Alexandria Journal of Medicine (2013) **49**, 29–33

Alexandria University Faculty of Medicine

Alexandria Journal of Medicine

www.sciencedirect.com

ORIGINAL ARTICLE

Earliest signs and management of leakage after bariatric surgeries: Single institute experience

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Received 14 July 2012; accepted 21 September 2012
Available online 25 October 2012

KEYWORDS

Morbid obesity;
Bariatric surgery;
Complication;
Leak

Abstract *Background:* The aim of this study was to describe the clinical presentation and outcomes of treatment in patients who develop gastrointestinal leaks after different bariatric surgeries.
Methods: Retrospective review of 632 consecutive bariatric surgical procedures performed from 1999–2009 in Alexandria University Hospital, Egypt.
Results: Leakage occurred in 10 patients. Symptoms and signs included tachycardia, fever, tachypnea, left shoulder pain, abdominal pain, chest pain, and/or change in the nature of the drain effluent. The earliest signs of presentation were tachycardia and unilateral decrease in air entry in all patients. The average time to diagnosis was 3.9 ± 2.6 days. In four patients contrast study was negative (40%). Six leaks occurred after laparoscopic sleeve gastrectomy (6.3%), 2 after laparoscopic gastric bypass (3.6%), one after open gastric bypass (2.3%), and 1 after laparoscopic vertical banded gastroplasty (2.4%). The most common leak location was at the esophagogastric junction (70%). Four patients (40%) required reoperations. A percutaneous abdominal drainage was placed in five patients (50%). In 2 patients (20%), the prophylactic drain was maintained in situ till cessation of leakage. Two patients (20%) died. Mean hospital length of stay was 13.9 ± 7.8 days.
Conclusions: Tachycardia and unequal breath sound in the early postoperative course are worrisome signs that warrant laparoscopic exploration even if contrast studies were negative. Patients with signs of sepsis or hemodynamic instability require emergent exploration. Leaks that are more insidious may be treated successfully with percutaneous drainage or maintenance of prophylactic drains.

1. Introduction

The prevalence of morbid obesity is rapidly increasing worldwide. As surgery has been recognized to be the only effective long-term treatment for morbid obesity,[1] the number of bariatric procedures realized each year has dramatically increased. However, surgical therapy can be associated with complications. Gastrointestinal (GI) leaks

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Peer review under responsibility of Alexandria University Faculty of Medicine.

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http://dx.doi.org/10.1016/j.ajme.2012.09.004

are one of the most dreaded complications following bariatric surgery because of the difficulty in diagnosing them and the associated increased morbidity and mortality. Difficulty in diagnosis is related to nonspecific systemic symptoms and limitations in most radiological studies. Treatment modalities are variable and ranges from observation to reoperation. The aim of this study was to describe our experience with the clinical presentation and outcomes of treatment in patients who developed GI leaks after different bariatric surgical procedures.

2. Materials and methods

A retrospective study of 632 consecutive morbidly obese patients who were treated with different surgical procedures was undertaken. These procedures were performed between November 1999 and December 2009 in General Surgery Department, Alexandria Main University Hospital, Egypt. They included open vertical banded gastroplasty (OVBG) in 308 patients, laparoscopic vertical banded gastroplasty (LVBG) in 95 patients, open gastric bypass (OGBP) in 68 patients, laparoscopic gastric bypass (LGBP) in 55 patients, Laparoscopic sleeve gastrectomy (LSG) in 41 patients, and laparoscopic gastric band (LGB) in 65 patients. In OVBG, the stomach was stapled in continuity using the bariatric notched stapler TA 90 BN™; while in LVBG, the stomach was transected to create the pouch. In both OVBG and LVBG, the pouch outlet was encircled by a polypropylene band (5×1.5 cm). Both OGBP and LGBP involved separation of the gastric pouch using a linear cutter stapler. While the gastro-jejunostomy was hand sewn in OGBP, it was created using a linear cutter stapler in LGBP. Laparoscopic sleeve gastrectomy involved gastric tubulization over a 36-French bougie starting 6 cm from the pylorus. The staple line was not reinforced by either over-sewing or buttressing material. An intraoperative leak test using methylene blue was done in all patients undergoing transection of the stomach. A prophylactic tube drain was routinely placed in all patients except after laparoscopic gastric band (LGB). Drains were removed 24 h after start of oral intake provided the output was neither excessive nor abnormal. A routine postoperative upper GI radiological study was not done.

