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SURGERY FOR OBESITY AND RELATED DISEASES

ASMBS Guidelines

American Society for Metabolic and Bariatric Surgery literature review on prevention, diagnosis, and management of internal hernias after Roux-en-Y gastric bypass

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Preamble

The American Society for Metabolic and Bariatric Surgery (ASMBS) issues the following clinical practice guideline for the purpose of enhancing the quality of care in bariatric surgery. This publication examines the currently available literature regarding the prevention, diagnosis, and management of internal hernias after Roux-en-Y gastric bypass surgery. The intent of issuing such a guideline is to provide an objective summary of current literature and provide recommendations based on clinical knowledge, expert opinion, and published peer-reviewed scientific evidence available at this time. The statement is not intended to establish a local, regional, or national standard of care. The statement will be revised in the future as additional evidence becomes available.

Background

In this statement, we review the current definitions of internal hernia and summarize the current, peer-reviewed, published scientific literature to describe the diagnosis and management of patients with suspected internal hernias and to suggest surgical approaches for the prevention of internal hernia after Roux-en-Y gastric bypass (RYGB) surgery.

The statement has been divided into the following 6 sections:

1. Review of the literature regarding the incidence of internal hernia after RYGB
2. Recommendations for the management of a patient with concern for an internal hernia after RYGB
3. Review of the literature on the value of prophylactic closure of mesenteric defects during RYGB
4. Review of the literature on which mesenteric defects should be closed
5. Review of the literature on the various methods of closure of defects during RYGB
6. Summary and recommendations

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Methods

An electronic MEDLINE literature search was performed for articles on the incidence of internal hernia and closure of mesenteric defects and bariatric surgery published between 1975 and 2020. Key search terms were "internal hernia," "laparoscopic/Roux-en-Y gastric bypass," "RYGB," "bypass," "mesenteric defect," "repair," "closure," "intestinal obstruction," "post-operative complication," "Petersen's defect," "Petersen's hernia," "Petersen's space," "small bowel obstruction," "chylous ascites," and "intussusception." The following exclusion criteria were initially applied to all articles identified: publication of abstracts only, case reports, letters and comments, and animal or in vitro studies. Articles were also excluded if they had fewer than 10 patients in the study, had a follow-up of fewer than 6 months, or were in languages other than English. After this initial screening, a full-text copy of each article was obtained for review. References within the selected articles were checked manually to supplement the electronic search for additional relevant articles. Selected studies could be of any design. When different articles reporting on overlapping populations were identified, the most recent article with the largest study population was selected for review. Each selected article was searched to extract data related to the research design used, population studied, the treatment described, and outcome measures. Two reviewers examined the articles and decided whether to include or exclude the studies based on exclusion criteria. Information extracted from eligible studies included basic study data (year, country, design, study size), demographic data, and clinical outcomes.

Review of the literature regarding the incidence of internal hernia after RYGB

Roux-en-Y gastric bypass is an effective treatment for severe obesity [1]. It is one of the most commonly performed bariatric procedures, resulting in significant postoperative weight loss and improvement or remission of obesity-associated medical problems [2]. With the advent of laparoscopy, the minimally invasive approach is now the standard of care. During the paradigm shift from open to minimally invasive RYGB, the rate of internal herniation significantly increased [3]. Based on the technique used—ante- versus retro-colic and ante- versus retro-gastric—2 or 3 potential mesenteric defects can be created. Today, an antecolic, antegastric RYGB technique is the most commonly performed technique, which could lead to 2 potential mesenteric spaces: between the biliopancreatic limb and the common limb jejunojejunostomy (mesojejunal defect) and between the mesentery of the alimentary Roux limb and the mesentery of the transverse colon (Petersen's space or retro-Roux limb mesentery space) [4,5].

An internal hernia can present at any time point following surgery. Internal herniation should be considered a part of the differential diagnosis in any patient who has previously undergone RYGB and has abdominal pain or bowel obstruction. Patients with an internal hernia can present acutely with a life-threatening, closed-loop obstruction or small bowel strangulation. In some cases, patients present subacutely or chronically with intermittent internal herniation [6].

