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The role of upper gastrointestinal endoscopy in treating postoperative complications in bariatric surgery

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Abbreviations: RYGB, roux-en-Y gastric bypass; GI, gastrointestinal; CT, computer tomography; SAGES, Gastrointestinal and Endoscopic Surgeons; CAGS, Canadian Association of General Surgeons; GAGES, Global Assessment of Gastrointestinal Endoscopic Skills

There are an estimated 500 million obese individuals worldwide. Currently, bariatric surgery has been shown to result in clinically significant weight loss. With increasing demand for bariatric surgery, endoscopic techniques used intra and postoperatively continue to evolve. Endoscopic evaluation of anastomotic integrity following RYGB allows for early detection of anastomotic leaks. Furthermore, endoscopy is a valuable tool to diagnose and treat RYGB postoperative surgical complications such as anastomotic leakage, hemorrhage and stricture formation. Early evidence suggests that endoscopic management of upper gastrointestinal hemorrhage following RYGB is effective. In addition, endoscopic balloon dilatation is able to effectively treat obstruction in the setting of gastrojejunal anastomotic strictures. With successful endoscopic management of these complications, bariatric patients may avoid more invasive surgical procedures.

Introduction

The World Health Organization estimates that there are 1.5 billion overweight and 500 million obese individuals worldwide.[1] Despite the awareness of obesity related health issues, the prevalence of this phenomenon is expected to increase. It is approximated in the next 20 years that the number of obese individuals will double to over 1 billion.[2] Although this is a global issue, North America remains a major region of concern. An estimated 68% of Americans are considered overweight, with 33.8% of Americans being defined as clinically obese.[3] In Canada, 60% of the population is overweight, with 24% defined as clinically obese.[4,5]

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Currently for super obese individuals, bariatric surgery is the only evidence-based approach that results in clinically significant and sustainable weight loss. A recent meta-analysis reported a mean 55.9% excess weight loss following bariatric surgery.[6] Furthermore, bariatric surgery improved obesity related co-morbidities in these patients. On average, 86% of patients had improvement or resolution of their type 2 diabetes mellitus, 83.6% had improvement or resolution of their obstructive sleep apnea, and 78.5% had improvement or resolution of their hypertension.[7] These findings suggest that weight loss following bariatric surgery has substantial benefits to obese patients.

With the increasing prevalence of obesity there has been an increased demand for bariatric surgery and a corresponding increase in the rates of bariatric surgery each year.[8] A common bariatric surgical procedure in North America is the Roux-en-Y gastric bypass (RYGB).[9] It involves the creation of a small gastric pouch from the upper portion of the stomach that is drained by a Roux limb from the proximal jejunum. This procedure effectively reduces the capacity of the stomach and leads to malabsorption in the bypassed segment of small intestine. Due to the novelty RYGB, the techniques and protocols for the procedure continue to evolve. One emerging technique is the use of endoscopy to identify and treat complications of the RYGB such as anastomotic leaks, hemorrhages, and strictures. This review will focus on the role of endoscopy intraoperatively and postoperatively in the context of RYGB.

The role of intraoperative endoscopy to detect anastomotic leaks

Considering RYGB relies on the rearrangement of the small intestine to produce malabsorption, leakage from the newly created anastomoses is a considerable concern. Anastomotic leakage from either the gastrojejunostomy or enteroenterostomy may result is serious morbidity to the patient. Failure to identify a gastrointestinal (GI) anastomotic leak has been shown to increase morbidity and mortality in patients who underwent GI surgery.[10]

