

Mini-CAT- Summer 2024

Clinical Question:

As the Physician Assistant in the Bariatric Clinic, you educate patients on sleeve gastrectomy, the most common bariatric surgery performed. However, you wonder if there are other bariatric methods that might be superior to sleeve gastrectomy. You have heard of patients needing to take proton pump inhibitors after their sleeve surgeries and question whether gastric bypass helps with gastroesophageal reflux symptoms. Is the bypass method superior to sleeve gastrectomy in reducing GERD symptoms?

Search Question: Clearly state the question (including outcomes or criteria to be tracked)

In obese adult patients undergoing bariatric surgery, is gastric bypass surgery associated with fewer gastroesophageal reflux disease (GERD) symptoms compared to sleeve gastrectomy?

PICO Question:

Identify the PICO elements – this should be a revision of whichever PICO you have already begun in a previous week.

| P | I | C | O |
|--------------------------|---------------------------------|-----------------------------------|--|
| Obese adult patients | Gastric bypass surgery | Sleeve gastrectomy | Decrease in GERD |
| Adult bariatric patients | Roux-en-Y gastric bypass (RYGB) | Vertical sleeve gastrectomy (VSG) | Improvement in reflux symptoms |
| Adults with obesity | | Cholecystectomy after resolution | Reduction in gastroesophageal reflux disease (GERD) symptoms |

Search Strategy:

Outline the terms used, databases or other tools used, how many articles returned, and how you selected the final articles to base your CAT on. This will likewise be a revision and refinement of what you have already done.

Pubmed

("gastric bypass surgery" OR "Roux-en-Y gastric bypass") AND "sleeve gastrectomy" AND "gastroesophageal reflux disease" – 237 results

- (Published in the last 10 years) – 218 Results
- (Further selected for Meta-analysis, RCT, Systematic Review) – 60 Results

Springer Link

gastric bypass AND sleeve gastrectomy AND GERD reduction - 1,399 results

- (Published in the last 10 years) -1,166 Results
- (Further selected for Meta-analysis) – 543 Results

ScienceDirect

Roux-en-Y gastric bypass AND sleeve gastrectomy AND gastroesophageal reflux disease reduction– 1,019 results

- (Published in the last 10 years) -772 Results
- (Further selected by only “open access & open archive) – 104 Results

Cochrane Library

Sleeve AND Bypass AND GERD– 50 Results (Trials)

- (Published in the last 10 years) – 48 Results (Trials)

I aimed to select articles with higher levels of evidence, such as systematic reviews, meta-analyses, or randomized controlled trials (RCTs). If those were unavailable, I prioritized cohort studies next. I ensured that the articles I chose were up-to-date, no older than 10 years. My preference was for studies conducted in the United States. For studies utilizing international data, I restricted my selection to meta-analyses or systematic reviews. I conducted searches across four databases: PubMed, SpringerLink, ScienceDirect, and Cochrane Library.

Ultimately, after extensive research, I chose three articles from PubMed—all being systematic reviews and meta-analyses. Another systematic review and meta-analysis was selected from ScienceDirect, and lastly, a cohort study was selected from SpringerLink. The cohort study was included because it was one of the few American studies located in the search engines above. All systematic reviews and meta-analyses were international studies, but they were included because they contained American studies. There was one exception: the systematic review and meta-analysis titled “Gastroesophageal reflux disease following laparoscopic vertical sleeve gastrectomy and laparoscopic Roux-en-Y gastric bypass: meta-analysis and systematic review of 5-year data.” This study did not include an American RCT but was still included due to its publication being this year, 2024, and due to its inclusion of several large European multicenter studies, which were not comparable to any American study I could locate. After extensive research, nothing else came close in comparison, and I decided to include it.

Articles Chosen (5) for Inclusion (please copy and paste the abstract with link):

Please pay attention to whether the articles address your question and whether they are the highest level of evidence available. If you cannot find high quality articles, be prepared to explain the extensiveness of your search and why there aren't any better sources available.

1. Gu, L., Chen, B., Du, N., Fu, R., Huang, X., Mao, F., Khadaroo, P. A., & Zhao, S. (2019). Relationship Between Bariatric Surgery and Gastroesophageal Reflux Disease: a Systematic Review and Meta-analysis. *Obesity surgery*, 29(12), 4105–4113. <https://doi.org/10.1007/s11695-019-04218-3>

Abstract:

The purpose of this study was to investigate the relationship between bariatric surgery (laparoscopic sleeve gastrectomy [LSG] and laparoscopic Roux-en-Y gastric bypass [LRYGB]) and gastroesophageal reflux disease (GERD). The number of obese patients with newly onset, worsened, or improved GERD after bariatric surgery in each article were extracted. In the pooled analysis, LSG was associated with a higher risk of GERD than LRYGB (odds ratio [OR] = 5.10, 95% confidence interval [CI] 3.60-7.23, $p < 0.001$). Compared with LSG, LRYGB had a better effect on GERD (OR = 0.19, 95% CI 0.12-0.30, $p < 0.001$). LRYGB was more effective for treating GERD in obese patients than LSG and the incidence of newly onset GERD after LRYGB was lower.