The incidence of internal hernia is dependent on whether the defects were closed at the time of index surgery, as it ranges from 4% to 17% without closure compared with 0% to 7% with closure in different series [6–9].

Recommendations for the management of a patient with concern for an internal hernia after RYGB

The diagnosis of internal hernia after RYGB can be difficult because a definitive diagnosis cannot be usually made from a single symptom, sign, or radiologic study. A high index of clinical suspicion is needed in order to avoid catastrophic complications, including strangulated small bowel or even short gut syndrome [10]. Patients often present with abdominal pain [9,11–17]. About half of internal hernias present to the emergency department or urgent care setting with pain that is acute and severe in onset, while the other half present in the outpatient setting with pain that is chronic, intermittent, and mild [14]. The pain may be localized or diffuse, and the location of the pain is not particularly helpful in diagnosing internal hernia [14,18]. Colicky pain, nausea, vomiting, diarrhea, and localized peritonitis are occasionally present, but the majority of patients with proven internal hernia may not have these findings [9,14,15,18]. Brammerloo et al. investigated which signs and symptoms were predictive of internal hernia amongst gastric bypass patients with abdominal pain. Postprandial pain, pain radiating to the back, localized peritonitis on examination, and leukocytosis were associated with increased odds of internal hernia [18].

A careful history adds to the evaluation of the bariatric patient with abdominal pain and possible internal hernia. It is important to confirm that the patient indeed underwent RYGB. Review of prior operative notes, or a computed tomography (CT) scan, is often necessary to confirm a history of RYGB. Additionally, a careful review of prior operative notes is helpful in knowing possible locations of internal hernia and whether mesenteric defects were closed at the time of the index operation. Patients with a retrocolic alimentary (Roux) limb have 3 potential internal hernia sites: the mesocolic window, Petersen's defect, and the mesenteric defect at the jejunojejunostomy (Fig. 1). Patients with an antecolic alimentary limb have 2 sites: Petersen's defect and the mesenteric defect at the jejunojejunostomy. Even when mesenteric defects were described as closed during the initial procedure, the defect may have not been closed properly, or the defects may have reopened over time, and so an internal hernia is still possible. Samur et al. showed that even when mesenteric defects were closed

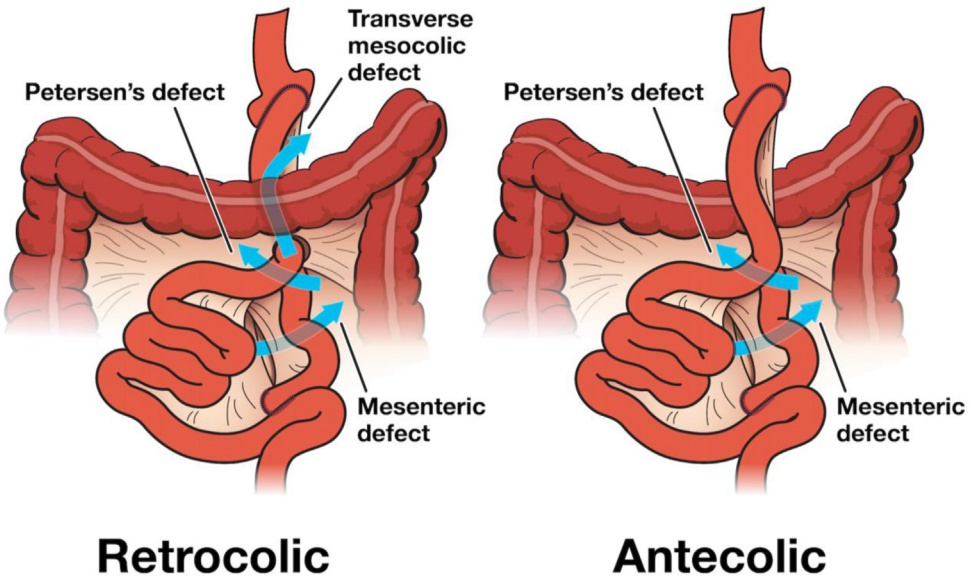

Fig. 1. Possible sites of internal hernia after Roux-en-Y gastric bypass.

with non-absorbable running sutures during gastric bypass, the rate of finding hernias upon repeat surgical evaluation of the defects could be as high as 40%–50% [19]. Additional factors in the history that may increase the risk of internal hernia are rapid weight loss [20] and pregnancy, particularly for patients in their second or third trimester [21–25].