Hospital records were reviewed for patient demographics, body mass index (BMI), co-morbidities, type of surgical procedure, primary procedure vs revision, use of drains, the postoperative time for leak diagnosis, clinical signs and symptoms, the radiologic findings, location of the leak, treatment rendered, length of hospital stay, and outcomes. Data are presented as mean ± SD. The Fisher's exact test was used to determine the statistical significance between groups.

3. Results

A total of 632 patients underwent different bariatric surgical procedures. All patients had a BMI $\geqslant 40$ kg/m^2 or $\geqslant 35$ kg/m^2 plus one or more of the obesity related co-morbidities. Five hundred forty-nine patients (87%) had one or more co-morbidity, including degenerative arthropathy (62%), hypertension (53%), dyslipidemia (48%), lower limb venous insufficiency (34%), diabetes mellitus (12%), and obstructive sleep apnea (9%). There were 493 women (78%) and 139 men (22%), with a mean age of 35 years (range 16–58). six hundred twenty-one were primary procedures and 11 were revision procedures.

Ten patients (1.6%) developed GI leaks and were the subject of this study. They consisted of 7 women and 3 men, with a mean age of 31.2 ± 9.7 years (range 20–51). Their mean BMI before surgery was 47.2 ± 8.1 kg/m^2 (range 40–66). Table 1 shows details of the surgical procedures and the related incidence of leak. The highest rate (6.3%) was seen after LSG and the lowest (0.0%) after LGB and OVBG. Two were after revision surgery (20%). One failed LGB underwent conversion to LGBP and one failed OVBG underwent conversion to OGBP. The incidence of leak in the 11 patients who underwent revision procedures was 18%. This was significantly higher when compared to the leakage rate in primary GBP procedures ($P = 0.02$).

Table 2 presents a summary of the main findings in the present study, showing the type of the bariatric procedure, the postoperative timing and the method of diagnosis of leak, its location, the treatment rendered, the hospital stay, and the mortality.

The average time to the diagnosis of the leak was 3.9 ± 2.6 days (range, 1–10 days). All leaks were clinical as no routine postoperative radiological study was done to detect subclinical leaks. Patients showed signs and/or symptoms of leak at a mean of 3.2 ± 2.7 days (range 0–10 days) postoperatively. The clinical presentation included tachycardia (70%), fever (70%), tachypnea (50%), left shoulder pain (30%), a change in the nature of the drain effluent (30%), abdominal pain (20%), chest pain (10%), oliguria (10%), and/or hypotension (10%). In 6 patients (60%), the leak was diagnosed before discharge after surgery, while 4 (40%) patients were readmitted because of the leak. All patients diagnosed before discharge showed tachycardia and unequal air entry. An upper GI series using water soluble contrast (Gastrographin) was used in 7 patients. It showed the leak in 4 patients but was negative in 3 patients. Six patients underwent computed tomographic scans (CT) of the abdomen and an abnormality was found in all of them. Three patients underwent an ultrasound as the initial diagnostic test before CT in 2 patients and before Gastrographin in 1 patient. An abdominal collection was found in the 3 patients.

Seven leaks (70%) were noted at the staple line just below the esophagogastric (EG) junction. The site of leakage was diagnosed using upper GI Gastrographin study in 4 patients. Two patients were operated upon based on the clinical findings alone and abdominal CT was used to diagnose the leak site in one patient. One patient (10%) had a leak at the gastro-jejunal anastomosis as documented by Gastrographin study. One patient (10%) had a leak at the staple line of the distal portion

Table 1 Details of bariatric surgical procedures and the related incidence of leak ($n = 632$).