Keywords: Bariatric surgery; Gastroesophageal reflux disease; Meta-analysis; Roux-en-Y gastric bypass; Sleeve gastrectomy.

2. Abdel-Naser Elzouki, Muhammad-Aamir Waheed, Salah Suwileh, Islam Elzouki, Hisham Swehli, Maryam Alhitmi, Mona Saad, Elmukhtar Habas, Suhail A. Doi, Mohammed I. Danjuma (2022).

Evolution of gastroesophageal reflux disease symptoms after bariatric surgery: A dose–response meta-analysis. *Surgery Open Science*, Volume 7, 2022, Pages 46-51, ISSN 2589-8450, <https://doi.org/10.1016/j.sopen.2021.11.006>.

(<https://www.sciencedirect.com/science/article/pii/S2589845021000282>)

Abstract:

Background Obesity is associated with increased prevalence of gastroesophageal reflux disease, with recent reports suggesting improvement in gastroesophageal reflux disease symptoms and weight loss following bariatric surgical intervention. However, the exact impact of the type of bariatric surgery on the evolution of gastroesophageal reflux disease symptoms has remained unexamined.

Methods We systematically searched electronic databases (PubMed, EMBASE, Web of Science, and the Cochrane Library from inception to December 2018) for eligible studies that satisfy prespecified inclusion criteria. We included clinical trials of all designs that reported on gastroesophageal reflux disease outcomes following laparoscopic sleeve gastrectomy or laparoscopic Roux-en-Y gastric bypass. Two independent reviewers extracted relevant data based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guideline. Data were pooled using a random-effects model. Main outcomes were symptomatic improvement in gastroesophageal reflux disease symptoms following bariatric surgery.

Results A total of 31 studies were analyzed, and a robust-error meta-regression model was used to conduct a dose–response meta-analysis synthesizing data on 31 studies that reported gastroesophageal reflux disease outcomes after bariatric surgery. Of 5,295 patients who underwent either laparoscopic sleeve gastrectomy ($n = 4,715$ patients) or laparoscopic Roux-en-Y gastric bypass ($n = 580$ patients), 63.4% experienced improvement in gastroesophageal reflux disease symptoms (95% CI 32.46–72.18). The dose–response meta-analysis demonstrated a window period of 2 years for sustained improvement after which symptoms began to recur in those that were asymptomatic.

Conclusion Bariatric surgery may improve gastroesophageal reflux disease symptoms in obese patients who underwent laparoscopic sleeve gastrectomy; however, the most favorable effect is likely to be found after Roux-en-Y gastric bypass surgery. The effects were not sustained and returned to baseline within 4 years.

3. Zhao, H., & Jiao, L. (2019). Comparative analysis for the effect of Roux-en-Y gastric bypass vs sleeve gastrectomy in patients with morbid obesity: Evidence from 11 randomized clinical trials (meta-analysis). *International journal of surgery (London, England)*, 72, 216–223.
<https://doi.org/10.1016/j.ijso.2019.11.013>

Abstract:

Background Laparoscopic Roux-en-Y gastric bypass (LRYGB) and laparoscopic sleeve gastrectomy (LSG) are the most common procedures performed during bariatric surgery and both of them have been demonstrated having significant efficacy for morbid obesity. However, the comparative analysis of the effect of them has not been well studied. Thus, this comparative analysis was conducted to determine whether LRYGB and LSG are equivalent for mid- and long-term weight loss, resolution of comorbidities and adverse events (AEs).

Methods We searched the Cochrane Library, PubMed, Embase and Web of Science databases up to January 1, 2019 for studies that investigated LRYGB and LSG with respect to weight loss outcomes, resolution of comorbidities and AEs. Standardised mean differences (SMDs) and risk ratios (RR) with 95% confidence intervals (CIs) were calculated to compare the outcomes of the groups. Two reviewers assessed the quality of the trials and extracted the data independently. All statistical analyses were performed using the standard statistical procedures in Review Manager 5.2.

