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Asmbs guidelines/statements

ASMBS literature review on the treatment of marginal ulcers after metabolic and bariatric surgery

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Abstract Marginal ulcers (MUs) encompass a group of mucosal disruptions and subsequent inflammatory changes and their sequala found after Roux-en-Y gastric bypass (RYGB) oneanastomosis gastric bypass (OAGB), and, less commonly, after biliopancreatic diversion with duodenal switch (BPD/DS) or single anastomosis duodeno-ileostomy with sleeve gastrectomy (SADI-S). Prevalence of MU after RYGB ranges from .6%–16%. This review summarizes the current knowledge about the treatment options available for MU after MBS for providers who treat them. (Surg Obes Relat Dis 2024;■:1–8.)

Keywords: Marginal ulcers; Bariatric surgery complications; Complicated ulcers; Bleeding; Perforation; Stricture; Recurrent ulcer

Marginal ulcers (MUs) encompass a group of mucosal disruptions and subsequent inflammatory changes and their sequala found after Roux-en-Y gastric bypass (RYGB) one-anastomosis gastric bypass (OAGB), and, less commonly, after biliopancreatic diversion with duodenal switch (BPD/DS) or single anastomosis duodeno-ileostomy with sleeve gastrectomy (SADI-S). Prevalence of MU after RYGB ranges from .6%–16% [1].

This review summarizes the current knowledge about the treatment options available for MU after MBS for providers who treat them.

Methods

A literature search was conducted using Ovid MEDLINE using the following terms: "bariatrics," "bariatric surgery," "gastric bypass," "gastroplasty," "jejunoileal bypass," "sleeve gastrectomy," "gastric band," "biliopancreatic diversion," "duodenal switch," "gastric balloon," "intragastric balloon," "vagal nerve block," "transoral outlet reduction," and "peptic

Preamble: This review is in response to inquiries made to the society regarding marginal ulcers in patients who have had metabolic and bariatric surgery. These recommendations are based on current clinical knowledge, expert opinion, and published peer-reviewed scientific evidence available at this time. The paper is not intended to establish a local, regional, or national standard of care. The paper will be revised in the future as additional evidence becomes available.

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ulcer perforation," "stomach ulcer," "duodenal ulcer," "peptic ulcer," "ulcer," "peptic ulcer hemorrhage," "anti-ulcer agents," "*Helicobacter pylori*," and "postoperative period," "postoperative care," "postoperative complications," or "postoperative." To ensure capture of all pertinent articles, a PubMed search for "bariatric surgery" and "postoperative ulcer" was also completed and the results from both search platforms were merged and deduplicated. All searches were limited to human subjects and English language as well as papers published from 2000 to present. Authors were also free to add additional articles that met relevance to the topic outside of this search if they saw fit. The manuscript was peer-reviewed by the membership of the Clinical Issues Committee and then approved by the American Society for Metabolic and Bariatric Surgery (ASMBS) Board of Directors prior to submission for publication.

Management of uncomplicated MUs

Most MU are simple ulcers without major bleeding, perforation, or gastrogastric fistula. An algorithm for the management of uncomplicated MU is shown in Fig. 1. The treatment of uncomplicated ulcers includes smoking cessation, discontinuation of non-steroidal anti-

