Chronic ulcer after LRYGB
–
What are the treatment options?

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Conflict of Interest

I have the following potential conflict(s) of interest to report:

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  - Uniscientia Foundation
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Epidemiology

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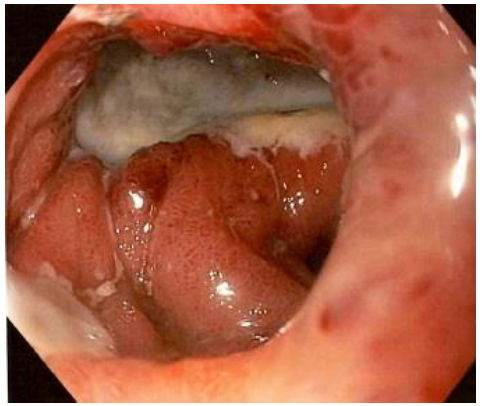
- Marginal ulcer (MU) is a potential complication after RYGB, which is typically located near the gastrojejunal anastomosis
- Incidence rate is extremely variable and ranges between <1% and 4.6% [1-3]
- Can occur at any time after RYGB [1-3]



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2 Coblijn, U.K. et al. Symptomatic marginal ulcer disease after Roux-en-Y gastric bypass: Incidence, risk factors and management. ***Obes. Surg.*** **2015**, 25, 805–811

3 Di Palma, A. et al. Marginal ulceration following Roux-en-Y gastric bypass: Risk factors for ulcer development, recurrence and need for revisional surgery. ***Surg. Endosc.*** **2021**, 35, 2347–2353

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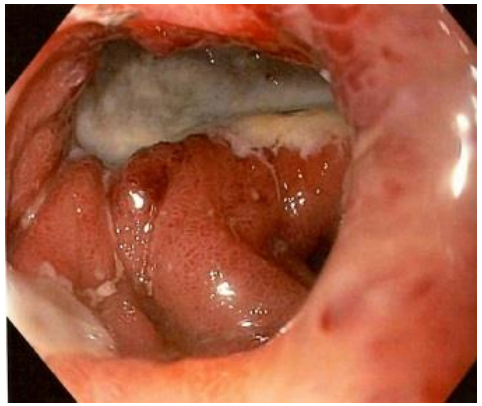
- In severe cases, MU may perforate and require urgent treatment [4]



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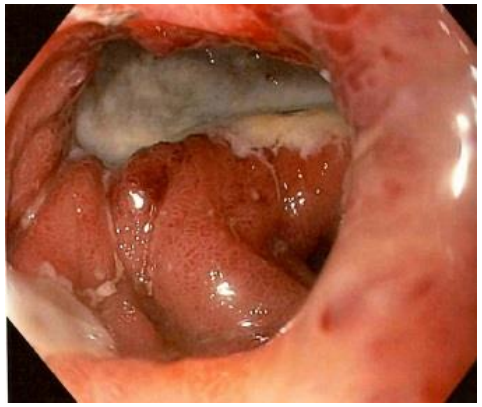
- **Early detection and prompt management, whether medical or surgical, are crucial**



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Pathophysiology & Predictors

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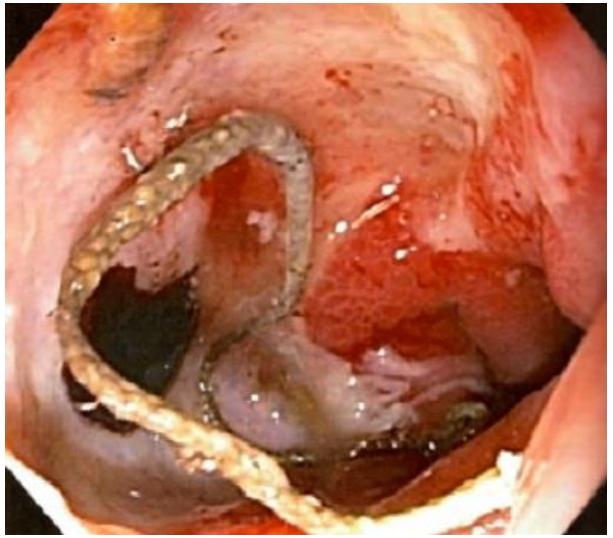
- Multifactorial and incompletely understood