Results We included 11 studies (N = 1,328 participants) in this meta-analysis. Our results showed no significant difference in excess weight loss between LRYGB and LSG, with a pooled SMD of -0.16 (95% CI: -0.52-0.19; P = 0.36). Further, the pooled results showed no significant difference in midterm and long-term weight loss between the comparative groups. Similarly, no significant difference was found in T2DM resolution. The pooled results indicate that patients receiving LSG experienced fewer postoperative complications and reoperation rate, with pooled RRs of 1.66 (95% CI: 1.33-2.07; P < 0.00001) and 1.73 (95% CI: 1.14-2.62; P = 0.01). LRYGB may be superior to LSG in dyslipidemia, hypertension and gastroesophageal reflux disease (GERD) remission.

Conclusion The present meta-analysis indicated that both LRYGB and LSG are equivalent for excess weight loss and T2DM resolution. However, patients receiving LSG experienced fewer postoperative complications and reoperation rate than those who underwent LRYGB. LRYGB may be superior in dyslipidemia, hypertension and gastroesophageal reflux disease (GERD) remission.

Keywords: Bariatric surgery; Laparoscopic Roux-en-Y gastric bypass; Laparoscopic sleeve gastrectomy; Obesity.

4. Memon, M. A., Osland, E., Yunus, R. M., Alam, K., Hoque, Z., & Khan, S. (2024). Gastroesophageal reflux disease following laparoscopic vertical sleeve gastrectomy and laparoscopic roux-en-Y gastric bypass: meta-analysis and systematic review of 5-year data. *Diseases of the esophagus : official journal of the International Society for Diseases of the Esophagus*, 37(3), doad063.
<https://doi.org/10.1093/dote/doad063>

Abstract:

To compare 5-year gastroesophageal reflux outcomes following Laparoscopic Vertical Sleeve Gastrectomy (LVSG) and Laparoscopic Roux-en-Y gastric bypass (LRYGB) based on high quality randomized controlled trials (RCTs). We conducted a sub-analysis of our systematic review and meta-analysis of RCTs of primary LVSG and LRYGB procedures in adults for 5-year post-operative

complications (PROSPERO CRD42018112054). Electronic databases were searched from January 2015 to July 2021 for publications meeting inclusion criteria. The Hartung-Knapp-Sidik-Jonkman random effects model was utilized to estimate weighted mean differences where meta-analysis was possible. Bias and certainty of evidence was assessed using the Cochrane Risk of Bias Tool 2 and GRADE. Four RCTs were included (LVSG n = 266, LRYGB n = 259). An increase in adverse GERD outcomes were observed at 5 years postoperatively in LVSG compared to LRYGB in all outcomes considered: Overall worsened GERD, including the development de novo GERD, occurred more commonly following LVSG compared to LRYGB (OR 5.34, 95% CI 1.67 to 17.05; p = 0.02; I2 = 0%; (Moderate level of certainty); Reoperations to treat severe GERD (OR 7.22, 95% CI 0.82 to 63.63; p = 0.06; I2 = 0%; High level of certainty) and non-surgical management for worsened GERD (OR 3.42, 95% CI 1.16 to 10.05; p = 0.04; I2 = 0%; Low level of certainty) was more common in LVSG patients. LVSG is associated with the development and worsening of GERD symptoms compared to LRYGB at 5 years postoperatively leading to either introduction/increased pharmacological requirement or further surgical treatment. Appropriate patient/surgical selection is critical to minimize these postoperative risks.

Keywords: bariatric surgery; gastroesophageal reflux disease; laparoscopic; meta-analysis; roux-en-y gastric bypass; sleeve gastrectomy; systematic review.

5. Barr, A.C., Frelich, M.J., Bosler, M.E. et al (2017). GERD and acid reduction medication use following gastric bypass and sleeve gastrectomy. *Surg Endosc* 31, 410–415 (2017). <https://doi.org/10.1007/s00464-016-4989-4>

Background Gastroesophageal reflux disease is a common comorbid medical condition of obesity. Laparoscopic sleeve gastrectomy has been associated with de novo and worsening GERD following surgery. For this reason, patients who suffer from GERD and are considering bariatric surgery are often counseled to undergo gastric bypass. Given this practice, we sought to determine acid reduction medication (ARM) utilization in bariatric surgical patients who undergo one of these procedures prior to surgery and at 1 year following surgery.

Methods A retrospective review of prospectively maintained data on patients to undergo gastric bypass or sleeve gastrectomy between November 2012 and December 2014 was conducted after IRB approval. ARM utilization and Gastroesophageal Reflux Disease Health-Related Quality of Life (GERD-HRQL) scores [range 0 (no symptoms)–50 (severe GERD)] were compared prior to surgery and at 1 year postoperatively.