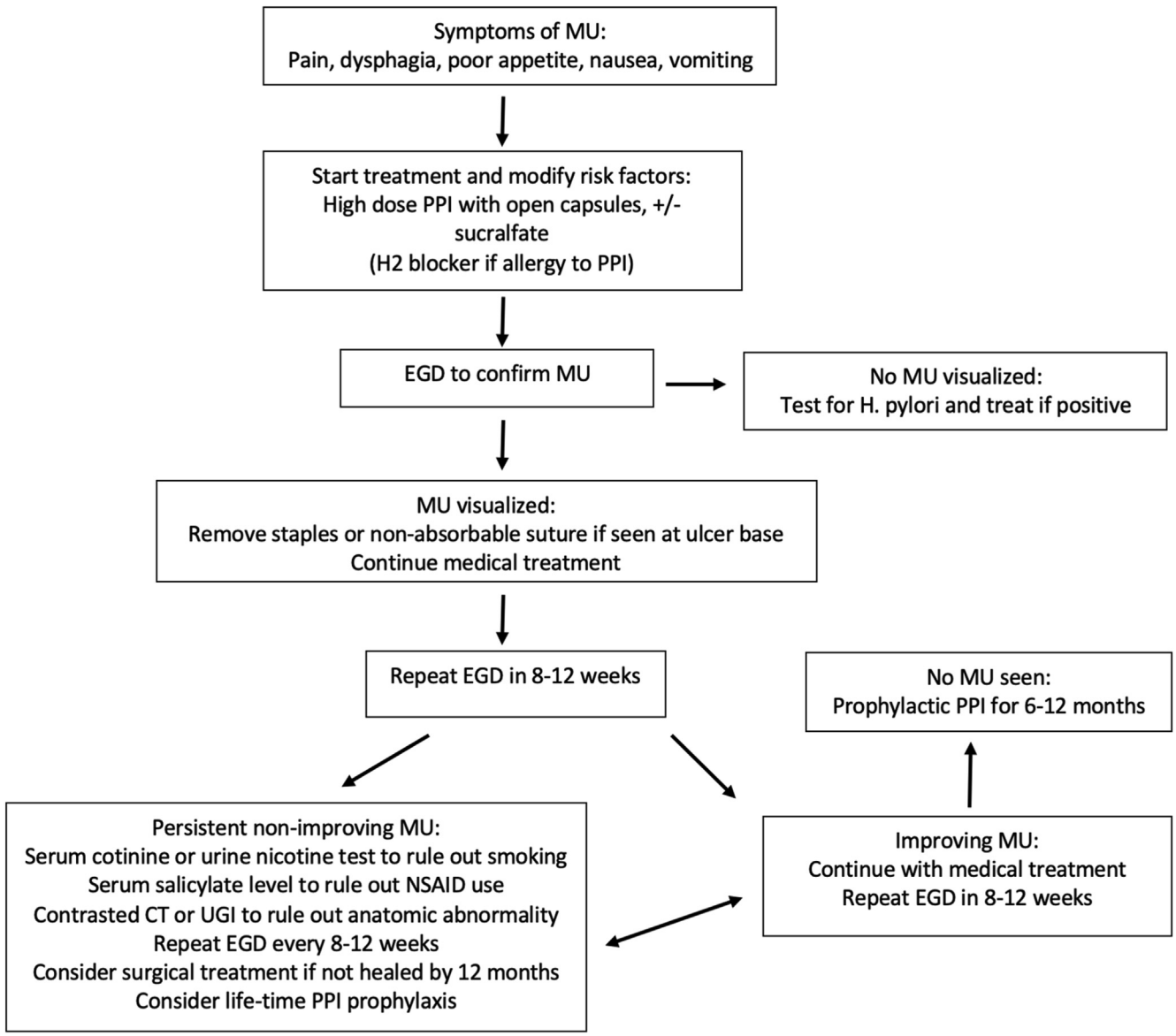

Fig. 1. Flowchart for the management of uncomplicated MU in patients who have undergone metabolic and bariatric surgery. EGD = esophagoduodenoscopy; *H. pylori* = *Helicobacter pylori*; MU = marginal ulcer; UGI = upper GI swallow study.

inflammatory drugs (NSAIDs), dose reduction or discontinuation of immunosuppressants (if medically appropriate), diagnosis and treatment of *Helicobacter pylori* (*H. pylori*), and endoscopic removal of any permanent suture material (Fig. 1) [1,2]. The medical treatment of MU is proton pump inhibitors (PPIs) with or without sucralfate. As a result, there is considerable variation in practice. For example, an international survey of 189 surgeons asked about treatment for a first occurrence of MU and reported that 60% used PPI alone, 32% used a combination of PPI and sucralfate, and 6% used PPI, H2 blockers, and sucralfate [1]. As for the duration of therapy, 49% of respondents continued treatment until the resolution of the ulcer was verified by endoscopy, 31% provided treatment for a set duration of 3 months, and 20% continued treatment for up to 2 years. Published success rates with medical treatment of uncomplicated MU range from 67%–100% [3,4].

