%)</td>
<td>11 (39%)</td>
<td>0.04</td>
</tr>
<tr>
<td>Nausea/vomiting</td>
<td>8 (38%)</td>
<td>9 (32%)</td>
<td>0.77</td>
</tr>
<tr>
<td>Dysphagia</td>
<td>3 (14%)</td>
<td>5 (18%)</td>
<td>1.00</td>
</tr>
<tr>
<td>Upper GI hemorrhage</td>
<td>1 (5%)</td>
<td>3 (11%)</td>
<td>0.25</td>
</tr>
<tr>
<td>Weight regain</td>
<td>0 (0%)</td>
<td>3 (11%)</td>
<td></td>
</tr>
</tbody>
</table>
January 2001 and February 2003. During the study period, 33 patients underwent one procedure; 14, two procedures; one patient, 3 procedures; and one patient, 5 procedures. The median time interval from surgery to initial endoscopy for the entire cohort was 77 weeks (range 5-703 weeks). There was no complication of endoscopy in any patient.

### Endoscopic findings

The most common endoscopic findings were, in order of decreasing frequency: normal post-surgical anatomy (21 patients, 43%), marginal ulcer/erosion (13 patients, 27%) (Fig. 1), stomal stenosis (9 patients, 19%, including 5 with concomitant marginal ulcer) (Fig. 2), staple-line dehiscence (8 patients, 16%), one of whom had a concomitant marginal ulcer) (Fig. 3), esophagitis (two patients, 4%), large hiatal hernia with intrathoracic pouch (one patient, 2%), and an abnormally large anastomosis (diameter >20 mm) (one patient, 2%). Overall, 28 patients (57%) had at least one major abnormality. Patient characteristics and presenting symptoms are compared for those with a normal endoscopy and those with

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Marginal ulcer</th>
<th>Stomal stenosis</th>
<th>Staple-line dehiscence</th>
<th>Esophagitis</th>
<th>Large stoma</th>
<th>Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal pain</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>Nausea/vomiting</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Dysphagia</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Hemorrhage</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Weight regain</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Some patients had more than one symptom and more than one endoscopic finding.

**Table 2. Frequency of presenting symptoms and endoscopic diagnoses**

**Figure 2. A,** Endoscopic view showing marked stomal stenosis before balloon dilation. **B,** Endoscopic balloon dilation of stomal stenosis. **C,** Endoscopic appearance after balloon dilation.
abnormal endoscopy in Table 1. There was a statistically significant difference in the gender ratio between the two groups, because all 7 men in the cohort had an abnormal endoscopy ($p = 0.015$). Although not statistically significant, there was a trend toward a shorter time between surgery and endoscopy for those with an abnormal endoscopy compared with those with a normal endoscopy ($p = 0.09$). There were no statistically significant differences between the two groups with regard to presenting symptoms, with the exception of abdominal pain, which was more frequent in the normal endoscopy group ($p = 0.04$).

Predictive value of symptoms

The major presenting symptoms leading to endoscopy were abdominal pain (26 patients, 53%), nausea/vomiting (17 patients, 35%), dysphagia (8 patients, 16%), UGI hemorrhage (6 patients, 12%), and regained weight (3 patients, 6%). Several patients had more than one major symptom. The frequency of specific endoscopic findings and each of the major presenting symptoms are shown in Table 2.

Twenty-three of the 49 patients (47%) complained of nausea, vomiting, and/or dysphagia. Stomal stenosis was present in 9 of these 23 patients (39%) but in none of the 26 patients who did not have these symptoms ($p = 0.001$), yielding a negative predictive value of 100% (95% CI [87, 100]). Therefore, the absence of nausea, vomiting, and dysphagia ruled out the diagnosis of stomal stenosis. However, the positive predictive value of these symptoms was only 40% (95% CI [20, 61]).

Upper-GI hemorrhage (melena and/or hematemesis) was an uncommon indication for endoscopy (6 patients). This presentation was associated with the finding of marginal ulcer in 4 patients (67%) and staple-line dehiscence in one patient (17%). Regained weight was noted for only 3 patients but in each case was predictive of an abnormal finding: staple-line dehiscence (two patients) and an excessively large anastomosis (one patient). These associations were not statistically significant, likely because of the small number of patients in the series.

Relationship between time interval from surgery and endoscopic findings

The relationship between the time interval from surgery and endoscopic findings is shown in Table 3. Although no specific temporal pattern was evident for the individual abnormal findings, the longer the time interval from surgery, the greater the likelihood of a normal endoscopy. Only 15% of patients undergoing endoscopy within the first 6 postoperative months had normal findings, compared with 53% of patients beyond 6 months from the time of surgery ($p = 0.02$).

