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ORIGINAL CONTRIBUTIONS

The Utility of Diagnostic Laparoscopy in Post-Bariatric Surgery Patients with Chronic Abdominal Pain of Unknown Etiology

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Abstract
Purpose Chronic abdominal pain after bariatric surgery is associated with diagnostic and therapeutic challenges. The aim of this study was to evaluate the yield of laparoscopy as a diagnostic and therapeutic tool in post-bariatric surgery patients with chronic abdominal pain who had negative imaging and endoscopic studies.
Methods A retrospective analysis was performed on post-bariatric surgery patients who underwent laparoscopy for diagnosis and treatment of chronic abdominal pain at a single academic center. Only patients with both negative preoperative CT scan and upper endoscopy were included.
Results Total of 35 post-bariatric surgery patients met the inclusion criteria, and all had history of Roux-en-Y gastric bypass. Twenty out of 35 patients (57%) had positive findings on diagnostic laparoscopy including presence of adhesions (n = 12), chronic cholecystitis (n = 4), mesenteric defect (n = 2), internal hernia (n = 1), and necrotic omentum (n = 1). Two patients developed post-operative complications including a pelvic abscess and an abdominal wall abscess. Overall, 15 patients (43%) had symptomatic improvement after laparoscopy; 14 of these patients had positive laparoscopic findings requiring intervention (70% of the patients with positive laparoscopy). Conversely, 20 (57%) patients required long-term medical treatment for management of chronic abdominal pain.
Conclusion Diagnostic laparoscopy, which is a safe procedure, can detect pathological findings in more than half of post-bariatric surgery patients with chronic abdominal pain of unknown etiology. About 40% of patients who undergo diagnostic laparoscopy and 70% of patients with positive findings on laparoscopy experience significant symptom improvement. Patients should be informed that diagnostic laparoscopy is associated with no symptom improvement in about half of cases.

Keywords Bariatric surgery · Diagnostic laparoscopy · Abdominal pain · Gastric bypass · Complication · Adhesion · Internal hernia · Endoscopy

Introduction

Chronic abdominal pain following bariatric surgery presents with various diagnostic and therapeutic challenges. The differential diagnosis is broad, with a wide spectrum in severity and acuity. The differential diagnosis includes biliary pain, adhesions, incisional hernias, and in the case of bypass procedures, marginal ulcer at the gastro-jejunostomy anastomosis, as well as internal hernias. Methods of evaluation include history and physical examination, endoscopy, imaging in the forms of computed tomography (CT) scans of the abdomen and small bowel series, and finally surgical exploration in the forms of either diagnostic laparoscopy (DL) or laparotomy. Diagnostic and therapeutic laparoscopy is a well-established

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tool in the surgeon's armamentarium for the diagnosis of both acute and chronic abdominal pain since the 1970s [1, 2].

The efficacy of DL after bariatric surgery was reported a decade ago on 13 eligible patients with history of Roux-en-Y gastric bypass (RYGB) and chronic abdominal pain of unknown etiology [3]. The aim of our study was to further analyze the utility of DL in a greater number of eligible post-bariatric surgery patients with chronic abdominal pain to assess its safety, diagnostic value, and therapeutic efficacy.

Methods

Approval for this study was obtained from our Institutional Review Board. A retrospective review of our bariatric surgical database from 2003 to 2015 was performed. Our inclusion criteria included all patients with history of bariatric surgery and all of the following conditions:

1. History of abdominal pain for over 30 days after the initial bariatric procedure.
2. CT scan of abdomen/pelvis with no positive findings
3. Abdominal ultrasound (for patients with gallbladders) with no gallstones
4. Upper gastrointestinal (GI) endoscopy with no abnormal findings

After applying the inclusion criteria, a list of 35 eligible patients was generated. The following data was collected on each of these patients: age, gender, body weight and BMI (at time of bariatric of surgery and DL), type of bariatric procedure, and the time interval between the bariatric surgery and first presentation with abdominal pain. The specific findings found on DL were recorded, if any. Outcome measures included the operative time, length of hospital stay, adverse events after DL, and pain resolution or improvement in follow-up. The information on the study parameters are expressed as median (interquartile range (IQR)) and number (%).