Pathophysiology & Predictors

- **Anatomic and Surgery-Related Factors**

Pathophysiology & Predictors

- **Anatomic and Surgery-Related Factors**
  - large Gastric pouch size (greater parietal cell mass, increased acidity levels) [4, 5]
  - prolonged irritation from foreign materials (e.g. non-absorbable suture material)
  - tension on the anastomosis [6]
  - Anastomotic technique (CSA >> LSA) [7]



Source: The ASMBS Textbook of Bariatric Surgery

4 Gao, X. et al., Large Versus Small Gastric Pouch for Roux-en-Y Gastric Bypass in IndividualsWith Type 2 Diabetes and a Body Mass Index < 35 kg/m2: Six-Year Outcomes. ***Front. Endocrinol*. 2022**, 13, 913062

5 Siilin, H. et al. The proximal gastric pouch invariably contains acid-producing parietal cells in Roux-en-Y gastric bypass. ***Obes. Surg*. 2005**, 15, 771–777

6 Sundaresan, N. et al., Impacts of Gastrojejunal Anastomotic Technique on Rates of Marginal Ulcer Formation and Anastomotic Bleeding Following Roux-en-Y Gastric Bypass. ***Obes. Surg*. 2021**, 31, 2921–2926

7 Lois, A.W. et al., Gastrojejunostomy technique and anastomotic complications in laparoscopic gastric bypass. ***Surg. Obes. Relat. Dis*. 2015**, 11, 808–813.

Pathophysiology & Predictors

- **Helicobacter pylori (*H. pylori*)**

Pathophysiology & Predictors

- **Helicobacter pylori (*H. pylori*)**
  - exact role remains unclear
  - H. pylori may lead to a state of chronic inflammation with gastritis resulting in MU formation [8]
  - Literature suggests a substantial correlation between the presence of *H. pylori* and MU [9]
  - Diagnostics :
    - (1) Biopsies/ histology
    - (2) monoclonal stool antigen test
    - (3) serology
    - (4) urea breath test [10]
  - **Preoperative screening, and pre-OP eradication of *H. pylori* may help to minimize MU incidence after RYGB**

8 Rasmussen, J.J. et al., Marginal ulceration after laparoscopic gastric bypass: An analysis of predisposing factors in 260 patients. ***Surg. Endosc.* 2007**, 21, 1090–1094

9 Beran, A. et al., Predictors of marginal ulcer after gastric bypass: A systematic review and meta-analysis. ***J. Gastrointest. Surg.* 2023**, 27, 1066–1077

10 Malfertheiner, P. et al., Management of Helicobacter pylori infection--the Maastricht IV/ Florence Consensus Report. ***Gut* 2012**, 61, 646–664

Pathophysiology & Predictors

- **Smoking**

Pathophysiology & Predictors

- **Smoking**
  - Literature suggests a significant association between smoking and MU formation following RYGB with a 4.6-fold higher risk [11]
  - **Refraining from smoking before bariatric surgery is recommended for at least six weeks preoperatively [12]**

11 Dittrich, L. et al., Marginal ulcers after laparoscopic Roux-en-Y gastric bypass: Analysis of the amount of daily and lifetime smoking on postoperative risk. ***Surg. Obes. Relat. Dis.*** **2020**, 16, 389–396

12 Carter, J. et al., ASMBS position statement on preoperative patient optimization before metabolic and bariatric surgery. ***Surg. Obes. Relat. Dis.*** **2021**, 17, 1956–1976