Initial evaluation includes laboratory analysis to look for evidence of sepsis (i.e., end-organ derangement or inflammation), although blood tests can be normal in the majority of cases of internal hernia [14,18]. Since gallstone disease may have a similar presentation to internal hernia, an ultrasound may also be helpful in the initial evaluation to rule out gallbladder disease or biliary obstruction if there is clinical suspicion. If a marginal ulceration of gastrojejunal anastomosis is suspected, upper endoscopy is indicated.

The best initial study in a stable patient with history of RYGB who presents with abdominal pain is usually a CT scan of the abdomen and pelvis with intravenous contrast. For pregnant patients, magnetic resonance imaging is a good alternative [26]. Diseases other than internal hernia may be diagnosed, such as pancreatitis, cholecystitis, diverticulitis, appendicitis, perforated marginal ulcer, intussusception, and distal adhesive small bowel obstruction. For the diagnosis of internal hernia, a number of studies have identified specific findings seen on CT and their accuracy in predicting internal hernia [26–33]. The most accurate finding is the mesenteric "swirl sign" with sensitivity of 78%–100% and specificity of 80%–90% [27–29,34]. Other important signs include a superior mesenteric vein "birds-beak" sign, small-bowel obstruction, clustered small bowel loops, the "mushroom" sign, the "hurricane eye" sign, small bowel located behind the superior mesenteric artery, location of the jejunojejunostomy in the right hemiabdomen, engorged mesenteric lymph nodes, venous congestion, and mesenteric edema [28,29,33,34]. With structured CT reporting for each of these signs read by radiologists familiar with RYGB anatomy, the overall accuracy of CT imaging in diagnosing internal hernia can be improved to a positive predictive value of 81% and a negative predictive value of 96% [27]. However, in everyday practice without structured reporting, the overall accuracy is lower [31,32], and so it is essential to realize that patients with a "normal" CT scan may still have an internal hernia.

Patients with a prior RYGB who present with unexplained acute severe abdominal pain, small bowel obstruction, or chronic intermittent unexplained abdominal pain (including those with a prior "normal" CT) should undergo surgical exploration to rule out internal hernia. In contrast to most general surgery patients with small bowel obstruction, patients presenting with small bowel obstruction with history of RYGB are a surgical emergency and should usually not undergo a trial of nonoperative management with nasojejunal tube decompression first, because of the possible risk of catastrophic strangulation and bowel compromise that may result from internal hernias [10,35]. An initial laparoscopic approach to abdominal exploration would be preferred in most patients and most clinical situations, except for patients with prior major open abdominal operations.

The operative technique includes methodical evaluation and closure of all sites of internal hernias (Fig. 1) [12,35]. To identify Roux-en-Y anatomy, if the alimentary limb is antecolic, the gastrojejunostomy is identified and the alimentary limb is followed in an antegrade direction to the jejunojejunostomy. Next, the transverse colon is retracted anteriorly, and the biliopancreatic limb is identified at the ligament of Treitz and followed down to the

jejunojejunostomy. If in doing these maneuvers, the intestines are seen to be diving underneath the mesentery, are inflamed, or seem tethered, an internal hernia is likely. Reduction of the internal hernia is facilitated by starting at the ileocecal valve and following the common channel retrograde, hand-over-hand, placing the ileum and then jejunum into the lower abdomen [36]. This will reduce any herniation of the common channel up to the jejunojejunostomy. The biliopancreatic limb, most likely to be herniating through Petersen's space, can then be reduced by starting at the jejunojejunostomy and working retrograde, placing it in the left hemiabdomen. Next, any herniation of the alimentary limb can be reduced by starting at the jejunojejunostomy and working retrograde up to the gastrojejunostomy. One interesting finding that is sometimes found is the presence of chylous congestion of the mesenteric leaflets with chylous ascites, a finding not to be confused with pus (Fig. 2) [18]. Presence of chyle in the abdominal cavity indicates small bowel lymphatic obstruction from the internal hernia. Chylous congestion and ascites usually resolve after reducing the herniated intestine and, in and of itself, are not an indication for small bowel resection.