There has been concern about whether PPIs, which are typically in capsule form, are effective after RYGB, given the small gastric pouch and increased small bowel transit time seen after RYGB. These factors have the potential to limit the absorption of the medication. A retrospective review by Schulman included 162 patients with MU and showed faster MU healing rates in patients who were treated with open capsules versus intact capsules (91 days versus 342 days, $P < .001$) [5].

The addition of sucralfate to PPIs has been hypothesized to improve healing rates of MU; however, its actual benefit has not been proven. In a retrospective review by Azagury et al., there were no significant differences in healing rates of MU between the PPI alone cohort (68%) and PPI plus sucralfate cohort (67%) [3,6]. Additional research is needed to understand if adding sucralfate improves healing rates of MU. Sucralfate's help with timeliness of symptom resolution remains to be determined.

There is no consensus as to the optimal duration of PPI therapy for uncomplicated MU. Several strategies have been employed, including continuing PPIs until complete healing, continuing for a set duration of 3–24 months, and lifetime PPI use [1,2]. In patients with recurrent ulcers, continued smoking, or anatomic abnormalities, lifetime prophylaxis may be warranted. If the MU fails to heal, it becomes chronic. There is no consensus as to when nonhealing MU should be labeled as chronic or refractory, but a duration of 12 months can be considered. Once an MU becomes refractory, it is important to consider anatomic abnormalities that may be contributing, such as a large gastric pouch, gastrogastric fistula, or strictures [7].

Management of complicated MUs

The complications of MU include bleeding, perforation, stricture, and gastrogastric fistula. These often require surgery to manage. Pyke et al. used a New York State longitudinal administrative database and reported that 9.3% of MU after RYGB ultimately required surgery [8]. MU treated surgically was also associated with high recurrence rates. The estimated cumulative incidence of MU recurrence was 15% (95% confidence interval [CI]: 9%–22%) at 6 months and 24% (95% CI: 15%–32%) at 12 months following surgical intervention [8]. Similarly, Azagury et al. reported that 9% of patients with MU required surgical intervention, including revision of the gastrojejunostomy, due to nonhealing, recurrence, perforation, obstruction, or gastrogastric fistula [3]. Athanasiadis et al., reported that smoking may influence the risk of requiring surgery for MU; patients who quit smoking within a year prior to RYGB had a higher rate of reoperation to treat complications of MU (15.9%) compared to patients who quit smoking more than a year prior to the initial bariatric consultation (5.7%), and lifetime nonsmokers (1.3%) [9]. The specific management of bleeding, perforation, stricture, and gastrogastric fistula are described below.

Bleeding

Bleeding may be present in up to 24% of patients with MU [3]. It usually manifests acutely with hematemesis, hematochezia, melena, or, more subtly, with iron deficiency anemia and heme-positive stools. One risk factor for bleeding is antiplatelet and anticoagulation therapy [10]. Initial management includes securing the airway when necessary and providing large-bore intravenous access for resuscitation with crystalloids and blood products. Cessation of antiplatelet and anticoagulation agents and correction of coagulopathy is recommended. After the patient is stabilized, an upper endoscopy should be performed. In most cases, bleeding can be controlled endoscopically by applying clips, epinephrine injection, argon coagulation, heater probes, topical anticoagulants, or other endoscopic interventions [11,12]. Patients with recurrent or uncontrolled bleeding may need angiographic embolization or surgical intervention, which in most cases involves resection of the bleeding ulcer and any associated gastrogastric fistula with the creation of a new gastrojejunostomy [13]. Bleeding pseudoaneurysms of the splenic artery and aortoenteric fistula associated with bleeding MU after RYGB have also been described [14,15]. Surgical considerations such as emergent reversal of the RYGB or conversion of OAGB to RYGB are some proposed options to manage bleeding MU [16,17].

Perforation

Perforation can occur with known MU or can be the presenting symptom of MU in previously asymptomatic patients. The incidence of perforated MU varies from .44%–1.0% [18–22] in patients who undergo RYGB. Of patients who develop MU, approximately 20% will present with perforation [23]. For instance, a series of 340 MUs at 1

year after RYGB using the Scandinavian Obesity Surgery Registry reported 78 perforations (23%) [24].