Consequently, multiple techniques are utilized to identify potential anastomotic leaks. One of these methods involves the injection of methylene blue dye near the gastrojejunal anastomosis via a nasogastric tube.[11] If there is an inadequate anastomosis, methylene blue dye will leak out of the anastomosis and can be easily identified by the surgeon. However, following repair of the anastomotic leak, the surgeon is unable to use methylene blue again as the field is now contaminated with blue dye. Consequently, the use of endoscopy to identify anastomotic leaks intraoperatively has been evolving. Intraoperative endoscopy allows for visualization of the upper gastrointestinal tract and direct placement of the endoscope just above the gastrojejunal anastomosis.[12] Assessment of the anastomosis involves submerging the gastrojejonostomy in saline, and clamping the Roux limb, followed by insufflation with air. Bubbles escaping from the anastomosis indicate a leak. Additionally, endoscopy has the added benefit of allowing multiple leak checks and direct visualization of the anastomosis.[13]

Alasfar and Chand recently reported a retrospective review of 290 patients who underwent RYGB, in which intraoperative endoscopy was utilized to identify anastomotic leaks. Of these patients, 3.7% had anastomotic leaks, which were identified by endoscopy intraoperatively. The anastomosis were subsequently revised and corrected by surgical oversewing of the anastomosis.[12] All patients then underwent radiographic contrast imaging on postoperative day 1, with no subsequent anastomotic leaks identified.[12] Thus early identification of potential anastomotic compromise allowed for early repair and prevention of future morbidity for these patients. Alaedeen et al. preformed a retrospective review of RYGB surgical procedures, in which they compared 200 cases in which intraoperative endoscopy was used to 200 cases in which methylene blue was used to identify potential anastomotic leakage. On postoperative day 1 all patients underwent a radiologic contrast study of their upper GI tract to identify anastomotic leakage that may have been missed intraoperatively. They reported an anastomotic leak rate of 0.4% with the use of intraoperative endoscopy which was significantly lower than the anastomotic leak rate of 4% with methylene blue.[14] These findings support the increased sensitivity of intraoperative endoscopy to detect early anastomotic leakage following RYGB.

The role of postoperative endoscopy to detect and treat anastomotic leaks

Identification of an anastomotic leakage postoperatively suggests that either an intraoperative leak test via endoscopy missed the defect or that the leak developed after the completion of the surgery. Studies indicate that anastomotic leaks following RYGB occur in 0.7% to 20% of patients.[15-20] The wide range of anastomotic leakage may be attributed to variable experience among surgical centers. Typically high volume centers tend to report anastomotic leak rate of less than 2%.[13,21,22]

Upper GI contrast studies are commonly performed to evaluate the integrity of the gastrojejunostomy postoperatively if clinical symptoms suggest anastomotic compromise. Some centers routinely perform an upper GI series after a RYGB, even in asymptomatic patients. Computer tomography (CT) scans are another common technique used to examine the anatomy of the roux limb and the anastomoses. If both the contrast studies and CT scans are equivocal, then endoscopy may be considered to assess the gastrojejunostomy. Unfortunately there remains limited studies reporting the systematic use and evaluation of endoscopy to detect postoperative leaks.

The treatment of postoperative anastomotic leakage following RYGB depends on a variety of factors including the patient's hemodynamic status, size and location of the anastomotic leak. In hemodynamically unstable patients with significant compromise of the anastomosis, emergent laparotomy and repair to the defect may be considered appropriate. In a hemodynamically stable patient with contained anastomotic leak, treatment with antibiotics and percutaneous drainage of fluid collections with initiation of total parenteral nutrition may be appropriate. This may allow time for the anastomosis to heal, and avoids a second surgery for the patient. In hemodynamically stable patients, that fail conservative management, laparoscopic repair is a reasonable treatment option. Additionally, in these patients, endoscopy is emerging as an effective method to treat the anastomotic leakage, while avoiding an invasive surgical reoperation.