Pathophysiology & Predictors

- **Non-Steroidal Anti-Inflammatory Drugs**

Pathophysiology & Predictors

- **Non-Steroidal Anti-Inflammatory Drugs**
  - NSAID inhibit cyclooxygenase, reducing prostaglandins, and decreasing blood flow [13]
  - Literature shows conflicting results with with NSAID use which may be due to methodological differences [14, 15]
  - Overall, there is a consensus that NSAIDs should be avoided after RYGB
  - **However, in patients in whom low dose aspirin is warranted due a medical indication low-dose aspirin therapy should be combined with proton pump inhibitors (PPIs)**

13 Bjarnason, I. et al., Mechanisms of Damage to the Gastrointestinal Tract From Nonsteroidal Anti-Inflammatory Drugs. ***Gastroenterology* 2018**, 154, 500–514

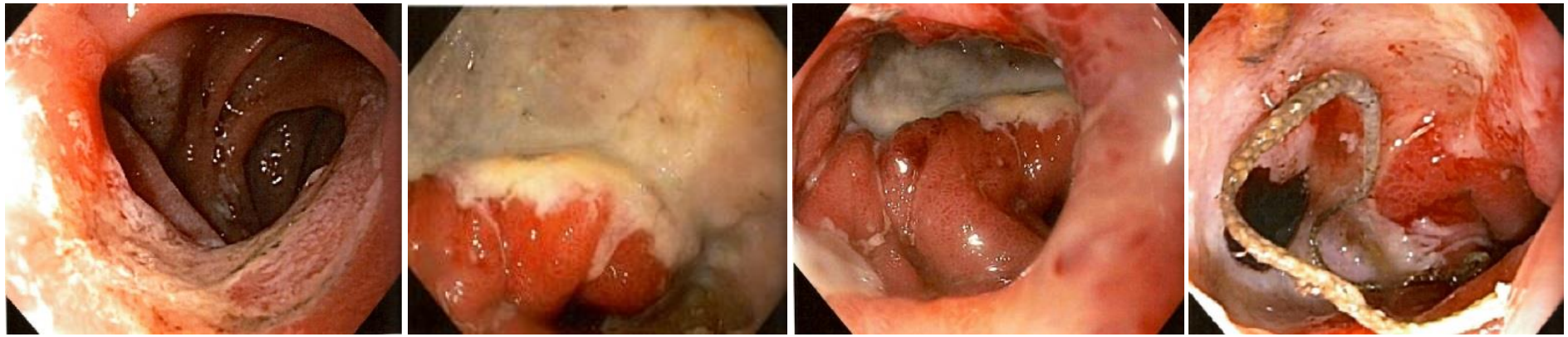
14 Boerlage, T.C.C. et al., Upper endoscopy after Roux-en-Y gastric bypass: Diagnostic yield and factors associated with relevant findings. ***Surg. Obes. Relat. Dis.* 2020**, 16, 868–876

15 Sverdén, E. et al., Risk Factors for Marginal Ulcer After Gastric Bypass Surgery for Obesity: A Population-based Cohort Study. ***Ann. Surg.* 2016**, 263, 733–737

Diagnosis

Diagnosis

- Upper endoscopy represents the gold standard [16]
- MU usually appear as an area of tissue loss or erosion, with smooth base and edges, inflamed mucosa, and visible blood vessels



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16 Chau, E. et al., Surgical management and outcomes of patients with marginal ulcer after Roux-en-Y gastric bypass. ***Surg. Obes. Relat. Dis.*** **2015**, 11, 1071–1075

Diagnosis

- Upper endoscopy represents the gold standard [16]
- MU usually appear as a area of tissue loss or erosion, with smooth base and edges, inflamed mucosa, and visible blood vessels
- GJ-Stomy and the jejunal limb adjacent to the GJ-Stomy are the most common sites for MU after RYGB [17, 18]
- Other options: GI Series (Fistulae?), Computerized tomography (CT)

16 Chau, E. et al., Surgical management and outcomes of patients with marginal ulcer after Roux-en-Y gastric bypass. ***Surg. Obes. Relat. Dis.*** **2015**, 11, 1071–1075

17 Bacoeur-Ouzillou, O. et al., Management strategies of anastomotic ulcer after gastric bypass and risk factors of recurrence. ***Surg. Endosc.*** **2022**, 36, 9129–9135

18 Azagury, D.E. et al., Marginal ulceration after Roux-en-Y gastric bypass surgery: Characteristics, risk factors, treatment, and outcomes. ***Endoscopy*** **2011**, 43, 950–954.