Patients with a perforated MU usually present emergently with acute onset of abdominal pain and may have peritonitis, tachycardia, tachypnea, or fever. Upright chest radiograph may show free air under the diaphragm. A computed tomography scan may show free air, free fluid, inflammation around the gastrojejunostomy, and/or contrast extravasation. Management of perforated MU requires prompt resuscitation with intravenous fluids, broad spectrum antibiotics, and PPIs. Early surgical intervention is important to reduce septic complications. If the patient is hemodynamically stable, transfer to a bariatric center may be considered; however, a general surgeon should be able to explore the patient, either laparoscopically or via laparotomy, and treat the perforation [11]. Most bariatric surgeons perform a diagnostic laparoscopy, abdominal washout, primary repair of the perforated ulcer, coverage with an omental patch, and placement of a drain adjacent to the repair. Intraoperative endoscopy may help identify the site of the perforation and assess the size, number, and depth of MU. Thorough abdominal washout is important to decrease the risk of postoperative intraabdominal abscesses. Feeding access to the bypassed stomach or tacking the bypassed stomach to the abdominal wall for easier percutaneous access may be necessary for patients with complicated ulcers at risk for malnutrition. Liquid food intake is initiated 2–3 days after surgery based on clinical improvement or the results of a water-soluble radiographic study demonstrating no leak. In patients with a persistent leak following a primary repair, initiating parenteral nutrition or distal tube feeds is required to promote healing. Following surgical repair, patients are maintained on oral PPIs, and risk factors such as smoking, NSAID or immunosuppressant use, and *H. pylori* status are modified.

Outcomes after repair or resection of perforated MU have been reported. Altieri et al. used a Statewide Planning and Research Cooperative System longitudinal database for all patients who underwent an RYGB between 2005 and 2010 in the state of New York and reported a .83% incidence of perforated MU with an intervention at a median of 942 days [25]. Caucasian race, Medicaid or Medicare insurance, peripheral vascular disease, renal failure, drug abuse, and tobacco use were independently associated with developing a perforated MU. Ulcer repair was performed in 39.4%, revision of the gastrojejunostomy in 21.9%, and nonsurgical management in 34.6% of patients. Complications did not statistically differ between anastomotic revision and omental patch.

The recurrence rate of MU was high following both repair (26.1%) and revision (29.7%), with an overall 31.6% estimated incidence of recurrence at 1 year after surgery [26]. Crawford et al. compared 2 techniques for managing perforated MU: suturing the ulcer with or without an omental patch and gastrojejunostomy revision [27]. In their series of 17,087 RYGB patients, the rate of perforated MU was .84%. Perforation occurred at a mean of 2.9 ± 2.5 years after RYGB. Revision of the gastrojejunostomy was associated with lower ulcer recurrence (11.4% versus 41.7%) and lower chance of RYGB reversal (2.8% versus 11.1%) with comparable rates of anastomotic leak (1.4% versus 2.8%), readmission (4.2% versus 4.2%), and reoperations (2.8% versus 5.6%). While revision of the gastrojejunostomy has the advantage of addressing underlying anatomic factors such as ischemia of the gastrojejunostomy or large gastric pouch, revision during emergency surgery is more technically challenging and requires a hemodynamically stable patient and specialized bariatric surgeon expertise. Several series have documented omental patch repair as a safe and effective first approach [2,18].

MU perforation has been described after OAGB and is managed similarly to patients with RYGB anatomy. In a series by Carandina et al., the incidence of perforated ulcers at 10 years following OAGB was .8% [28]. If the ulcer is not amenable to primary repair due to its large size or unhealthy ulcer edges, conversion to RYGB can be considered [29,30]. Abou Hussain et al. advocated conversion to RYGB or creation of a side-side jejunojejunal anastomosis to divert the biliopancreatic secretions away from the area of the perforation [29]. They also recommended conversion to RYGB for posterior ulcers, which can be difficult to expose and surgically repair. Another treatment option for patients with unfavorable anatomy at the time of emergency exploration due to scar tissue and peritonitis is T-tube catheterization of the perforation and external drainage [31].