Schubert et al. demonstrated the successful use of a self-expanding removable polyester stent to treat esophageal anastomotic leaks.[23] 11 out of their 12 patients had complete closure of the leak after placement of the stent. However, the majority of these patients had undergone surgery for esophageal cancer and not a RYGB. Nonetheless, Schubert and colleagues were able to demonstrate a proof of concept that endoscopically placed stents may be a viable treatment option in the setting of an anastomotic leak. This finding was recently supported by Werner et al. when they reported the successful use of endoscopically placed stents to close anastomotic leaks in 10 patients.[24] The individuals in their study had also undergone esophagectomy for esophageal cancer. In 2006, Benjamin et al. reported three cases where they treated RYGB patients endoscopically after they developed postoperative gastric leaks.[25] They used a variety of techniques, including: stents, clips, plasma argon coagulation, and fibrin glue. Gastric leak closure was successful in all patients, leading the authors to conclude that endoscopy may be a feasible, less invasive alternative to surgical repair.[25] Further research is needed to clarify the role of endoscopy to treat postoperative anastomotic leakage following RYGB.

Postoperative endoscopy to detect and treat hemorrhage

Postoperative hemorrhage within the first 30-days following RYGB has been reported to occur in 1.1-4% of patients.[26-31] The timing and extent of postoperative hemorrhage following RYGB and associated clinical symptoms aid in determining management. Overt bleeding and a decline in hematocrit within the first 6 hours post-surgery is an indication that intervention may be required.[26] However, bleeding 48 hours post-surgery with a stable hematocrit generally resolves with conservative management.[26] The most common site of bleeding following RYGB is the gastrojejunal anastomosis.[26,32] Additionally, endoscopic management of hemorrhage from the gastrojejunal anastomosis has been shown to be successful.[26,33] Interestingly some authors believe that

diagnostic studies are of limited value for patients with signs and symptoms of GI hemorrhage after a RYGB. Their justification is that the source of bleeding is most commonly the gastrojejunal anastomosis and thus therapy should be initiated without wasting resources on diagnosis.[26,34,35] However, the benefit of endoscopy in this clinical setting is that it can provide both diagnosis and treatment at the same time in most cases.

The literature describes numerous approaches to treating active upper GI hemorrhage; most commonly peptic ulcers. These approaches are endoscopic, however are not limited to bariatric surgical procedures.[36] One endoscopic technique involves the use of thermal energy, including electrocoagulation, heater probe, and argon plasma coagulation to achieve hemostasis.[37] A second endoscopic technique involves local injection with epinephrine, sclerosants, and thrombin/fibrin glue to stop active bleeding.[37] A third endoscopic technique involves the mechanical application of clips. Furthermore, combinations of the above endoscopic modalities may be utilized. However, in patients with bleeding without presence of ulcer, epinephrine injection or clip placement may be preferable. Theoretically, GI hemorrhage following bariatric surgery may also be amenable to these endoscopic techniques. However, we caution that endoscopic treatment of bleeding in the early postoperative period may disrupt or blow out the gastrojejunal anastomosis.

Rabl et al. recently published a retrospective review of 722 obese patients who underwent RYGB at their institution. They reported postoperative hemorrhage in 2.6% of all the patients within 2 weeks of the surgery.[38] 6 of the patients with hemorrhage were diagnosed with endoscopy and 5 of them were subsequently treated with endoscopic clipping and epinephrine injections. Additionally, Rabl et al. further reported that 0.9% of patients were found to have late gastrointestinal bleeding (after 5 months), which was diagnosed by endoscopy. However, endoscopic epinephrine injections were only successful in two patients, while the rest needed reoperation for surgical revision. In a separate retrospective review of 933 patients undergoing RYGB, 3.2% were reported to have postoperative hemorrhage complications.[39] Of note, in this review, the authors did not differentiate between early and late hemorrhage. Nevertheless, 90% of the patients with suspected hemorrhage following RYGB underwent upper endoscopy for diagnosis, while the other 10% were managed conservatively with observation. Of those diagnosed endoscopically with GI bleeding, 80% were treated successfully with concurrent endoscopic intervention, including epinephrine injections, heater probes, and clips to achieve hemostasis. Of these patients, five required a second endoscopy for recurrent bleeding. As a result, the authors concluded that although there is hesitation to use endoscopy following RYGB, the technique might be safe and effective at controlling postoperative upper GI hemorrhage. Recently, Fernández-Esparrach et al. reported a prospective review of 381 patients who underwent RYGB. 5.8% were found to have upper GI hemorrhage[40], however only six patients had clinical signs suggestive of active bleeding. Endoscopy was used successfully to identify the source of bleeding in all cases and five of the patients successfully received endoscopic injections of epinephrine and/or polidocanol to achieve hemostasis. Overall, the evidence supporting endoscopic management of postoperative upper GI bleeding following RYGB seems favorable. Furthermore, the use of endoscopic techniques as initial management of postoperative GI bleeding following RYGB may avoid a second surgical operation.