Management

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- **General**: Initial management includes the modification of the non-surgical risk factors (e.g. smoking, H. pylori eradication, NSAIDs, and alcohol)

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- Administering acid-reducing medications such as PPIs, H2 blockers, and sucralfate [19, 20]
- **Of note**: appropriate regimen, dose, and duration are still controversial [21]

19 Carr, W.R. et al., An evidence-based algorithm for the management of marginal ulcers following Roux-en-Y gastric bypass. ***Obes. Surg*. 2014**, 24, 1520–1527
20 Steinemann, D.C. et al., Management of anastomotic ulcers after Roux-en-Y gastric bypass: Results of an international survey. ***Obes. Surg*. 2014**, 24, 741–746
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- Administering acid-reducing medications such as PPIs, H2 blockers, and sucralfate [19, 20]
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- healing rate ranges from 68% to 100%, but relapse rates of up to 8% have been reported [22, 23]

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22 Carrodeguas, L. et al., Management of gastrogastric fistulas after divided Roux-en-Y gastric bypass surgery for morbid obesity: Analysis of 1,292 consecutive patients and review of literature. ***Surg. Obes. Relat. Dis. 2005***, 1, 467–474

23 Chang, P.C. et al., Revision using totally hand-sewn gastrojejunostomy and truncal vagotomy for refractory marginal ulcer after laparoscopic Roux-en-y gastric bypass: A case series. ***Surg. Obes. Relat. Dis.* 2017, 13, 588–593**

Management

- **General**: Initial management includes the modification of the non-surgical risk factors (e.g. smoking, H. pylori eradication, NSAIDs, and alcohol)
- **(1) Medical Therapy**
- **Of note**: Open capsule approach significantly reduced ulcer healing times!
- ***Schulman et al.:*** Healing time: Open-capsule PPIs 3 months vs. Intact-capsule 11 months [24]

24 Schulman, A.R.; Chan,W.W.; Devery, A.; Ryan, M.B.; Thompson, C.C. Opened Proton Pump Inhibitor Capsules Reduce Time to Healing Compared With Intact Capsules for Marginal Ulceration Following Roux-en-Y Gastric Bypass. ***Clin. Gastroenterol. Hepatol.*** **2017**, 15, 494–500.e491

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- **(2) Endoscopic Therapy**
- In cases of non-healing MU, risk of perforation, and MU bleeding
- In cases non-responsive to conventional endoscopic therapy (e.g. coagulation, endoscopic clips) [25]
- Then, endoscopic suturing and/ or stenting has been suggested

25 Kumbhari, V. et al., Endoscopic Evaluation and Management of Late Complications After Bariatric Surgery: A Narrative Review. ***Obes. Surg.*** **2021**, 31, 4624–4633

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- **(3) Revisional Surgical Therapy**
- In cases refractory to or recurrent after medical treatment (e.g. gastrogastric fistulas)
- Necessary in 3.9% to 33% of cases [26, 27]
- **Of note**: there is no consensus on the optimal procedure for addressing recurrent MU!