Surgical Procedure

Our approach to DL is as follows [3]. A 5-mm port is inserted at the Palmer's point utilizing an optical trocar after insufflation with a Veress needle. A 5-mm 0-degree camera is inserted and initial inspection for trocar site injuries is performed. Thereafter, the camera is switched to an angled camera. The anterior abdominal wall is inspected for potential incisional hernias and adhesions. If adhesiolysis is required, 5-mm ports are inserted where necessary for sharp lysis of adhesions. If the patient has significant adhesions, then it would be safer to convert to an open procedure to avoid the possibility of missed injury. Three 5-mm ports are then inserted under direct vision: one between the umbilicus and pubic bone, and two in right quadrants, one hand's breadth apart. The angled camera is then placed in the suprapubic port. We then identify the cecum/ileocecal valve and run the bowel retrograde towards the ligament of Treitz. This comprises the evaluation of the common channel. Once the entero-enterostomy is identified, it is checked for any adhesions, kinking, intussusception, and mesenteric defects and any such issues are addressed as deemed appropriately. The bilio-pancreatic and alimentary limbs are then identified and similarly lysed of adhesions if significant kinking is encountered. The Petersen's space is identified and closed if open, utilizing a permanent running suture. We do not routinely dissect the gastro-jejunostomy area if it appears grossly normal. We also assess the liver, gallbladder, and pelvic organs. Finally, a routine upper endoscopy is performed to evaluate the pouch and gastro-jejunostomy before final closure. During DL, we perform laparoscopic-assisted gastroscopy of the excluded stomach by anchoring the stomach to the anterior abdominal wall. A 15-mm port was inserted directly through a defect created on the greater curvature of the excluded stomach for percutaneous insertion of gastroscope. The routine examination of the excluded stomach is not necessary unless the patient does have upper abdominal pain or GI bleeding with no other possible etiology [3].

Results

A total of 35 post-bariatric surgery patients met the inclusion criteria, and all had history of RYGB. There were 31 (89%) female and 4 (11%) male patients, with a median age at the time of RYGB of 48 years (IQR 39–52), preoperative weight of 125 kg (IQR 115–143,) and BMI of 46 Kg/m^2 (IQR 43–51). Eight patients had psychiatric disorders (depression and/or anxiety disorders) and three patients had fibromyalgia before surgery.

Median duration from bariatric surgery to first abdominal pain presentation was 26 months (IQR 12–41). Nine patients developed pain within the first year after RYGB. At the time of presentation with abdominal pain, median weight was 82 kg (IQR 76–95), BMI was 30 kg/m^2 (IQR 27–35), and percent excess weight loss was 71 (IQR 55–93).

During the DL, two patients underwent laparoscopic-assisted gastroscopy which did not show any pathologies in the excluded stomach and duodenum. Median operative time was 64 min (IQR 52–85) and length of hospital stay was 1 day (IQR 0–2).

Twenty out of 35 patients (57%) had positive findings on DL including the presence of adhesion (n = 12), chronic cholecystitis (n = 4), mesenteric defect (n = 2), internal hernia (n = 1), and necrotic omentum (n = 1). Half of the adhesions occurred at the jejunojejunostomy. All four patients with intraoperative diagnosis of cholecystitis had histopathological

findings compatible with chronic cholecystitis. One patient with an internal hernia required conversion to a laparotomy for reduction of hernia and closure of mesenteric defect at the jejunojejunostomy.

Two patients developed post-operative complications within 30 days including a pelvic fluid collection requiring percutaneous image-guided drainage and an abdominal wall abscess at the site of gastrostomy tube, which was placed at the conclusion of laparoscopic-assisted gastroscopy of excluded stomach, necessitating incision and drainage. No mortalities occurred.

Overall, 15 patients (43%) had symptomatic improvement after laparoscopy; 14 of these patients had positive laparoscopic findings requiring intervention (70% of the patients with positive laparoscopy). Conversely, 20 (57%) patients (14 out of 15 with negative laparoscopy and 6 patients with positive laparoscopy) required long-term medical treatment for management of chronic abdominal pain.

Discussion

Chronic abdominal pain after RYGB has a broad list of differential diagnoses including the presence of adhesions (which can cause intermittent partial small bowel obstruction), incisional hernia, biliary pain, gastritis in the gastric pouch and remnant, marginal ulceration at the gastrojejunal anastomosis, and internal hernias. Many of these conditions can be diagnosed with UGI endoscopy and imaging studies. In our series of 35 post-RYGB patients with abdominal pain and negative UGI endoscopy and imaging studies, DL was positive in 57% of patients which led to an overall 43% pain improvement rate. Surgical complications occurred in two patients with no mortalities. Only 1 out 15 patients with negative DL experienced pain improvement, and 70% of patients with positive DL findings improved. Importantly, most patients with negative DL had persistent abdominal pain, likely due to functional non-organic causes. These patients were referred to chronic pain management in our institution.

Similarly, Pitt et al. reported the ability of DL to identify significant pathological entities in about 85% of cases with a 25% complication rate [3]. This study utilized data from 13 eligible bariatric surgical patients with chronic abdominal pain of unknown etiology after RYGB. The study also revealed an overall resolution of pain in 55% of the patients included in that study. There are many reports in the field of the minimally invasive general surgery which have utilized laparoscopy for diagnosis and treatment of chronic abdominal pain (in patients with no bariatric surgical history) [4–9]. Klingensmith et al. reported a 70% diagnostic rate and post-operative pain resolution in 73% [5]. Furthermore, another study by Husain et al. revealed a diagnosis in 86.5% of patients who underwent DL for chronic abdominal pain of known etiology, with a therapeutic rate of 46.5%. No major complications were reported [6]. Furthermore, a study by Salky et al. where 387 patients underwent DL for acute and chronic abdominal pain reports the diagnosis in 76% with a therapeutic effect in 48% [7].