The surgeon should methodically inspect and close all internal hernia locations: Petersen's defect, the mesenteric defect under the jejunojejunostomy, and the defect in the transverse mesocolon (for retrocolic alimentary limbs) (Fig. 1). Lysis of adhesions, particularly omental adhesions to the alimentary limb, biliopancreatic limb, or jejunojejunostomy, is often necessary and should be performed to properly evaluate sites of internal hernia. Even when no obvious herniation of the bowel is identified, open mesenteric defects sites should still be closed, as closure has a relatively high probability of resolving the patient's abdominal pain [11,37–39]. The entirety of the small bowel should be evaluated to ensure there are no internal hernias or obstructions caused from adhesions. The different methods of internal hernia closure are reviewed later in this guideline.

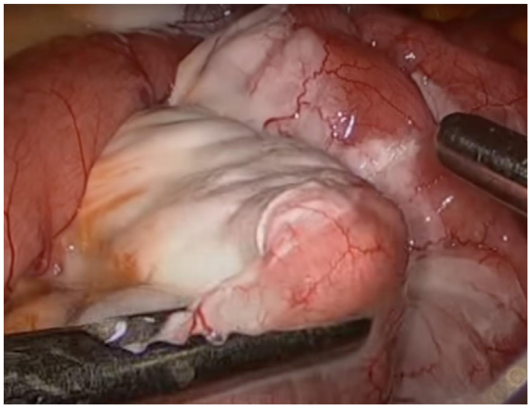

Fig. 2. Chylous mesenteric congestion. Triglyceride-rich lymph is seen within the mesentery and extending into the serosa of the small intestines, indicative of chronic or recurrent small bowel obstruction mainly from the internal hernia. Milky-white ascites was also present in this patient.

Review of the literature on the value of prophylactic closure of mesenteric defects during RYGB

There are several studies reporting the outcomes after routine closure versus non-closure of mesenteric defects at the time of laparoscopic RYGB [6,8,40–48]. However, most studies are limited by retrospective design, inadequate sample size, short and incomplete follow-up time, and lack of robust analytic techniques. Sufficiently powered randomized clinical trials (RCTs) with complete and long follow-up time are available and provide a high level of evidence to answer this important question.

Randomized clinical trials

Currently, the best available evidence is based on a large and well-conducted RCT that was published in the journal *Lancet* in 2016 [40]. In a multicenter trial from 12 centers in Sweden between May 2010 and November 2011, 2507 patients who underwent laparoscopic RYGB were randomly assigned to closure of the mesenteric defects beneath the jejunojejunostomy and at Petersen's space using a running, braided, non-absorbable suture (n = 1259) or non-closure (n = 1248). The main outcomes were reoperation for small bowel obstruction within 3 years (efficacy endpoint) and severe postoperative complications within 30 days after surgery (safety endpoint). Ninety-nine percent of patients had long-term follow-up.

Three years after surgery, the cumulative incidence of reoperation due to small bowel obstruction was 44% lower in the closure group (5.5%) versus non-closure group (10.2%) (hazard ratio = .56; 95% confidence interval [CI], .41–.76; $P = .0002$; Fig. 3).

Overall, the most common cause for small bowel obstruction was internal hernia (119 [68%] of 174 cases), which was most often beneath the jejunojejunostomy (about 70% of internal hernia cases) than at the Petersen's space (about 30% of internal hernia cases). At the end of the study, the cumulative incidence of internal hernia was 71% lower in the closure group (2.5%) versus non-closure group (8.9%) (hazard ratio = .29; 95% CI, .19–.45; $P < .0001$; Fig. 4).