26 Pyke, O. et al., Marginal ulcer continues to be a major source of morbidity over time following gastric bypass. ***Surg. Endosc.*** **2019**, 33, 3451–3456

27 Patel, R.A. et al. Revisional operations for marginal ulcer after Roux-en-Y gastric bypass. ***Surg. Obes. Relat. Dis.*** **2009**, 5, 317–322

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- **(3) Revisional Surgical Therapy**
  - GJ revision (resection + redo of the anastomosis) with/ without
    - Vagotomy (transthoracic or transabdominal) [28, 29]
    - subtotal or total gastrectomy [30]
  - reversal of gastric bypass [31]
  - RYGB conversion to sleeve gastrectomy [32]

28 Bonanno, A., Thoracoscopic truncal vagotomy versus surgical revision of the gastrojejunal anastomosis for recalcitrant marginal ulcers. ***Surg. Endosc.*** **2019**, 33, 607–611
29 Yu, L.J. et al., Video- and Robotic-Assisted Thoracoscopic Truncal Vagotomy. ***Am. Surg.*** **2022**, 31348221087385
30 Pang, A.J. et al., Laparoscopic approach to a bleeding marginal ulcer fistulized to the gastric remnant in a patient post RYGB. ***Surg. Obes. Relat. Dis.*** **2017**, 13, 1451–1452
31 Ma, P. et al., Reversal of Roux en Y gastric bypass: Largest single institution experience. ***Surg. Obes. Relat. Dis.*** **2019**, 15, 1311–1316
32 Carter, C.O. et al., Conversion from gastric bypass to sleeve gastrectomy for complications of gastric bypass. ***Surg. Obes. Relat. Dis.*** **2016**, 12, 572–576

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MU Complications

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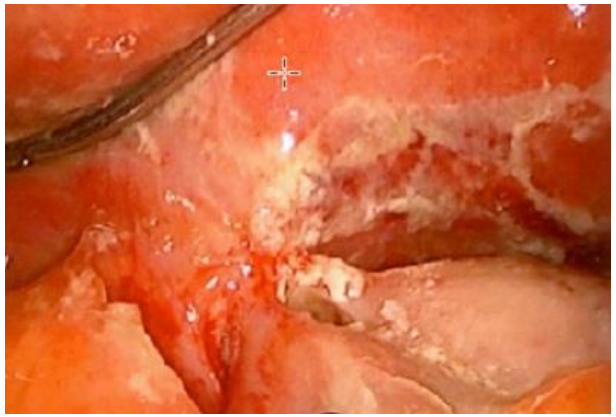
- **(1) Perforation**
- optimal surgical treatment for perforated MU remains controversial, as there is no consensus among experts



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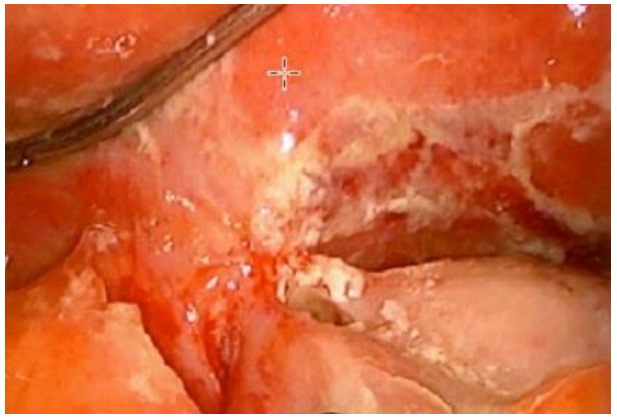
MU Complications

- **(1) Perforation**
- optimal surgical treatment for perforated MU remains controversial, as there is no consensus among experts
- GJ revision (resection + redo of the anastomosis) is safe and effective for perforation after RYGB, with a lower chance of ulcer compared to suturing with or without an omental patch [33]
- **Of note:** Endoscopic management may be a viable option for a contained perforation before revisional surgery [34]