One of the serious adverse events of RYGB would be the presence of an internal hernia, which may lead to bowel incarceration, with resultant strangulation, bowel necrosis, and potentially life-threatening peritonitis and short bowel syndrome. Many patients with internal hernia present with non-specific abdominal pain without typical clinical picture of small bowel obstruction, with negative imaging and endoscopic findings and thereby presenting the surgeon with a diagnostic enigma [10]. Three potential sites where internal hernias can occur include the entero-enterostomy gap, the gap between the mesentery of the alimentary limb, and transverse mesocolon (the Petersen's space), and in the case of a retrocolic ascending alimentary limb, the transverse mesocolon defect [11–13]. A significant number of internal hernias can be missed by relying solely on imaging studies including high-resolution CT scans and therefore surgical exploration is justified in the post-RYGB patient with persistent and non-specific abdominal pain or bowel obstruction. The sensitivity of CT scan in identifying the "mesenteric swirl sign," the most sensitive CT scan sign suggestive of internal hernia, has been reported to be between 68 and 89% [14]. In our series, we identified three cases with open mesenteric defect including one patient with herniated bowel. Quezada et al. reported a rate of 59% of internal hernias on exploration in post-RYGB patients with intermittent abdominal pain and negative preoperative work-up consisting of upper gastrointestinal series, upper endoscopy, and abdomino-pelvic CT scan [15]. Another study by Higa et al. revealed the presence of internal hernias on exploratory laparoscopy in about 20% of post-RYGB patients with abdominal pain and normal preoperative small bowel series and/or CT scans [11].

In addition to common conditions, some rare causes of abdominal pain can be diagnosed by utilizing DL in bariatric surgical patients. Intussusception at the entero-enterosotomy in post-RYGB patient has been described as possible source of small bowel obstruction and intermittent abdominal pain [16]. In the study of 12 patients, only 1 patient was found to been diagnosed with this entity by imaging alone, and an overwhelming 92% were diagnosed intraoperatively [16]. While all three limbs of the entero-enterosotomy can be affected by intussusception, the most common form is retrograde invagination of common channel into the jejunojejunostomy [17, 18]. One study even reported cecal volvulus as the causative culprit in a 50-year-old female with history of laparoscopic RYGB [19]. This patient had negative preoperative imaging studies. Clearly, the utilization of imaging alone is insufficient to diagnose such patients.

Our routine DL method does not include an evaluation of the excluded stomach, unless we suspect the presence of pathology in the gastric remnant. Severe gastritis/duodenitis and ulceration can occur at the excluded stomach and thus be a source of pain, mainly in the epigastric area and left upper quadrant [20–22]. One observational study in which the excluded stomach was successfully intubated using double-balloon enteroscopy in 35 out of 40 RYGB patients revealed some form of gastritis in 74% of patients. These patients did not have any specific complaints [23]. In another series, the excluded stomach was endoscopically accessed in 19 out of 24 patients after traversing the jejunojejunostomy and the pylorus from the duodenal side. Gastritis of excluded stomach and jejunojejunostomy stenosis were among the findings [24]. Another alternative method to access the bypassed segments would be virtual CT gastroscopy [25]. We have indeed had rare cases of severe gastritis, perforated ulcer, and bleeding from the gastric remnant. In the elective setting, in addition to double-balloon enteroscopy, a CT scan may also show the presence of gastric wall thickening (suggestive of gastritis) and presence of hyperdense fluid material (suggestive of blood) in the gastric remnant in the case of hemorrhagic gastritis.

Our study does have limitations. As a retrospective study, it is prone to selection bias and the data may have been incomplete or inaccurate. Furthermore, our records documenting pain resolution or improvement stem from records that could not accurately quantify the pain. Although the sample size of 35 would be the largest series to date, it still can be considered small. A larger sample size would have been more representative. None of our patients had undergone sleeve gastrectomy. Sleeve gastrectomy has become the most commonly performed bariatric surgery worldwide and has an acceptable safety and efficacy profile [26, 27]. Our finding may indirectly indicate that the sleeve gastrectomy would be associated with less chronic abdominal pain.

Conclusions

This study highlights the importance of offering DL as both a diagnostic and therapeutic tool in post-bariatric surgery patients with chronic abdominal of unknown etiology. Diagnostic laparoscopy, which is a safe procedure, can detect pathological findings in more than half of post-bariatric surgery patients with chronic abdominal pain of unknown etiology. About 40% of patients who undergo DL and 70% of patients with positive findings on DL experience significant symptom improvement. The vast majority of patients with negative laparoscopy had chronic abdominal pain with no organic cause, necessitating long-term pain management. Patients should be informed that DL is associated with no symptom improvement in about half of cases.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval For this type of study, formal consent is not required.

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