Procedure	Total number	Leak number (%)
Laparoscopic VBG	95	1 (2.4)
Open VBG	308	0 (0.0)
Open GBP	68	1 (2.3)
Laparoscopic GBP	55	2 (3.6)
Laparoscopic sleeve gastrectomy	31	6 (6.3)
Laparoscopic gastric band	65	0 (0.0)
Total	632	10 (1.6)

GBP, gastric bypass; VBG, vertical banded gastroplasty.

of the stomach after LVBG. The leak was missed on a Gastrographin study and discovered at laparoscopic exploration. Another patient (10%) with a repeated negative Gastrographin study was noted at exploration, for a leak after LGBP, to have a perforation at the afferent biliary limb. The perforation was believed to be due to an injury caused by the linear cutter stapler while transecting the jejunum and had been missed during the primary procedure.

Four patients (40%) underwent reoperations to diagnose and treat the leak. The decision to operate was based on the clinical condition of the patients. Operative treatment included drainage of intra-abdominal collections, washout of the abdominal cavity, and placement of tube drains, in addition to repair of the leaking defect using simple sutures. Four patients were successfully treated non-operatively with percutaneous drainage of the leak site and any associated collection. A fifth patient required percutaneous drainage of an intra-abdominal collection that developed subsequent to reoperation. Percutaneous drainage was CT-guided in one patient and ultrasound-guided in the rest of the patients. Two patients were treated with continued drainage via tube drains prophylactically placed at the time of the index surgery. All patients received intravenous broad-spectrum antibiotics and proton pump inhibitors, and all patients were kept nothing per mouth. Total parenteral nutrition was administered to 7 patients (70%), and one patient (LVBG) (10%) received enteral nutrition through a nasogastric tube. Four patients (40%) were transferred to the intensive care unit (ICU) for a mean of 5.3 ± 2.1 days (range 3–7 days). Two patients (20%) required endotracheal intubation and mechanical ventilatory support. The remaining 60% of the patients were managed without being transferred to the ICU. The mean hospital stay for the patients who developed leaks, including 2 admissions for 4 patients, was 12.7 ± 7.3 (range 5–28). Two patients (20%) died 10 and 21 days, respectively, after surgery secondary to sepsis and multiple organ failure in the first patient and pulmonary embolism in the second. Excluding the 2 deaths, the mean hospital stay was 13.9 ± 7.8 (range 5–28).

4. Discussion

GI leak after bariatric surgery is not an uncommon complication and one that can be expected to occur at some point in every bariatric surgeon's experience. The incidence in our overall series was 1.6%. The reported incidence in the literature varies according to the procedure; 0–5.6% for OGBP,[2–7] 0–4.3% for LGBP,[8–11] 0.7–5.3% for (LSG) ,[12–17] 1.1–7.1% for LVBG,[18–20] 0.07% for OVBG,[21] and 0–0.5% for LGB.[22–24] These figures are comparable to ours of 2.3%, 3.6%, 6.3%, 2.4%, 0.0%, and 0.0% respectively. We noted a significantly higher incidence of leak after LSG. This may be attributed to a higher pressure in the pouch. As expected, procedures which did not involve transection of stomach, namely LGB and OVBG had a very low incidence of leakage. Leaks were noted to be more frequent with revision bariatric surgery (18%). This increased rate of leakage was statistically significant when compared with the corresponding primary procedures. Revision of previous bariatric procedures has been found to carry a higher risk of leakage reported to be as high as 19% ,[25] probably due to the increased dissection required by re-operative surgery, with a resulting increased risk of injury and ischemia to the tissues.

In the majority of our patients (70%), leak was located just below the EG junction. The EG junction has been reported as the usual site of leak after LSG.[15,17,26] Particular attention should be paid to this area at the time of staple firings. It is important to use staples of an adequate height and to avoid stapling the esophagus. Tucker et al.[13] suggested leaving a narrow cuff of tissue at the most superior aspect of the greater curve, just below the angle of His, which should be imbricated with a running 2/0 silk suture. There is no consensus with regard to the need for reinforcement of the staple line with buttressing material or over-sewing.[27–29]

GI leakage after bariatric surgery has been identified as an independent risk factor associated with perioperative death.[30] The early recognition and prompt treatment cannot be overemphasized. As expected, the most common signs (tachycardia, tachypnea, and fever) in the present study were not specific. This raises the importance of high index of suspicion for diagnosis of this potentially lethal complication. Gastrographin upper GI series examinations are helpful to establish leaks at the gastro-jejunostomy or upper gastric pouch staple line. However, they do not definitively rule out leaks in other locations.[31] In the present study, the Gastrographin study was falsely negative in 2 patients. Although abdominal CT scan was positive in all cases in the present study, important limitations exist in its use and accuracy.[5,31] A positive

Table 2 Details of leakage in 10 patients.