Of notice, closure of mesenteric defects increased the risk for severe postoperative complications (54 [4.3%] for closure versus 35 [2.8%] for non-closure; odds ratio [OR] = 1.55; 95% CI, 1.01–2.39; $P = .04$), mainly because of kinking or narrowing of the jejunojejunostomy (n = 16 in the closure group versus n = 3 in the non-closure group), underscoring the need to align the mesenteric leaflets correctly while closing the defects.

The study investigators concluded that mesenteric defects should be closed at the time of laparoscopic RYGB. Even though mesenteric defects closure significantly reduced the risk for reoperation because of small bowel obstruction over time, surgeons should be aware that closure of the mesenteric defects might be associated with an increased

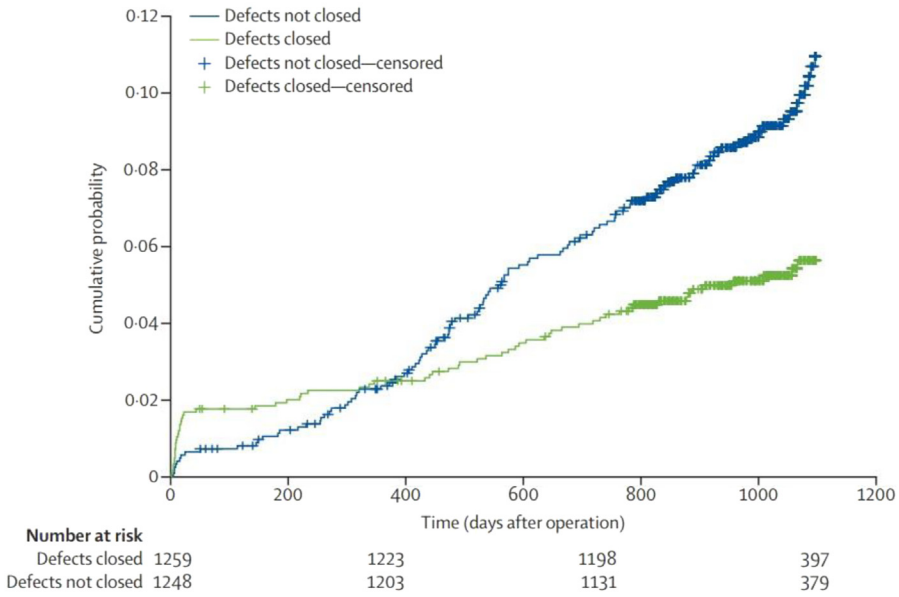

Fig. 3. Cumulative incidence of reoperation due to small bowel obstruction in the randomized clinical trial published in the *Lancet* [40].

risk for early small bowel obstruction caused by kinking of the jejunojejunostomy. Furthermore, although the risk for internal herniation was 71% reduced in this RCT, closure of mesenteric defects could not eliminate the risk [40].

The second RCT was published in the *British Journal of Surgery* in 2021 [6]. In a single-center trial from Denmark between 2012 and 2017, 401 laparoscopic RYGB patients were randomized to closure (201) or non-closure (200) of mesenteric defects with clips. The primary endpoint was the incidence of internal herniation. Based on the power calculation, the study was planned to enroll 464 patients. However, after publication of the aforementioned RCT in *Lancet* showing clear benefits after closure of mesenteric defects, the study group found it unethical to enroll new patients and decided to terminate the inclusion of patients before reaching the calculated sample size of 464.

The median follow-up for both groups was 59 months. Within the first 2 years, 16 of 200 patients in the non-closure group and 9 of 201 in the closure group had surgery for internal herniation. Although the cumulative risk of