Results 334 patients underwent an eligible procedure in the study interval. 147 patients (44 %) had data on both preoperative and 1 year postoperative ARM use (93 gastric bypass and 54 sleeve gastrectomy). ARM utilization prior to surgery in gastric bypass patients did not reach statistical significance when compared to sleeve gastrectomy (40.9 vs. 26 %, p = 0.07). GERD-HRQL scores were greater prior to surgery in gastric bypass patients (GERD-HRQL 8.2 vs. 1.9; p < 0.01). At 12 months postoperatively, sleeve gastrectomy patients had a significantly higher rate of overall ARM use (48.1 vs. 16.1 %, p < 0.01), new ARM use (35 vs. 7.3 %, p < 0.01), and persistent ARM use (78.6 vs. 21.9 %, p < 0.01) when compared to gastric bypass patients. GERD-HRQL scores were similar overall at 12 months postoperatively (4.4 bypass vs. 4.8 sleeve; p = 0.72).

Conclusion Laparoscopic sleeve gastrectomy is associated with a significantly increased likelihood that acid reduction medications will be necessary for GERD symptom control 12 months postoperatively when compared to gastric bypass.

Summary of Evidence:

| Author (Date) | Level of Evidence | Sample/Setting (# of subjects/ studies, cohort definition etc.) | Outcome(s) studied | Key Findings | Limitations and Bias |
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| <p>Gu L., Chen B., Du N., Fu R., Huang X., Mao F., Khadaroo P. A., & Zhao S. (2019).</p> | <p>Systematic Review and Meta-analysis</p> | <p>- The databases we searched included Web of Science, PubMed, EBSCO, Medline, and Cochrane Library. The databases were searched for articles published before June 2019.</p> <p>- 23 studies were included, including 6 RCTs, 6 prospective observational studies, and 11 retrospective observational studies.</p> <p>- From 2010 to 2019, a total of 23 studies including 5000 patients (2463 in Laparoscopic Sleeve gastrectomy (LSG) and 2537 in Laparoscopic Roux-en-Y Gastric Bypass (LRYGB) from the USA, India, China, Korea, Austria, France, Greece, Venezuela,</p> | <p>- Nine studies, four studies and two studies showed the results of 1, 2, and 3 years of follow-up, respectively.</p> <p>- Eight studies provided data from a follow-up of ≥ 5 years after surgery.</p> <p>- Ten studies compared the efficacy of LSG and LRYGB for GERD in obese patients.</p> <p>- Seventeen studies reported the results of newly onset GERD after LSG and LRYGB, and two reports reported worsened GERD after surgery.</p> | <p>- Bariatric surgery, particularly LSG and LRYGB, is considered effective for treating obesity and GERD, but each has different impacts on GERD symptoms.</p> <p>- Sleeve gastrectomy is associated with a 23% incidence of newly onset GERD post-surgery.</p> <p>- Roux-en-Y gastric bypass shows a more significant improvement in GERD symptoms compared to sleeve gastrectomy in both short-term and long-term outcomes.</p> <p>- The incidence of newly onset GERD after Roux-en-Y gastric bypass is lower than after sleeve gastrectomy.</p> <p>-GERD symptoms reportedly improve by 90% after Roux-en-Y, with a reduction</p> | <p>- Diagnosis of GERD in most included studies relied on symptoms and drug efficacy without objective evaluation.</p> <p>-Variability in follow-up times among studies resulted in differences in reported incidence of GERD.</p> <p>-Obesity does not necessarily cause GERD, and bariatric surgery is not a 100% cure for GERD.</p> |

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| | | Turkey, Finland, and Switzerland, and clinical follow-up ranging from 1 to 6 years were selected. | | in reflux esophagitis from 45% to 19%. | |
| Elzouki A., Aamir Waheed M., Suwileh S., Elzouki I., Swehli H., Alhitmi M., Saad M., Habas E., Doi S., Danjum M. (2022). | Meta-analysis | <ul style="list-style-type: none"> - A systematic literature search was performed using PubMed, Medline, EMBASE, Web of Science, and the Cochrane Library from inception to December 2018 - A total of 31 studies including 5,295 patients (4,715 in LSG and in 580 LRYGB) were enrolled for the DRMA from a cluster of 2,500 studies pooled from all databases. - 31 selected studies included 9 prospective studies and 23 retrospective observational studies. -Conducted in 19 different countries (Argentina, Austria, Belgium, Canada, Chile, Colombia, France, Greece, India, Israel, Italy, Poland, | <ul style="list-style-type: none"> - Studies reporting on the efficacy of LSG and/or LRYGB on GERD symptomatology - New onset or worsening GERD after LSG and/or LRYGB | <ul style="list-style-type: none"> - Significant decrease in GERD-related symptoms up to 2 years following both LSG and LRYGB surgeries. - The rate of symptomatic improvement is faster with LRYGB compared to LSG. - Improvement in GERD symptoms plateaus at 4 years, with significant uncertainty afterward, potentially due to rapid weight gain. - Mixed outcomes in GERD symptom improvement following LSG in various studies. - Improvement in GERD symptoms post-surgery is debated but often attributed to significant and durable weight reduction. | <ul style="list-style-type: none"> -Marked heterogeneity in the evaluation methods of GERD (clinical evaluation, 24-hour ambulatory pH studies, esophageal manometry, contrast studies, endoscopy). -Most studies were retrospective, with only one prospective study included. -Differences in the mode of adjudication of GERD symptoms may account for imprecise point estimates. |