Outcomes after therapeutic endoscopy

Endoscopic balloon dilation was attempted in 7 patients with stomal stenosis (balloon diameters ranging from 11 to 15 mm). Dilation technically was successful in all 7, permitting passage of the 9.8-mm endoscope through the stoma without resistance. All patients reported initial improvement in symptoms. Four patients (57%) had complete symptom resolution after a single dilation (median follow-up, 44 weeks; range 19-68 weeks). In one patient, symptoms recurred and required another dilation 7 weeks after the initial procedure. Another patient required two repeat dilations, 8 and 18 weeks after the initial procedure, respectively. The fourth patient, who had stomal stenosis associated with a marginal ulcer unresponsive to medical therapy, ultimately required revisional gastric bypass and truncal vagotomy at 62 weeks after the initial endoscopic dilation.
Yield of barium contrast UGI radiography

Thirty-one patients had barium contrast UGI radiography. The median time interval between endoscopy and UGI radiography was 26 days (range 1-142 days). Of the 13 patients with marginal ulcer/erosions, 8 had UGI radiography. Of these, two studies (25%) correctly identified the abnormality. Among the 9 patients with endoscopically defined stomal stenosis, 6 had UGI radiography (4 had a concomitant marginal ulcer). Stenosis (Fig. 4) was identified correctly in 5 of these studies (83%). All 8 cases of staple-line dehiscence were correctly diagnosed by UGI radiography (Fig. 5). Among the 10 UGI radiography studies performed in patients with a normal endoscopy, 7 were normal and 3 suggested anastomotic narrowing. Upper-GI radiography was normal in both patients with endoscopically diagnosed esophagitis. In the patient with a supradiaphragmatic pouch and the patient with an excessively large anastomosis, UGI radiography correctly demonstrated the abnormality.

DISCUSSION

The performance of bariatric surgery has increased considerably in recent years. According to estimates from the American Society for Bariatric Surgery, the number of procedures performed rose from approximately 23,000 in 1997 to over 63,000 in 2002. Although successful outcomes, in terms of weight reduction and improvement of comorbid conditions, are achieved in the vast majority of patients undergoing bariatric surgery, many patients develop untoward postoperative GI symptoms. These can develop at any time, from the first postoperative week to several years after surgery. As the field of bariatric surgery grows, an increase in the number of patients referred for endoscopy can be expected. Therefore, endoscopists must be familiar with the surgically altered anatomy and the possible endoscopic findings in this patient population. A recent review emphasized this point as well as the importance of communication with the referring bariatric surgeon to ensure successful, useful, and safe endoscopy. Gastroenterologists should be prepared to become integral members of multidisciplinary teams caring for these patient, to provide accurate diagnosis and adequate treatment of postoperative GI complications.

Earlier endoscopic studies, largely in surgical publications, describe several important GI complications after gastric bypass surgery. The most common reported include marginal ulcer, stomal...
H pylori preoperative screening and treatment of symptomatic marginal ulcer can be reduced by 19,20 Variations in surgical technique appear to play an important role in the development of these complications.10,15 It is not yet known how the laparoscopic approach will affect the frequency of these specific complications, although an increase in stomal stenosis compared with open surgery was noted in one study.6 Another more recent study confirmed that the rate of stenosis after laparoscopic RYGBP is relatively high (27%).16 In the present series, only one patient had a laparoscopic RYGBP, which was complicated by a gastric fistula.

The most common endoscopic abnormalities detected in our cohort of patients with symptoms after RYGBP were marginal ulcer and erosions (27% of patients). The etiology of marginal ulcer after RYGBP remains unclear. Potential contributory factors include gastric acidity, pouch orientation and size, staple-line dehiscence, ischemia and tension at the gastrojejunal anastomosis, or possibly a still-undefined paracrine process.11,13,15,17 The manner in which the gastrojejunal anastomosis is fashioned (hand sewn vs. stapled) also may be an important factor in the development of marginal ulcer.18 A role for Helicobacter pylori infection in the development of marginal ulcer has not been established definitively. Uncontrolled data suggest that the frequency of symptomatic marginal ulcer can be reduced by preoperative screening and treatment of H pylori infection.19 Although routine preoperative testing for H pylori has been advocated,20 this has not been studied rigorously and is not routine at our institution. Data from the present series are insufficient to reach any conclusion as to the etiology of marginal ulcer.

GI hemorrhage was an uncommon indication for endoscopy in the present series; indeed, hemorrhage has been reported infrequently after gastric bypass surgery.21-24 In patients who develop early postoperative GI hemorrhage, the most likely sites are the gastrojejunostomy, gastric remnant, and jejuno-jejunostomy staple lines.24 Late GI hemorrhage is commonly caused by marginal ulcer at the gastro-jejunostomy. However, it is important to consider the excluded gastric segment and duodenum as potential sites of bleeding.25 Endoscopic evaluation of these areas may be attempted in retrograde fashion with a pediatric colonoscope or enteroscope.25,26