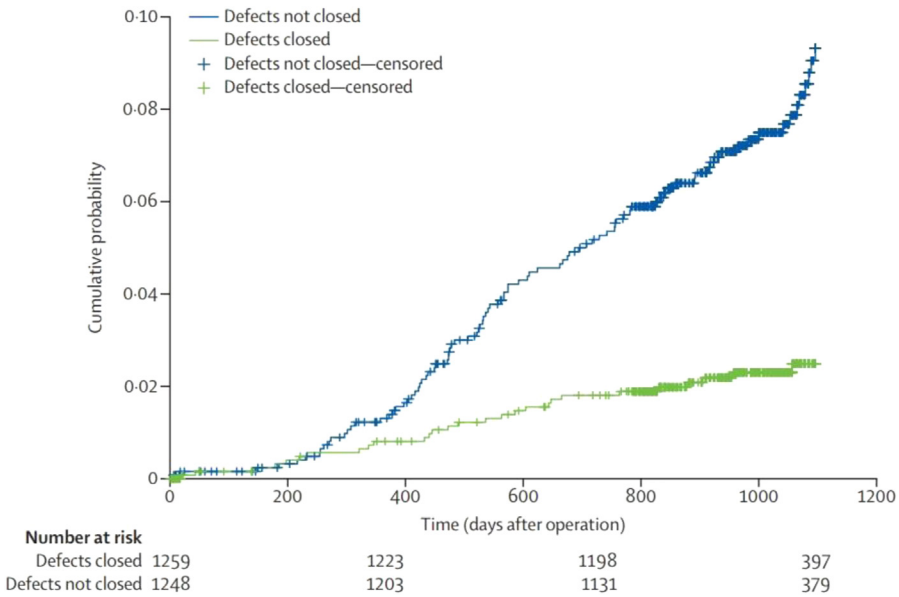

Fig. 4. Cumulative incidence of reoperation due to small bowel obstruction from internal hernia in the randomized clinical trial published in the *Lancet* [40].

internal hernia (8.0% in the non-closure group and 4.5% in the closure group) did not reach a statistical level of significance at 2 years, the difference was significant at 5 years; internal hernia occurred in 15.5% of non-closure group and 6.5% of the closure group (hazard ratio = .40; 95% CI, .21–.76; P = .005) [6].

In this RCT, the closure of the mesenteric defects was done with clips and was associated with an increased median operating time of 4 minutes. A median of 20 clips was used for closure of mesenteric defects. Although terminated early, this RCT had enough power to show that closure of mesenteric defects with clips was associated with 60% lower risk of internal herniation 5 years after laparoscopic RYGB [6].

There is another RCT on only 105 patients who were followed for a short period of time that did not have enough statistical power to reach to a meaningful conclusion [48].

Observational studies

Several large retrospective studies on thousands of laparoscopic RYGB patients compared the incidence of internal hernia after closure of mesenteric defects with a historical cohort of non-closure group during surgeons' career and evolution of laparoscopic RYGB in the past 2 decades [8,41,42,44]. Studies by Brolin et al. on 872 patients [41], Aghajani et al. on 4013 patients [8], Amor et al. on 2093 patients [42], and Blockhuys et al. on 3124 patients [44] consistently showed that after modification of RYGB technique by closing the mesenteric defects the incidence of internal hernia significantly reduced compared with historical cohorts of patients who did not undergo closure of mesenteric defects at the same centers. These findings are consistent with outcomes reported in the 2 aforementioned large RCTs. However, findings from smaller retrospective studies with short and incomplete follow-up time are not always consistent. These studies generally lack statistical power and robust analytic techniques.

Furthermore, a large registry-based study from the Scandinavian Obesity Surgery Registry on 34,707 patients between 2010 and 2015 in Sweden examined the incidence of reoperation for small bowel obstruction after laparoscopic RYGB [43]. The study showed that reoperation for small bowel obstruction within 5 years after RYGB was significantly higher in the non-closure group (cumulative incidence 11.2%) compared with the groups who underwent closure of mesenteric defects with sutures (cumulative incidence 6.9%) and clips (cumulative incidence 7.3%) [43].

Meta-analyses

Recently, 2 large systematic reviews and meta-analysis examined the association between mesenteric closure and the risk of internal hernia after laparoscopic RYGB. Hajibandeh et al. [45] analyzed 10,031 patients in observational studies and showed closure of mesenteric defects resulted in lower risks of internal hernia (OR = .28; 95% CI, .15–.54) and reoperation for small bowel obstruction (OR = .30; 95% CI, .10–.83).