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| | | Lebanon, Netherlands, Sweden, Switzerland, Taiwan, United Kingdom, USA) | | | |
| Zhao H., & Jiao L. (2019). | Meta-Analysis | -Searched the Cochrane Library, PubMed, EMBASE and Web of Science databases up to January 1, 2019 -11 RCTs, (N = 1,328 participants) were included in this meta-analysis. - Among the studies, the sample size ranged from 15 to 238 patients. The follow-up time ranged from one month to 60 months. | -Difference in weight loss, T2DM resolution, between LRYGB and LSG. - Mid- and long-term weight loss outcomes -Resolution of comorbidities including T2DM, complication and reoperation, dyslipidemia, hypertension, and GERD symptoms. | -LRYGB is more beneficial for GERD improvement compared to LSG. -LSG may worsen GERD symptoms and can lead to de novo (new onset) GERD. - Both LRYGB and LSG show significant improvement in GERD symptoms up to 2 years post-surgery. -Long-term remission of GERD is more frequently observed with LRYGB than with LSG. | - Variability in sample sizes and patient demographics among included studies. -Limited number of studies prevented detailed subgroup analysis of midterm and long-term reoperation rates and causes. -Small number of studies included in the analysis of comorbidity resolution, potentially biasing results. |
| Memon, MA., Osland E., Yunus RM., Alam K., Hoque Z., & Khan S. (2024). | Systematic Review and Meta-analysis | -Only RCTs describing clinical outcomes of LRYGB with LVSG performed in adult patients were eligible for inclusion. -Six studies meeting inclusion criteria were identified, however, only | - All included studies reported long-term follow-up data from studies included in our original systematic review and meta-analysis on this topic. -Outcomes studied were if there were worsened GERD post-operatively. | - There was improvement in GERD symptoms in 40-60% of patients following LVSG and up to 80% following LRYGB. -Found that LVSG is associated with an increase in adverse GERD outcomes relative to LRYGB, and | -There is a low number of RCTs that were eligible for inclusion. - The variation in criteria for diagnosing GERD in the published literature is a weakness within and across studies, which rarely provided a clear |

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| | | four studies were included in the final analysis. (LVSG n=266, LRYGB n=259) | - Other factors that were considered were the non-surgical management for worsened GERD and reoperations for the management of severe GERD. | confirms that in many cases GERD remains an issue 5 years postoperatively for those that underwent LVSG. -There seems to be an increased association between the increased need for reoperation for GERD complications in LVSG compared to LRYGB. -GERD has more significant consequences following LVSG compared to LRYGB. | definition of GERD diagnostic criteria. |
| Barr AC., Frelich MJ., Bosler ME, Goldblatt MI., Gould JC. (2017) | Cohort Study | - Retrospective review of prospectively maintained data was conducted on patients who underwent either laparoscopic Roux-en-Y gastric bypass or sleeve gastrectomy for morbid obesity [body mass index (BMI) \geq 35 kg/m ²] between November 2012 and December 2014. - A total of 334 patients underwent either | -The outcomes studied were acid reduction medications (ARM), such as overall use, new use, persistent use and discontinuation of use. -Surgical details such as those undergoing gastric bypass and sleeve gastrectomy. -GERD-HRQL scores that were measured preoperatively and postoperatively. | -GERD symptoms persisted or worsened postoperatively in a significant proportion of LSG patients. -LRYGB patients had higher rates of GERD resolution compared to LSG patients. - ARM use decreased postoperatively in bariatric surgery patients, but the likelihood of continued ARM use was higher for LSG than LRYGB. | -Small sample size and retrospective design. -Not all patients completed GERD-HRQL surveys at both preoperative and postoperative intervals. -ARM use does not always equate with a clinical diagnosis of GERD. |

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| | | laparoscopic Roux-en-Y gastric bypass or laparoscopic sleeve gastrectomy during the study interval. | | -Postoperative use of ARM at 1 year was significantly less in LRYGB compared to LSG. -New ARM use was more common in LSG patients. | |
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Conclusion(s):

- Briefly summarize the conclusions of each article, then provide an overarching conclusion.