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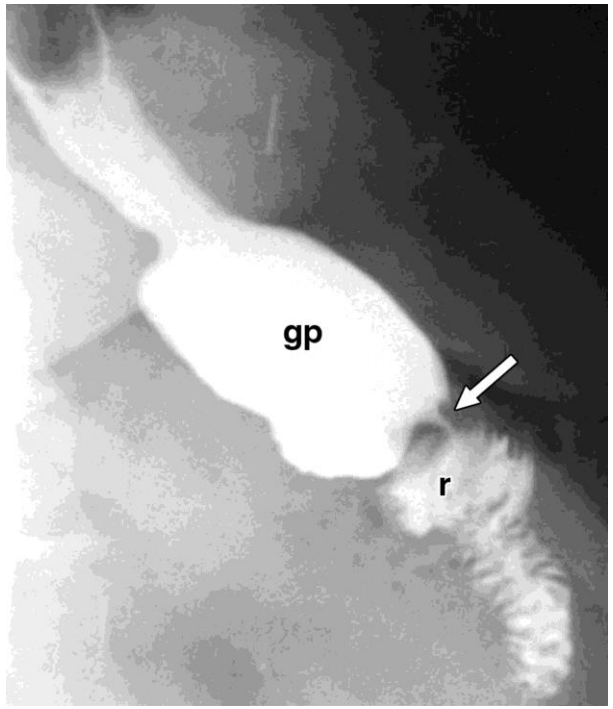
33 Crawford, C.B. et al., Revision Gastrojejunostomy Versus Suturing With and Without Omental Patch for Perforated Marginal Ulcer Treatment After Roux-en-Y Gastric Bypass. ***J. Gastrointest. Surg.*** **2023**, 27, 1–6

34 Barola, S. et al., Endoscopic Suturing for Massively Bleeding Marginal Ulcer 10 days Post Roux-en-Y Gastric Bypass. ***Obes. Surg. 2017***, 27, 1394–1396.

MU Complications

- **(2) Anastomotic Strictures at GJ level**
- Symptoms: vomiting, dysphagia, and abdominal pain [35]
- First option usually endoscopic dilation using a balloon or bougie [36]
- most cases respond to first dilation and < 10% of cases require three or more dilations [35]



Source: Chandler RC et al., AJR 2008

35 Yimcharoen, P. et al., Successful management of gastrojejunal strictures after gastric bypass: Is timing important? ***Surg. Obes. Relat. Dis.*** **2012**, 8, 151–157

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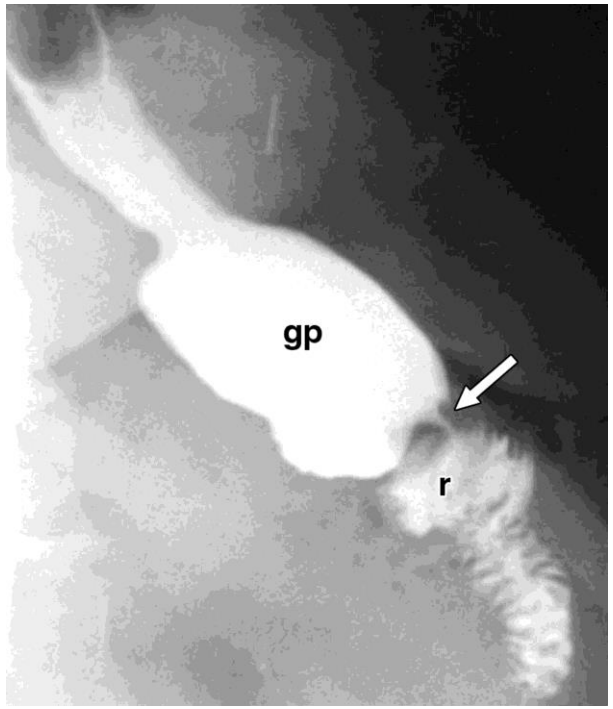
- First option usually endoscopic dilation using a balloon or bougie [36]
- most cases respond to first dilation and < 10% of cases require three or more dilations [35]
- **CAVE**: presence of an ulcer at the stricture site might predispose to perforation
  - Endoscopic stenting [37]
  - GJ revision (resection + redo of the anastomosis) [38]



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37 Mahmoud, T. et al., Lumen-apposing metal stents for the treatment of benign gastrointestinal tract strictures: A single-center experience and proposed treatment algorithm. ***Surg. Endosc.*** **2023**, 37, 2133–2142