Magouliotis et al. [46] performed meta-analysis on 16,520 patients in observational studies and RCTs. Closure of the mesenteric defects was associated with a lower incidence of internal hernias (OR = .25; 95% CI, .20–.31), small bowel obstruction (OR = .30; 95% CI, .17–.52), and reoperations (OR = .28; 95% CI, .15–.52) compared with non-closure. Both approaches had similar complication rates and weight loss outcomes.

Review of the literature on which mesenteric defects should be closed

Both Petersen's and mesojejunal defect closure

A 2015 metanalysis by Geubbels et al. evaluated 45 articles covering 31,320 patients who underwent laparoscopic RYGB. The lowest incidence of internal hernia was noted in the antecolic group with closure of all defects (1%), followed by the antecolic group with all defects left open and the retrocolic group with closure of both defects (both 2%), while incidence was highest in the antecolic group with closure of the mesojejunal defect only and the retrocolic group with closure of all defects (both 3%). Of 4345 patients who underwent an antecolic RYGB with closure of all defects, a total of 34 internal hernias were noted [14].

Obeid et al. performed a retrospective analysis of all consecutive 914 patients who had a laparoscopic RYGB during a 10-year period: 663 patients who underwent an antecolic RYGB with all defects closed compared with 251 who had no defects closed. Forty-six patients (5%) developed an internal hernia: 25 (3.8%) patients in the group with all defects closed versus 21 (8.4%) patients in the no defects closure group (P = .005) [16].

Delko et al. published a 2016 retrospective study of 585 patients who underwent laparoscopic RYGB: 269 patients without the closure of all the defects and 316 patients with the closure of all the defects. Of 316 patients who underwent closure of all defects, the reoperation rate was 13.6% with diagnosis of internal hernia of .6%, while 21 patients had an internal hernia in the non-closure group (14.4%): 13 patients with an internal hernia at the Petersen's and 8 at the mesojejunal defect [49].

Aghajani et al. demonstrated similar findings in a 2017 retrospective study that evaluated 4013 patients who underwent laparoscopic RYGB. Of these, 1570 patients did not have their mesenteric defects closed (non-closure group, operated from 2005 to May 2010), and 2443 had both defects closed (operated from June 2010 to November 2015). When analyzing data at the 60-month follow-up time with a Kaplan-Meier estimate, the incidence of confirmed postoperative internal hernia was significantly

lower: 2.5% in the closure group compared with 11.7% in the non-closure group [8].

In the previously explained RCT published in *Lancet*, patients were randomized to either closure of mesenteric defects beneath the jejunojejunostomy and at Petersen's space or non-closure [40]. Of importance, the study also showed that there was a significant reduction in cumulative incidence of internal herniation rates when closing defects beneath both sites. There was a reduction in incidence of internal hernia beneath the mesojejunal defect (closed, 1.4% versus not closed, 4.6%) and a reduction beneath the Petersen's space (Petersen's defect closed, .6% versus Petersen's defect not closed, 1.9%). This last observation is important because it provides evidence to support closing both defects.

Petersen's closure only

There were no studies or data for closure for the Petersen's defect only.

Mesojejunal defect closure only

Schneider et al. published a 2021 observational study of 785 patients undergoing laparoscopic RYGB, with 493 patients without mesojejunal defect closure and 292 patients with closure of the mesojejunal defect. In total, 67 patients presented typical symptoms of an internal hernia and received diagnostic laparoscopy (51 [10.3%] in the non-closure versus 16 patients [5.5%] in the closure group [$P = .02$]). Body mass index at the time of revisional surgery showed no difference between the groups [20].

Bauman et al. published a retrospective review in 2008 evaluated closure of the mesojejunal defect without closure of Petersen's defect. Of the 73 patients who underwent surgical exploration for a possible internal hernia, 65 were found to have entrapped small bowel within Petersen's space: 58 (80.6%) involved the biliopancreatic limb entrapped within Petersen's space, traveling posterior to the alimentary limb and from left to right. The remaining 7 Petersen's space hernias (9.7%) traveled right to left and contained the alimentary limb. There were 7 hernias at the site of mesojejunal defect. The laparoscopic findings for 1 patient were negative [50].