Gu L., Chen B., Du N. et al. (2019). This study concludes that both laparoscopic sleeve gastrectomy (LSG) and laparoscopic Roux-en-Y gastric bypass (LRYGB) are effective treatments for GERD in obese patients, with LRYGB demonstrating a superior effect in both short-term and long-term outcomes. LRYGB is associated with a lower risk of newly onset or worsened GERD compared to LSG. While LSG can lead to a significant incidence of new GERD cases post-surgery, LRYGB can mitigate GERD symptoms more effectively and is more suitable for patients with severe reflux or Barrett’s esophagus. Consequently, LRYGB is recommended as the preferred surgical option for obese patients with GERD.

Overarching conclusion: The study provides compelling evidence that LRYGB is more effective than LSG in managing GERD in obese patients, reducing the risk of new or worsened GERD, and offering better long-term outcomes. Despite the potential for non-acid reflux post-LRYGB, the overall benefits make it the preferred surgical treatment.

Elzouki A., Aamir Waheed M., Suwileh S. (2022) This meta-analysis is the first comprehensive study to compare the prevalence of GERD symptoms following LSG and LRYGB surgeries. It found significant improvement in GERD symptoms for up to two years post-surgery for both types, with LRYGB showing a faster rate of symptom improvement but quicker relapse compared to LSG. However, beyond two years, the impact on GERD symptom relief remains uncertain, with improvement plateauing at four years.

Overarching conclusion: This meta-analysis shows both LSG and LRYGB are effective in improving GERD symptoms in obese patients up to two years post-surgery, with LRYGB providing quicker relief. Despite the initial benefits, the sustainability of GERD symptom improvement beyond four years is uncertain.

Zhao H., & Jiao L. (2019) This study found that LRYGB (Laparoscopic Roux-en-Y Gastric Bypass) is more effective than LSG (Laparoscopic Sleeve Gastrectomy) in achieving GERD (gastroesophageal reflux disease) remission, with a pooled relative risk (RR) of 1.48. LSG may worsen GERD symptoms and cause new onset GERD, with pooled RRs of 0.16 and 0.33, respectively. Gastric reflux worsened more frequently after LSG (31.8%) than LRYGB (6.3%).

These findings suggest that LRYGB is beneficial for GERD improvement, while LSG may exacerbate GERD symptoms or cause new cases of GERD.

Overarching conclusion: LRYGB is superior to LSG in treating GERD in obese patients. The choice of bariatric surgery should consider the patient's co-morbidities, especially GERD, given the potential for LSG to worsen or cause GERD. LRYGB should be preferred for patients with existing GERD or at high risk of developing GERD post-surgery to achieve better long-term outcomes.

Memon MA., Osland E., Yunus RM. et. al. (2024) This systematic review and meta-analysis found that while both LVSG (Laparoscopic Vertical Sleeve Gastrectomy) and LRYGB (Laparoscopic Roux-en-Y Gastric Bypass) can improve GERD symptoms, LVSG is associated with a higher risk of adverse GERD outcomes. Improvements in GERD symptoms were reported in 40-60% of patients following LVSG and up to 80% following LRYGB. However, the risk of developing new onset GERD following LVSG ranged between 8% and 30%, with many patients experiencing GERD issues up to five years postoperatively. There was a higher rate of reoperation for GERD complications following LVSG compared to LRYGB, and GERD significantly impacted patients' quality of life, including physical, mental, and emotional well-being.

Overarching conclusion: While both LVSG and LRYGB can provide long-term improvement in GERD for some patients, LVSG is associated with a higher incidence of worsened GERD outcomes and the need for reoperation compared to LRYGB. These findings suggest that LRYGB should be preferred for patients at risk of GERD or those with existing GERD. The study shows the importance of considering comorbidities and potential postoperative complications when selecting a bariatric surgical procedure.

Barr AC., Frelich MJ., Bosler ME, et. al. (2017) Laparoscopic sleeve gastrectomy (LVSG) and Roux-en-Y gastric bypass (LRYGB) are two commonly performed bariatric surgeries. This study observed that GERD symptoms requiring acid reduction medications (ARM) were more prevalent in patients who underwent LVSG compared to those who had LRYGB. The use of ARM was significantly lower one year postoperatively in the LRYGB group. Additionally, LVSG was associated with a higher risk of developing new GERD symptoms post-surgery. Despite LVSG's rising popularity, its impact on GERD is controversial, with some studies indicating a worsening of symptoms. The study suggests that LRYGB is more effective in resolving GERD due to its ability to divert acid and digestive enzymes away from the esophagus and reduce abdominal pressure through weight loss.