38 Palermo, M. et al., Late surgical complications after gastric by-pass: A literature review. ***Arq. Bras. Cir. Dig.*** **2015**, 28, 139–143

Conclusion

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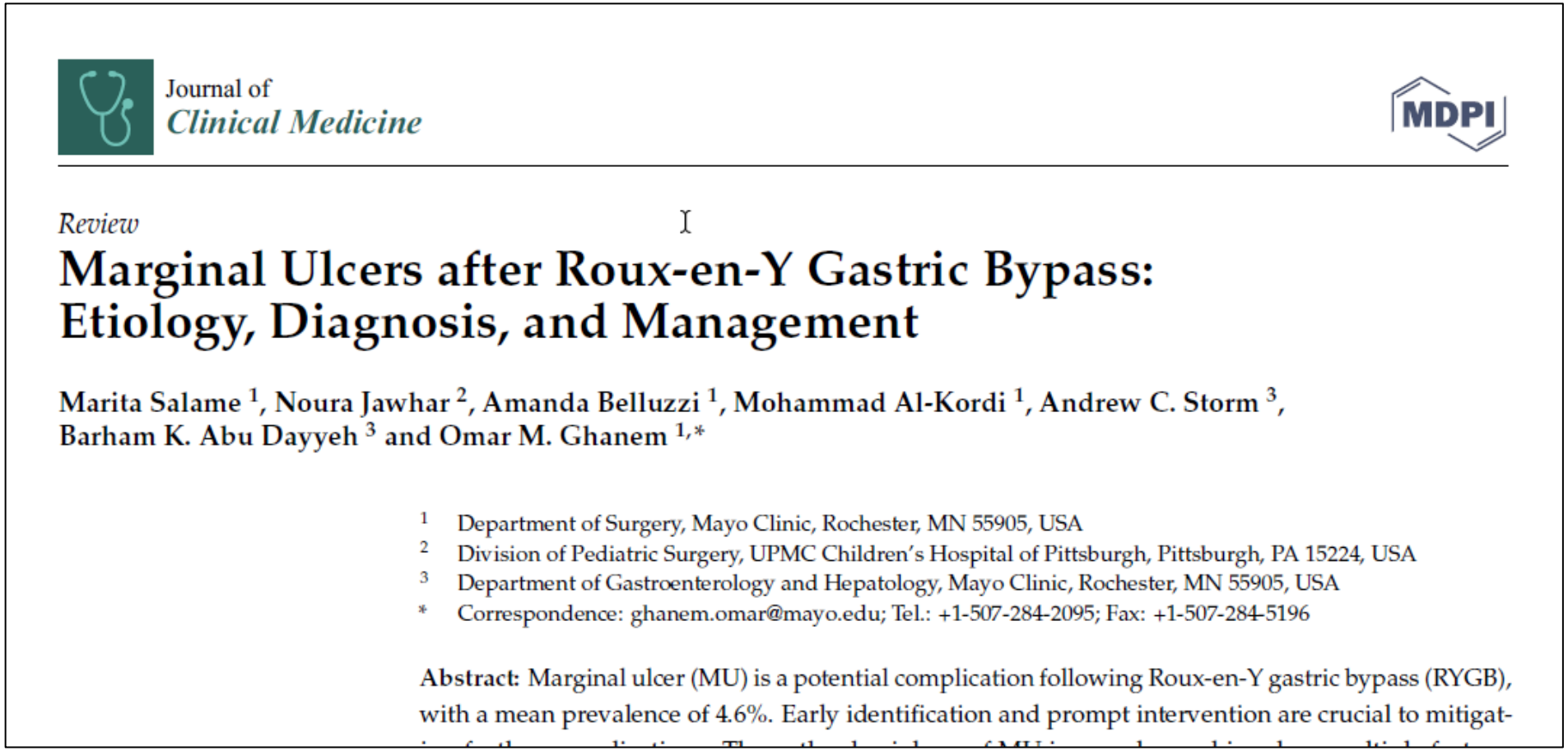
- Pathophysiology of MU is multifactorial
- Thorough diagnostic workup is essential to confirm the diagnosis
- Management strategies for MU include lifestyle modifications, PPI +/- sucralfate, endoscopic suturing and/or stenting, and revisional surgery
- Further research is needed to better understand the mechanisms underlying MU