Stricture

Stricture of the gastrojejunostomy after RYGB has been reported incidence of 3%–27% [32]. Anastomotic strictures are often due to the presence of a healing MU that produces excess scar, causing symptoms of obstruction and food intolerance [18,33]. In a series of revisional surgeries for recalcitrant gastrojejunal strictures, 11 of 25 patients (46%) had a MU at some point before the reoperation [32]. The proximal gastric pouch was downsized markedly in all but one patient, and reconstruction required an esophagojejunostomy in 6 of 25 patients (25%). The primary management of stricture of the gastrojejunostomy is endoscopic dilation. Physicians should recognize that dilation of an ulcer-associated stricture may be complicated by acute perforation. For example, in a series of 23 stricture patients with associated MU, 2 patients required emergent laparoscopy for acute perforation within a few hours of endoscopic balloon dilation. There were exudative changes in the left upper abdomen but no apparent perforation, indicating a microperforation that had sealed. Both patients recovered uneventfully but later required elective revision of the gastrojejunostomy for intractable MU [34].

Gastrogastric fistula

Gastrogastric fistula following divided RYGB is closely associated with MU [35]. Management of gastrogastric fistulas has been described in the literature. Closure of small gastrogastric fistulas less than 10-mm diameter can sometimes be achieved with PPI therapy, avoidance of smoking and NSAIDs, and endoscopic techniques using endoclips, fibrin sealant, covered esophageal stents, and endoscopic suturing systems [36,37]. Most authors advocate mucosal ablation of the fistula edges using argon plasma coagulation or a biliary brush prior to tissue approximation to address epithelization of the fistula tract and promote durable healing [38].

In a case series of gastrogastric fistulas by Carrodeguas et al., 8 of 15 (53%) patients had a concomitant MU [39]. Initial management was medical with PPI and sucralfate. Five patients required laparoscopic revision of the gastrojejunostomy for refractory MU. In a series by Chahine et al., 6 of 15 (40%) gastrogastric fistulas were associated with MU and were treated with resection of the gastrojejunal anastomosis en bloc with the fistula tract [40]. Similarly, Salimath et al. described gastric remnant resection en bloc with the fistulous tract and the gastrojejunostomy to avoid the challenging dissection between the gastric pouch and remnant [41]. In conclusion, surgeons should be aware that gastrogastric fistula is frequently found to be associated with MU and should be prepared to resect the fistula when planning operative therapy.

Refractory MUs

Chronic refractory MU most often requires surgical treatment. There is no consensus as to when an ulcer should be considered chronic, 12 months has been suggested. In an international experts' survey, 26% recommended surgical revision or conversion after 3 months of medical treatment, 44% recommended revision after 6 months, and 28% recommend revision after 12 months of medical treatment. If an ulcer has not healed after treatment of underlying causes and continuous PPI therapy for 12 months, a diagnosis of refractory ulcer can safely be made and therefore, surgical treatment may be considered.

Management options for refractory MU include endoscopic and surgical approaches. There are sparse data on endoscopic management. Barola et al., described 11 patients who underwent endoscopic suturing (n = 7), stent deployment (n = 2), or both suturing and stent (n = 2) to treat recalcitrant MU. At 8 weeks postintervention, 9 of 10 patients with postprocedural endoscopic surveillance had complete ulcer healing [42]. Because endoscopic management has not been well established, most reports in the literature focus on surgical management for refractory MU. Surgical therapy includes resection of the gastrojejunostomy to include all ulcerated or ischemic tissue and creation of a new anastomosis with or without reduction of the gastric pouch, resection of the bypassed stomach, or truncal vagotomy [1,22,43–45]. Other surgical approaches include resection of the pouch and creation of an esophagojejunostomy in order to eliminate acid exposure to the anastomosis entirely, or alternatively, reversal of the RYGB. The small sample size, heterogeneity, and short follow-up in these case series make it challenging to determine the ideal surgical approach for refractory MU [46]. In an international survey by Steinemann et al., 41% of respondents said they would perform surgical resection of the gastrojejunostomy in patients with refractory MU, 18% would add a truncal vagotomy, and 13% would also resect the bypassed stomach. Interestingly, surgeons with less experience (<200 cases) were more likely to recommend nonsurgical management of refractory MU than experienced surgeons [1].