Stomal stenosis was present in nearly 20% of patients in the present series, making it the second most common abnormality detected on endoscopy. Endoscopic management of stomal stenosis after bariatric surgery by using standard techniques is safe, effective, and reduces the need for revisional surgery, and can be performed successfully by using a variety of methods, including balloon dilation (TTS or guidewire assisted), passage of dilators over a guidewire (Eder-Puestow, Savary-Guilliard), and endoscopic electrosurgical incision.12,27-33 The optimal technique for dilation of stomal stenoses in patients who have undergone RYGBP remains to be determined. The preferred stomal diameter created during surgery is 12 to 15 mm, and the success of surgery depends not only on the creation of a small pouch that restricts caloric intake but also a narrow outlet that limits the rate of emptying.34 There is a concern that overaggressive endoscopic dilation may result in dumping syndrome and failure to lose weight, although successful dilation to 18 to 20 mm without resulting in re-operation for failure to lose weight has been reported.30 A retrospective study found a decreased risk of symptom recurrence when dilation to at least 15 mm was performed. Patients who returned with symptoms caused by recurrent stenosis underwent dilation to 18 mm with good outcomes. Moreover, all stenoses that could be traversed with the 9-mm endoscope subsequent to dilation were dilated to 18 mm. By using this technique, 67% of the patients had one dilation; 30%, two dilations; and 3% (one patient), 3 dilations.35 In the present series, only one patient with an excessively large anastomosis (diameter >20 mm) regained significant weight after surgery. At this time, it is our preference to perform serial dilations up to a maximum diameter of 15 mm by using TTS balloon dilators.

Staple-line dehiscence was detected in 16% of our patients. These patients most commonly presented with complaints of abdominal pain, with or without weight gain. Although a close association between staple-line dehiscence and marginal ulcer has been noted in earlier studies;10,17 only one of 8 patients in the current series had both complications simultaneously. The risk of staple-line dehiscence appears to be related closely to surgical technique, with a higher frequency for procedures with vertically oriented, lesser curvature pouches that are stapled but not divided. This may be a function of the musculature, compliance, and motility of this region of the stomach. In a review by Capella and Capella,10 the overall frequency of staple-line dehiscence was 21% when gastric segments (pouch and bypassed stomach) were stapled in continuity or partially transected, compared with 1% when the segments were transected completely. The risk of staple-line dehiscence, therefore, appears also to depend on the proximity of the gastric pouch to the bypassed stomach. Even when the pouch is completely transected, if it remains close to the bypassed stomach,
gastrogastric fistulas can occur, albeit uncommonly. Interposition of omentum or a limb of jejunum between the segments may reduce the risk of this complication. At our institution, complete transection of the gastric segments is performed routinely.

Overall, the most common endoscopic finding was normal post-surgical anatomy. Suture material frequently was present at the gastrojejunal anastomosis and generally is considered a normal finding, although suture-related erosions/ulceration can occur. Some investigators have suggested that erosion of suture material through the gastric mucosa also may contribute to recurrent or late stomal stenosis by inciting an inflammatory reaction. The significance of a normal endoscopy is that it excludes a mechanical/structural cause for symptoms and may implicate a behavioral/dietary problem. Long-term symptom management in such patients then can be focused on modifying eating habits and food selection.

Analysis of our data revealed that specific symptoms were not predictive of any particular endoscopic finding. However, the absence of nausea, vomiting, and dysphagia excluded the diagnosis of stomal stenosis. Endoscopic procedures performed more than 6 months after the date of surgery were significantly more likely to be normal than procedures performed within the first 6 postoperative months. Although this finding may reflect referral bias, it is conceivable that most clinically significant structural complications develop and cause symptoms within the first 6 months after RYGBP.

Barium contrast UGI radiography is useful in the evaluation of patients with symptoms after RYGBP when performed in conjunction with upper endoscopy. It provides important anatomic information, which may be particularly helpful to endoscopists with limited experience with this patient population. Barium contrast radiography is particularly useful and is the preferred initial study for the detection of staple-line dehiscence, which may be small and overlooked during endoscopy. Although the present study does not provide sufficient data to draw any firm conclusions regarding the sensitivity and specificity of barium contrast UGI radiography, an excellent endoscopic correlation was noted for staple-line dehiscence and stomal stenosis. Further study is needed to determine the accuracy of UGI radiography for detection of marginal ulcers; however, based on the limited data from the present study, a normal UGI study does not obviate the need for endoscopy in symptomatic patients.

In summary, the present study demonstrates that upper endoscopy is an important diagnostic modality for evaluating patients with UGI symptoms after RYGBP. The most common endoscopic finding was normal post-surgical anatomy, a finding that may imply a behavioral etiology for symptoms and thus helps to focus management on patient education and lifestyle modification. The most common abnormal endoscopic findings were marginal ulcer, stomal stenosis, and staple-line dehiscence. Endoscopic balloon dilation was a safe and effective treatment for stomal stenosis and should be attempted at least once in an effort to reduce the need for revisional surgery. There remains a concern, however, that excessive dilation may worsen dumping symptoms and lead to a regain in weight, potentially negating the benefit of the RYGBP. Further studies are needed to establish the optimal diameter and frequency of dilation for stomal stenosis.

REFERENCES


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