Conclusion



Journal of *Clinical Medicine*

MDPI

Review

Marginal Ulcers after Roux-en-Y Gastric Bypass: Etiology, Diagnosis, and Management

Marita Salame [1], Noura Jawhar [2], Amanda Belluzzi [1], Mohammad Al-Kordi [1], Andrew C. Storm [3], Barham K. Abu Dayyeh [3] and Omar M. Ghanem [1,*]

1 Department of Surgery, Mayo Clinic, Rochester, MN 55905, USA
2 Division of Pediatric Surgery, UPMC Children's Hospital of Pittsburgh, Pittsburgh, PA 15224, USA
3 Department of Gastroenterology and Hepatology, Mayo Clinic, Rochester, MN 55905, USA
* Correspondence: ghanem.omar@mayo.edu; Tel.: +1-507-284-2095; Fax: +1-507-284-5196

Abstract: Marginal ulcer (MU) is a potential complication following Roux-en-Y gastric bypass (RYGB), with a mean prevalence of 4.6%. Early identification and prompt intervention are crucial to mitigat-

Salame M et al., **J Clin Med.** ***2023*** Jun 28;12(13):4336

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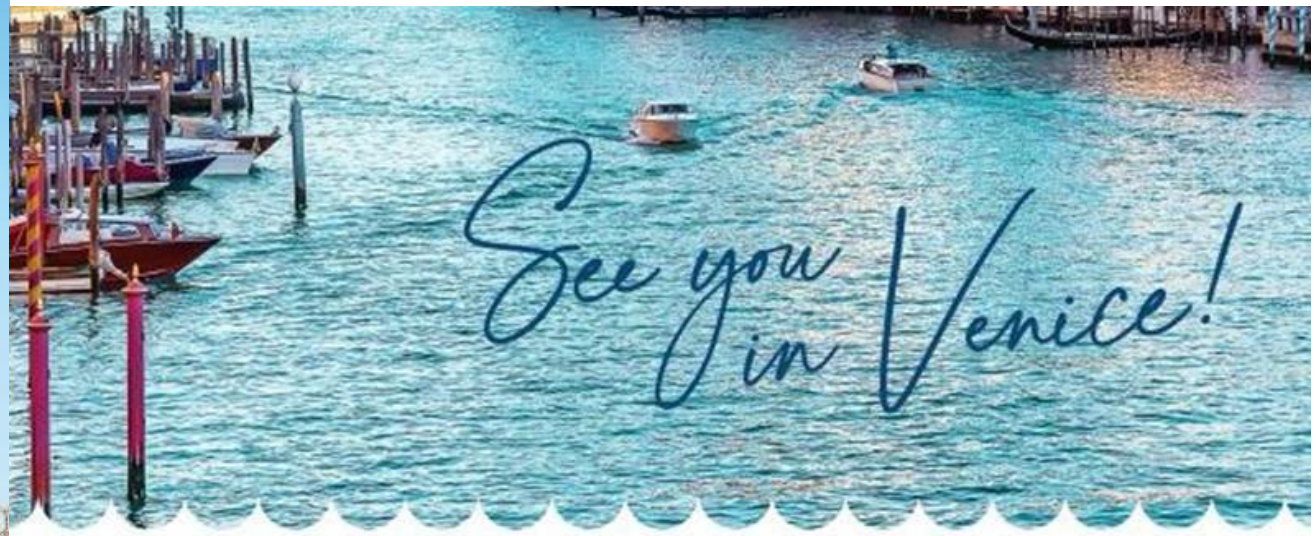

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