Review of the literature on the various methods of closure of defects during RYGB

While the concept of routine closure of the mesenteric defects is well studied and accepted in 2 high-quality randomized controlled trials that provide level 1 evidence, the method of closure is not standardized. A number of methods for closure have been proposed, such as suture, staples, clips, mesh, and fibrin glue.

A common and well established method is the complete closure of the defects with a running non-absorbable suture [9,40,51]. The mesojejunal defect is closed by approximating the 2 mesenteries, starting from the jejunal-jejunal anastomoses to the base of the mesentery or vice versa. Petersen's defect is closed by approximating the mesentery of the alimentary limb to the mesentery of the transverse colon. This is usually done from the apex of the colonic mesentery to the edge of the transverse colon. Care must be taken to close the defects completely and to avoid hematomas or kinking of the jejunal-jejunal anastomosis.

Yang et al. examined 331 patients following laparoscopic RYGB and subdivided the patients into 3 groups based on the suturing method (running or interrupted), alimentary limb position, and suture material (either absorbable or nonabsorbent braided sutures). Total incidence of internal hernia for the group at a mean follow-up time of 36 ± 12 months was 1.8%. There were 157 cases in the interrupted suture group, which had 6 cases of internal hernias, while no internal hernias were present in the running suture group (n = 174), which was significant ($P = .01$). There were no differences in terms of suture material [52].

The main concern with mesojejunal defect closure with suture is the kinking of the jejunojejunostomy [40,53]. Closure with metal clips has been viewed as an alternative method, although opponents cite the increased cost and limited durability [54]. A study compared the closure of defects with non-absorbable, running suture (n = 6149), non-absorbable metal clips (n = 19,436), versus non-closure (n = 9122) in order to compare postoperative complications. The authors deemed closure of the mesenteric defect with either non-absorbable metal clips or non-absorbable running suture to be safe and effective, although sutures appear to be slightly more effective [43].

In a recently published randomized controlled trial of routine closure of the mesenteric defect with laparoscopic clips versus non-closure of the defect found that the risk of internal herniation at 2 years was 4.5% versus 8.0%, respectively. At 5 years the rates were 6.5% for the closure group and 15.5% for the non-closure group [6]. Similarly, Aghajani et al. closed the mesenteric defects with a laparoscopic 4.8-mm stapling device catching the mesenteric peritoneum and noted that incidence of internal hernia was significantly lower in the closure group compared with the non-closure group, 2.5% versus 11.7%, respectively, at 60 months [8]. The relative risk reduction by closing the mesenteric defects was 4.1-fold as calculated using a survival model [8]. A current clinical trial aimed to be completed in 2023 seeks to evaluate the effectiveness of closure with clips (NCT01595230).

Other methods of closure such as fibrin glue have also been evaluated. Preliminary results at 15 months comparing suture closure versus fibrin glue at both defects sites showed no internal hernias in either group however there has been no follow-up to this study [55]. In order to induce adhesion and prevent breakdown of the closure over time, Skidmore, et al. closed the defects with a running non-absorbable suture and reinforced the closure of both defects with biosynthetic mesh [56]. They found that in patients that underwent

reoperation the incidence of internal hernia was lower in patients who had implantation of mesh when compared with those with only suture closure [56]. More studies are necessary to evaluate the optimal method of closure of mesenteric defects.

Summary and recommendations

Internal hernia can be a morbid complication following RYGB due to creation of mesenteric defects, either 2 or 3 potential spaces. This complication can occur at any time in the postoperative period. As signs and symptoms are nonspecific, a high index of suspicion is paramount.

Considering all currently available evidence, closure of both mesenteric defects (mesojejunal and Petersen's) during laparoscopic RYGB can significantly decrease the risk of internal herniation by approximately 70%. It is important to mention that closure of mesenteric defects does not eliminate the risk of internal herniation. Therefore, medical providers should have a high index of suspicion for internal hernia in patients whose clinical and radiologic findings are compatible with internal herniation, regardless of history of closure or non-closure of mesenteric defects at the index operation. If there is uncertainty as to whether a patient has an internal hernia, a diagnostic laparoscopy is warranted.

Disclosures

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

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