Overarching conclusion: This study concludes that while both LVSG and LRYGB are effective bariatric procedures, LRYGB is superior in managing GERD symptoms. Patients undergoing LVSG are more likely to need acid reduction medications and may develop new GERD symptoms postoperatively. These findings emphasize the importance of considering GERD when selecting the type of bariatric surgery, highlighting LRYGB as the preferred option for patients with existing GERD.

Clinical Bottom Line:

Please include an assessment of the following:

- Weight of the evidence – summarize the weaknesses/strengths of the articles and explain how they factored into your clinical bottom line (this may recap what you discussed in the criteria for choosing the articles)
- Magnitude of any effects
- Clinical significance (not just statistical significance)
- Any other considerations important in weighing this evidence to guide practice - If the evidence you retrieved was not enough to conclude an answer to the question, discuss what aspects still need to be explored and what the next studies will have to answer/provide (e.g. larger number, higher level of evidence, answer which sub-group benefits, etc)

Gu L., Chen B., Du N. et al. (2019) Out of all five studies, I would rate this one the strongest in terms of evidence because it included 23 studies: 6 RCTs, 6 prospective observational studies, and 11 retrospective observational studies. The study included a total of 5000 patients and incorporated American studies. Eight of the studies provided data with a follow-up of 5 years or more after surgery. Ten studies compared the efficacy of LSG and LRYGB for GERD in obese patients. Conversely, seventeen studies reported the results of newly onset GERD after LSG and LRYGB, and two studies reported worsened GERD after surgery. In the pooled analysis, LSG was associated with a higher risk of GERD than LRYGB (odds ratio [OR] = 5.10, 95% confidence interval [CI] 3.60–7.23, $p < 0.001$). Compared with LSG, LRYGB had a better effect on GERD (OR = 0.19, 95% CI 0.12–0.30, $p < 0.001$). LRYGB was more effective for treating GERD in obese patients than LSG, and the incidence of newly onset GERD after LRYGB was lower. However, the study had some weaknesses. For the diagnosis of GERD, most studies included in this meta-analysis relied on symptoms and drug efficacy without an objective evaluation, which inevitably led to inaccurate diagnoses of GERD. It must be emphasized that GERD is a complex disease with multiple pathogenic factors and is not unique to obese patients. Again, obesity does not necessarily cause GERD. Bariatric surgery is not a 100% cure for GERD. Therefore, for obese GERD patients, the selection of surgery should still be cautious. In conclusion, LRYGB is recommended as the preferred treatment for obese patients with GERD.

Elzouki A., Aamir Waheed M., Suwileh S. (2022) Out of all five studies, I would rate this one the second strongest in terms of evidence because it included 31 studies with 5,295 patients (4,715 in LSG and 580 in LRYGB), comprising 9 prospective studies and 23 retrospective observational studies. This meta-analysis included American studies and reported on the efficacy of LSG and/or LRYGB on GERD symptomatology and the new onset or worsening of GERD after LSG and/or LRYGB. Of the 5,295 patients who underwent either laparoscopic sleeve gastrectomy ($n = 4,715$) or laparoscopic Roux-en-Y gastric bypass ($n = 580$), 63.4% experienced improvement in gastroesophageal reflux disease symptoms (95% CI 32.46–72.18). The rate of improvement in GERD symptoms was faster but less durable with LRYGB compared to gastric sleeve surgery. The study did present some limitations, such as marked heterogeneity in the

evaluation methods of GERD (clinical evaluation, 24-hour ambulatory pH studies, esophageal manometry, contrast studies, endoscopy). Most studies were retrospective, with only one prospective study included. Differences in how GERD symptoms were determined may account for imprecise point estimates. In conclusion, bariatric surgery may improve gastroesophageal reflux disease symptoms in obese patients who underwent laparoscopic sleeve gastrectomy; however, the most favorable effect is likely to be found after Roux-en-Y gastric bypass surgery.

Zhao H., & Jiao L. (2019) Of all five studies, I would rank this one as the third strongest because, although it was a meta-analysis, it focused on many different comorbidities and not just GERD. Because it was less specific for GERD and its complications, I had to rate this study lower than the others mentioned. Still, this study is reliable as it included 11 RCTs (N = 1,328 participants). The study found that LRYGB may be superior to LSG in GERD improvement, with a pooled RR of 1.48 (95% CI: 1.07–2.04; P = 0.02). In contrast, LSG may worsen GERD symptoms and may lead to de novo GERD, with pooled RRs of 0.16 (95% CI: 0.06–0.44; P = 0.0004) and 0.33 (95% CI: 0.15–0.68; P = 0.003), respectively. Gastric reflux remission was observed more frequently after GBP (60.4%) than after SG (25.0%). Gastric reflux worsened (more symptoms or therapy) more frequently after SG (31.8%) than after GBP (6.3%). The study had some limitations, the most serious of which was the variation in sample size among the included studies. Although we analyzed 1,566 participants, the sample size ranged widely among the studies, from 15 to 238 patients, which may have constituted a bias. In conclusion, LRYGB may be beneficial for GERD improvement, but LSG may worsen GERD symptoms and may lead to de novo GERD.