No	Surgery	PO day	Location	Diagnostic tool	Treatment	LOS
1	Lap. VBG	1	Distal stomach	Exploration	Reoperation + PC drainage	17
2	LSG	2	EG junction	Gastrografin	PC drainage	11
3	LSG	2	EG junction	Gastrografin	Prophylactic drain	5
4	LSG	3	EG junction	Exploration	Reoperation	5
5	LSG	5	EG junction	Gastrografin	PC drainage	15
6	LSG	5	EG junction	Gastrografin	PC drainage	28
7	LSG	3	EG junction	Gastrografin	PC drainage	10
8	Lap. GBP	3	Jejunal perforation	Exploration	Reoperation	Died
9	Lap. GBP (revision)	5	EG junction	CT	Reoperation	Died
10	Open GBP (revision)	10	Gastrojejunostomy	Gastrografin	Prophylactic drain	20

EG junction, esophagogastric junction; GBP, gastric bypass; Lap VBG, laparoscopic vertical banded gastroplasty; LASG, laparoscopic sleeve gastrectomy LOS, length of hospital stay; No, serial number; PC drainage, percutaneous drainage; PO day, postoperative day of diagnosis; CT, computerized tomography.

radiology should not be awaited for before exploring patients in whom the diagnosis is still unclear. Two patients died in the present series, both after exploration for leakage after GBP. One patient was operated upon after repeated negative upper GI Gastrographin study and the other only after a positive CT scan. We believe that a lower threshold for exploration for a suspected leak, particularly after GBP, might have decreased the mortality in the series. Lee et al.[32] noted that reliance on false negative imaging studies may delay operative intervention, particularly when there is a leak at sites other than the gastro-jejunostomy, e.g. the gastric remnant or the jejuno-jejunostomy. We agree with Marshall et al.[33] that any patient who is ill after Roux-en-Y gastric bypass with unexplained tachycardia warrants an exploration, even in the face of a normal swallow study. Moreover, this approach was found useful in patients who had undergone bariatric surgeries other than GBP.

While operative treatment in patients with GI leak is mandatory when hemodynamic instability and peritonitis are present, not all leaks require operative management. Non-operative treatment was undertaken successfully in 6 patients (60%) in the present study. Four patients required percutaneous drainage technique. A fifth patient required percutaneous drainage of a recollection after surgical intervention. We recommend a skillful interventional radiologist to be among the team involved in the management of these patients. In many studies, percutaneous drainage was very advantageous in the control of leaks after bariatric surgery.[4,15,17,33] However, the patient must be clinically stable, without hypotension or oliguria, for this method to be chosen over exploration. In 2 patients, leaks were controlled by drains that were placed prophylactically at the time of surgery. These leaks were discovered by noting a change in the nature of the drainage; the patients were otherwise asymptomatic. Similarly, Gonzalez et al.[5] used closed suction drains routinely at the gastro-jejunostomy; finding that in the event of an early and small volume leak, those drains can evacuate effectively leaking enteric content, possibly allowing non-operative treatment in selected patients. Marshall et al.[33] recommended the use of prophylactic drains in re-operative surgery and in cases judged by the surgeon to be at a high risk of leakage. They also use drains in the extremely obese patient who, because of weight limitations, would be difficult to study radiographically.

In conclusion, leakage is a serious complication after bariatric surgery with a significant mortality. Early diagnosis is the key to adequate treatment. In patients in whom the diagnosis is unclear, a diagnostic laparoscopy is an integral part of the treatment algorithm. There are different ways to manage leaks, depending on the magnitude of the collection and the clinical presentation. Patients who present early with tachycardia and unilateral decrease in breath sounds warrant an exploratory laparoscopy even if they showed a negative contrast test. Patients with signs of sepsis or hemodynamic instability require emergent exploration. Leaks that are more insidious may be treated successfully with percutaneous drainage or maintenance of prophylactic drains.

Conflict of interest

The authors declare no conflict of interest.

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