The role of endoscopy postoperative to detect and treat anastomotic stricture

Narrowing or obstruction of the gastrojejunostomy may occur following RYGB, which in the past was treated solely with surgical revision. These patients may present with persistent emesis, malnourishment, and unhealthy rates of weight loss. The estimated rate of postoperative stricture formation following RYGB is around 3%.[31,41-43] Most commonly, the region of anastomotic stricture is the gastrojejunostomy site. Though strictures may occur at the enteroenterostomy site, they are not typically amenable to endoscopic treatment. In 2003, Ahmad et al. reported a review of 450 patients following RYGB, in which 3.1% of patients were found to have a stricture at the site of the gastrojejunal anastomosis.[44] Twelve patients underwent endoscopic balloon dilatation with 58% having improvement of symptoms following the initial dilatation.[44] Overall, at 18 months follow-up, all patients had no subsequent obstructive symptoms. This suggests that endoscopic balloon dilatation for post-RYGB anastomotic strictures may produce desirable results in the short-term. In 2004, Go et al. reported a retrospective review of 562 patients who underwent RYGB and reported a 6.8% rate of gastrojejunal anastomosis stenosis leading to gastric outlet obstruction.[45] Of these patients, 71% responded to one or two endoscopic balloon dilatations. 24% needed more than two dilatations and 5% needed surgical revision to relieve the stricture. Further research by Goitein et al. on 369 patients following laparoscopic RYGB, reported anastomotic strictures at the gastrojejunostomy site in 5.1% of their patients.[46] Endoscopic balloon dilatation relieved obstruction in a majority of patients, however most patients needed at least two dilatations. Peifer et al. demonstrated a 93% success rate of endoscopic dilatation in post RYGB strictures. Importantly, no major complications of perforation or bleeding were seen. This further supports the use of safe serial dilatation of anastomotic strictures.[47]

Patient factors and surgical technique can contribute to the formation of anastomotic strictures following RYGB. Takata et al. reported that 4.1% of 379 patients developed gastrojejunal strictures following RYGB. They identified a significantly increased frequency of stricture formation with the use of a 21-mm circular stapler to perform the gastrojejunal anastomosis compared to the 25-mm circular stapler.[48] However, endoscopic balloon dilatation was successful in treating the stricture after one attempt in a majority of patients. In contrast, Ukleja et al. reported the need for multiple dilatations in a majority (72%) of their patients presenting with anastomotic stricture.[49] However, none of the patients with strictures required surgical revision. It seems that although endoscopic management of anastomotic strictures is generally successful, it may require multiple dilatations. Nonetheless, endoscopic management is relatively less invasive than surgical revision, which does not necessary alleviate the need for future surgical revision. It has been suggested that there may be a role for steroid injection following balloon dilation, however

further evidence is needed. Also, in cases of refractory stricture despite multiple dilatations, stent placement may be reasonable. However, stent migration may limit long-term results.

Despite the fact that endoscopic balloon dilatation is less invasive, complications may arise. Caro et al. reviewed 111 patients that had undergone endoscopic balloon dilatation following RYGB[50] and reported two perforations and one hematoma of the esophagus following a total of 200 endoscopic dilatations. An average of 2.2 endoscopic dilatations per patient were needed to treat gastrojejunal strictures post-RYGB. As well, although the complication rate is low, follow-up care is needed.[51]

Also, balloon dilatation is not the only endoscopic technique that has been used to treat gastrointestinal strictures. Schubert et al. used argon plasma coagulation combined with diathermy to treat 49 patients with anastomotic strictures.[52] They used electroincision to create flaps and then argon plasma coagulation to reduce the size of the flaps, which resulted in dilatation of the gastrointestinal lumen at the location of the stricture. Although this was not specifically preformed for anastomotic strictures following RYGB, they reported that 92% of patients required only one treatment session to gain long-term recanalization. However, further research is needed to clarify which endoscopic treatment modality results in long-term success.