The literature contains several reports describing outcomes of refractory MU managed surgically. El-Hayek et al. reported on 12 patients with intractable MU managed with resection of the gastrojejunal anastomosis and associated stricture (3 patients), gastrogastric fistula (4 patients), or enlarged pouch (3 patients) [7]. Interestingly, 4 patients developed recurrent ulceration, 2 of whom smoked. This study highlighted the importance of smoking cessation confirmation, absence or eradication of *H. pylori*, and cessation of NSAID use before embarking on revisional surgery [7]. In a series by Chau et al., 12 patients with refractory MU underwent surgical revision [93]. Nine patients were also diagnosed with concomitant gastrogastric fistula and 11 had late MU diagnosed >1 year after surgery. Nine patients (75%) underwent subtotal gastrectomy in addition to revision of the gastrojejunostomy. One patient required the creation of an esophagojejunostomy, highlighting the need to protect the terminal branches of the left gastric artery in order to avoid recurrent MU from ischemia of the gastric pouch. One patient with a bleeding recurrent ulcer was managed with a thoracoscopic vagotomy. These authors advocated resection of the remnant stomach to avoid recurrent gastrogastric fistula [44].

Another series reported on 59 patients with MU at a single bariatric center, of whom 26 required surgery, 14 required urgent operation for perforation or active bleeding, and 10 had elective operations for refractory MU or gastrogastric fistula [43]. Perforations were managed with either sutured repair and omental patch (8 patients) or resection and revision of the gastrojejunostomy (4 patients) when the perforation was found to be too large to be oversewn. One patient required a second revision of the gastrojejunostomy due to a recurrent ulcer, and one patient underwent a reversal of gastric bypass due to malnutrition and recurrent ulcer [43]. Similarly, another series of 86 patients with MU reported on 10 patients who required surgical treatment: 2 patients underwent emergent laparoscopic suture repair of a perforated ulcer, 2 patients underwent resection of the

gastrojejunostomy and creation of a new anastomosis, and 6 patients underwent complete pouch resection and creation of an esophagojejunostomy [47]. In another series of 122 patients with MU, 38 underwent revision of the gastrojejunostomy and one underwent RYGB reversal for intractability. Six patients also underwent bilateral truncal vagotomy. Gastrogastric fistula was found in 28 patients. The primary indications of intractability were abdominal pain (67%), gastrointestinal bleeding (21%), stomal obstruction (10%), and perforation (3%). Postoperative complications included 2 leaks and 1 death. Most patients (87%) did not develop recurrent ulcers following surgical revision but 3 who smoked did develop recurrent MU [22].

Finally, the literature cautions that long-term recurrence of MU can occur after revisional surgery. In a series by Di Palma et al., 1% of RYGB patients required revisional surgery for recalcitrant MU [46]. Patients with a history of smoking (hazard ratio [HR] 5.03), immunosuppression (HR 4.60), and preoperative NSAID use (HR 3.11) were significantly more likely to require revisional surgery for refractory MU. Twelve of 28 patients (43%) had an associated gastrogastric fistula. One year following revision, only 10 patients (36%) reported resolution of their symptoms, and 16 (57%) had endoscopically-proven recurrence of their ulcer, with 3 patients ultimately requiring surgery to reverse the RYGB anatomy [5].

Taken as whole, the literature supports resection of the gastrojejunostomy along with any associated gastrogastric fistula (i.e., partial gastric remnant resection) and downsizing enlarged gastric pouches as the primary treatment for refractory MU but cautions that long-term ulcer recurrence remains a concern, and consequently, underlying medical causes such as smoking, NSAIDs, immunosuppressants, or *H. pylori* need to be addressed in order to optimize outcomes.