Memon MA., Osland E., Yunus, RM. et. al. (2024) I would rank this study second to last, only because it didn't include any American RCTs. However, out of all the studies, this one was the most recent, published in 2024, and it included several large European multicenter studies, which were not comparable to any American study I could locate. After extensive research, nothing else came close in comparison, so I decided to include it. Four RCTs were included (LVSG n = 266, LRYGB n = 259). An increase in adverse GERD outcomes was observed at 5 years postoperatively in LVSG compared to LRYGB in all outcomes considered. Overall worsened GERD, including the development of de novo GERD, occurred more commonly following LVSG compared to LRYGB (OR 5.34, 95% CI 1.67 to 17.05; p = 0.02; I² = 0%; Moderate level of certainty). Reoperations to treat severe GERD (OR 7.22, 95% CI 0.82 to 63.63; p = 0.06; I² = 0%; High level of certainty) and non-surgical management for worsened GERD (OR 3.42, 95% CI 1.16 to 10.05; p = 0.04; I² = 0%; Low level of certainty) were more common in LVSG patients. LVSG is associated with the development and worsening of GERD symptoms compared to LRYGB at 5 years postoperatively, leading to either the introduction/increased pharmacological requirement or further surgical treatment. Appropriate patient/surgical selection is critical to minimize these postoperative risks. There are a number of limitations that need to be acknowledged, with the most glaring being the low number of RCTs eligible for inclusion, which is anticipated to limit the statistical significance of outcomes. In conclusion, LVSG is associated with a higher incidence of overall worsened GERD outcomes compared to LRYGB.

Barr AC., Frelich MJ., Bosler ME, et. al. (2017) I would rank this study last in terms of strength of evidence because it is a small cohort study based in a Wisconsin hospital. All the other studies mentioned were systematic reviews and/or meta-analyses. A total of 334 patients

underwent either laparoscopic Roux-en-Y gastric bypass or laparoscopic sleeve gastrectomy during the study interval. At 12 months postoperatively, sleeve gastrectomy patients had a significantly higher rate of overall ARM use (48.1% vs. 16.1%, $p < 0.01$), new ARM use (35% vs. 7.3%, $p < 0.01$), and persistent ARM use (78.6% vs. 21.9%, $p < 0.01$) when compared to gastric bypass patients. The study has a number of limitations, firstly being the small sample size, and a large number of subjects who had surgery during the study interval were excluded due to missing data. Also, this study depended on the use of ARM to signify complications with GERD. Medical therapy with ARM is not always associated with a clinical diagnosis of GERD. In conclusion, laparoscopic sleeve gastrectomy is associated with a significantly increased likelihood that acid reduction medications will be necessary for GERD symptom control 12 months following surgery when compared to gastric bypass.

Based on the conclusions of five studies, gastric bypass surgery (LRYGB) is generally associated with fewer gastroesophageal reflux disease symptoms compared to sleeve gastrectomy (LSG). Gu et al. (2019) found that both LRYGB and LSG are effective for treating GERD in obese patients, but LRYGB shows superior long-term outcomes and a lower risk of new or worsened GERD, making it a better option for patients with severe reflux or Barrett's esophagus. Elzouki et al. (2022) reported that while both surgeries significantly improve GERD symptoms up to two years post-surgery, LRYGB provides faster symptom relief, although this advantage may diminish after two years. Zhao et al. (2019) demonstrated that LRYGB is more effective than LSG in achieving GERD remission, with a significantly lower risk of new onset GERD and worsening symptoms. Memon et al. (2024) confirmed that although both surgeries improve GERD symptoms, LVSG is associated with a higher risk of adverse GERD outcomes, including a higher rate of reoperations for GERD complications. Finally, Barr et al. (2017) observed that the need for acid reduction medications is significantly lower one year postoperatively in LRYGB patients compared to those who underwent LVSG, further indicating LRYGB's efficacy in resolving GERD.

In conclusion, for adult patients undergoing bariatric surgery, gastric bypass surgery (LRYGB) is generally recommended over sleeve gastrectomy (LSG) for the management of GERD symptoms. LRYGB not only provides superior and more sustained symptom relief but also reduces the likelihood of developing new GERD symptoms post-surgery. Therefore, for patients with pre-existing GERD, those at higher risk for GERD, or patients considering bariatric surgery that want to avoid GERD symptoms then LRYGB is the preferred surgical option.