The role of endoscopy training in bariatric surgery

Considering the current and evolving role of endoscopy in bariatric surgical patients, one may assume that surgical trainees receive extensive endoscopy training. Gastroenterologists, after all, must complete a formal two-year subspecialty-training program during their residency. In contrast, surgical trainees typically receive only 3-months of dedicated endoscopy training. However, according to Romagnuolo et al., it is difficult to provide the necessary level of training in less than 6 months.[53] Furthermore, Ponich et al. argue that there generally is not enough time for surgeons to acquire the necessary experience to perform advanced endoscopic techniques, such as endoscopic hemostasis.[54] Thus, in general, at least six months of training is needed to fully understand the cognitive aspects of endoscopy, such as contraindications, current guidelines, risks, complications, and management of adverse sequelae. Consequently, Asfaha et al. discovered that none of the surgical trainees at their institution met the American Society for Gastrointestinal Endoscopy minimum recommendations for endoscopy case numbers.[55] In contrast; all of the gastrointestinal trainees far exceeded these minimum recommendations.

The importance of this issue is highlighted by the developing use of endoscopy within surgical procedures, such as RYGB. Without surgeons to perform endoscopies, patient care may be affected. In support of this notion, Hilsden et al. looked at the type of physicians who performed at least 100 gastroscopies or colonoscopies in Canada in 2002 and discovered that 51% were surgeons. Furthermore, these surgeons performed 44% of the total colonoscopies and 28% of the total gastroscopies for that year,[56] which represents 337644 endoscopic procedures. Thus, surgeons perform a significant amount of endoscopic procedures. Furthermore, the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) have commented that surgeons are uniquely qualified to perform endoscopic procedures during and after a surgical operation.[57] Indeed, as this review has discussed, endoscopy is an invaluable tool for the assessment and treatment of surgical complications. Consequently, SAGES recommends that the training for surgeons should take into account their need to perform endoscopy in this unique situation. The Canadian Association of General Surgeons (CAGS) also stated that training of surgical residents in endoscopy is essential to the health and well being of the Canadian public.[58]

To improve endoscopy training for surgical trainees, some have suggested the use of gastrointestinal endoscopy simulators as a supplemental tool.[59] They provide a safe and stress-reduced environment to assess the competency of trainees. A formal endoscopic training curriculum as opposed to an informal apprenticeship program has also been suggested to improve development of endoscopic skills.[60] Furthermore, the Global Assessment of Gastrointestinal Endoscopic Skills (GAGES) has proposed using more than just case volume as an indicator of competency.[61] The GAGES score considers such factors as: quality of examination, ability to keep a clear endoscopic field, ability to intubate the esophagus and manipulate the scope, and the ability to direct the instrument to the desired target.[61] As, endoscopy continues to evolve and become necessary in surgical procedures like RYGB, surgeon trainees will be expected to have the competency and efficiency to diagnose and treat complications with endoscopy.

Conclusion

Bariatric surgery remains the most effective treatment to produce marked weight loss in obese individuals. With increasing demand for bariatric surgery (RYGB), along with increasing prevalence of obesity worldwide, the role of endoscopy will continue to evolve intraoperatively and postoperatively. Endoscopic evaluation of anastomotic integrity allows for early detection of anastomotic leakage, which may prevent morbidity and mortality in bariatric surgical patients. Post-operative complications of RYGB such as anastomotic leak, hemorrhage and anastomotic stricture can be diagnosed and treated endoscopically. The indications for endoscopy continue to be clarified, however, it will likely be most beneficial as an initial therapeutic option for surgical complications

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