The effect of truncal vagotomy as an adjunct or alternative to resection has been studied. Hunter et al. studied 17 patients who underwent a thoracoscopic truncal vagotomy to treat refractory MU [45]. Two patients had a remote history of perforated MU, and one had a recurrent MU after a prior revision of the gastrojejunostomy. Seven patients had endoscopic follow-up, and none had evidence of MU recurrence. Interestingly, 2 patients developed a recurrent anastomotic stricture, recalcitrant to dilatation, requiring revisional surgery [45]. Chang et al. reported that 11 patients with refractory MU underwent revisional surgery with totally hand-sewn gastrojejunostomy and truncal vagotomy. Eight patients had a stricture at the gastrojejunostomy. Nine patients with more than 1-year follow-up achieved endoscopic resolution of the refractory MU [48]. Bonanno et al. reported on 23 patients with recalcitrant MU who underwent revision of the gastrojejunostomy and compared them to 7 patients who underwent transthoracic vagotomy [49]. Recurrence of ulcers was ∼15% in both groups. More patients in the revision group suffered Clavien–Dindo grade >3 complications than the vagotomy group (38% versus 28%) [49]. These trials suggest that the addition of truncal vagotomy to MU resection may improve long-term outcomes for chronic MU, and in cases of recurrent MU after a revision, thoracoscopic truncal vagotomy may have benefit as a salvage procedure.

Complete reversal of RYGB, or reversal and conversion to sleeve gastrectomy, have been used to address refractory MU. In a series of 12 patients who underwent conversion of RYGB to sleeve gastrectomy by Carter et al., refractory MU was the indication in six patients, 3 of which had an associated anastomotic stricture [50]. Interestingly, 2 of the 6 patients had already undergone a revision of the gastrojejunostomy for a refractory ulcer/stricture. Not surprisingly, these technically challenging operations were associated with a high rate of major complications, readmissions, and the need for supplemental nutrition [50]. In a series of laparoscopic RYGB reversal procedures by Ma et al., 25 out of 48 patients underwent reversal to address a nonhealing MU, and among these, 17 had concurrent substance, alcohol, or tobacco abuse [51]. Forty percent (10/25) had a prior operation for perforated MU, and 2 patients had gastrogastric fistula and malnutrition. The overall complication rate was high at 29%, but in the long-term, all patients who were followed up achieved resolution of the symptoms which led to reversal of RYGB [51]. Finally, Zaveri et al. reported on 50 patients who underwent RYGB reversal; 27 were performed to address recalcitrant MU; 2 for a bleeding MU, 5 for severe recurrent gastrojejunal strictures related to chronic MU, and one of which urgently to address a perforation following balloon dilation of the stricture [16]. The outcomes following gastric bypass reversal included 25 patients with resolution from their chronic ulcers, 7 patients with resolution from their anatomic complications, 2 patients with resolution from their malnutrition, and 8 patients with resolution of their functional disorders [16]. Taken as a whole, this literature supports the reversal of RYGB as an option for the treatment of refractory MU.

Chronic MU can also occur after OAGB. The literature reports that such ulcers can be successfully treated with revision to RYGB [52–54].

Conclusions

Initial treatment of MU involves diagnosing and managing risk factors, PPI therapy, and repeating upper endoscopy to assess healing. While opening PPI capsules may confer better healing rates, the addition of sucralfate or histamine-blocking agents has not been shown definitively to improve healing rates.

Perforated MU may be treated with surgical closure of the ulcer with omental patch or resection of the gastrojejunostomy. Resection should include all ulcerated tissue with the creation of a new gastrojejunostomy, which a surgeon with bariatric expertise should perform.

An ulcer that has not healed after 12 months of medical therapy may be considered chronic or refractory. Such

ulcers should be evaluated by a surgeon, and a search for occult risk factors (such as smoking/NSAID use or occult gastrogastric fistula) should occur. Surgical management options for refractory MU include resection and redo of the gastrojejunostomy, reduction of the gastric pouch, resection of any gastrogastric fistula, and/or truncal vagotomy. In some cases, complete resection of the gastric pouch with esophagojejunostomy or reversal of the gastric bypass may be indicated. Revisional surgery for refractory MU carries a significant risk of short-term complications and a long-term risk of recurrent ulceration.

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