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HOW I DO IT

Gastric Perforation following Intragastric Balloon Insertion: Combined Endoscopic and Laparoscopic Approach for Management: Case Series and Review of Literature

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Abstract
Background Obesity is a serious disease, with substantial morbidity and mortality. The endoscopic placement of an intragastric balloon (IGB) in association with a low-calorie diet is an option for the treatment of obesity. IGB complications include dislocation of the balloon causing intestinal obstruction, upper gastro-intestinal bleeding and perforation, especially during balloon insertion or removal. Our work aims at decreasing the morbidity of open laparotomy in the management of such gastric perforations.
Methods We report three cases of gastric perforation following IGB insertion that needed surgical intervention. Decision was made to treat them with a minimally invasive combined endoscopic and laparoscopic approach to decrease postoperative morbidity.
Results All patients were successfully treated by a minimally invasive approach with less morbidity than the conventional open laparotomy.
Conclusion Gastric perforation should be suspected in any patient with IGB who presents with an acute abdomen. This can be managed with a minimal invasive approach.

Keywords Gastric · Perforation · Balloon · Laparoscopy · Endoscopy

Introduction

Obesity is a serious disease, with substantial morbidity and mortality. The endoscopic placement of an intragastric balloon (IGB) in association with a low-calorie diet is an option for the treatment of obesity. IGB complications include dislocation of the balloon causing intestinal obstruction, upper gastro-intestinal bleeding and perforation, especially during balloon insertion or removal. We report three cases of gastric perforation following IGB insertion that were successfully treated by a minimally invasive combined endoscopic and laparoscopic approach.

Case Number 1

Forty-year-old obese female (BMI = 43 kg/m^2) presented to the emergency department with diffuse abdominal pain of

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8 h duration. Pain was severe and associated with nausea and two episodes of non-bilious vomiting. No other complains were reported by the patient. No history of trauma or medication intake except for daily proton pump inhibitors (PPI).

She had no history of previous surgery, but she had an endoscopic IGB (Spatz Balloon) insertion twice in our institute; the first one was inserted 2 years prior to presentation, kept for 8 months, and removed upon patient's request after losing 7 kg (5.8 % of total weight loss (TWL)). The second one was inserted almost 1 year later (3 months prior to presentation), after which she was doing well and was maintained on daily gastric protection by PPI and she lost 5 kg (%TWL = 4.1 %).

On examination, the patient was conscious, anxious, and in pain. Vital signs showed low grade fever temperature (T) = 37.7 °C, pulse (P) = 110/min, and blood pressure (BP) = 100/60 mmHg.

Abdominal examination showed sluggish bowel sounds, severe tenderness, guarding, and rigidity.

Laboratory investigations showed white cell count (WBC) = 8500, neutrophils (Neu) = 67 %, and hemoglobin (Hgb) = 10 g/dl.

Plain abdominal X-ray showed pneumoperitoneum and dilated small bowel loops (Fig. 1).

The patient was resuscitated by intravenous fluids and started on antibiotics, pain killers, and proton pump inhibitors and then shifted to the operating room.

Under general anesthesia, simultaneous upper endoscopy and diagnostic laparoscopy were done. Upper endoscopy using CO_2 insufflation showed IGB in place and was removed smoothly revealing a deep gastric ulcer in the body of the stomach with perforation (Fig. 2).

Diagnostic laparoscopy confirmed the presence of perforation with moderate amount of turbid fluid in the abdomen (Fig. 3).

The perforation was repaired with 2/0PDS interrupted sutures and an omental patch. Peritoneal wash was done and a drain was left.

The patient did well in the postoperative period, tolerated diet and was discharged in a stable condition after 4 days.

Case Number 2

A 44-year-old female patient known to have pulmonary fibrosis, anti-phospholipid syndrome, and rheumatoid arthritis with morbid obesity (BMI = 47 kg/m^2) presented to the emergency department because of a 1-week history of epigastric pain that started suddenly then shifted to the whole abdomen, and increased in the last 12 h, associated with nausea and four episodes of non-bilious vomiting. The patient reported no change in bowel habits, no fever or chills, no other complains, and no history of abdominal trauma. The patient was maintained on steroids and PPI.

She had no previous abdominal surgeries, but she had an endoscopic IGB (Spatz Balloon) insertion in our institute 6 months prior to presentation in a trial for weight reduction and she lost around 12 kg (%TWL = 8.5 %).

On examination, the patient was looking sick, in pain, and dehydrated.

Vital signs showed T = 37.9 °C, P = 120/min, and BP = 90/60 mmHg.

The abdomen was severely tender, rigid, and guarding.

Laboratory tests showed WBC = 9600, Neu = 59 %, and Hgb =14.1 g/dl.

The patient was resuscitated with intravenous fluids and pain killers till she was stabilized then was shifted to the radiology department where a CT scan of the abdomen and pelvis with oral and intravenous contrast was done and showed (Fig. 4):

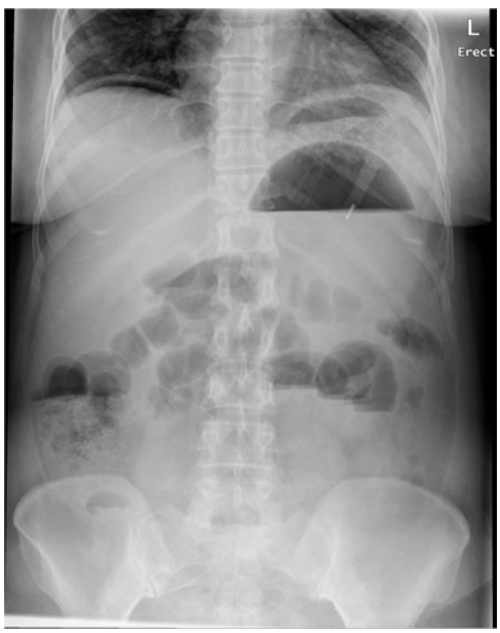

Fig. 1 Plain abdominal X-ray showing pneumoperitoneum and dilated small bowel loops (case number 1)

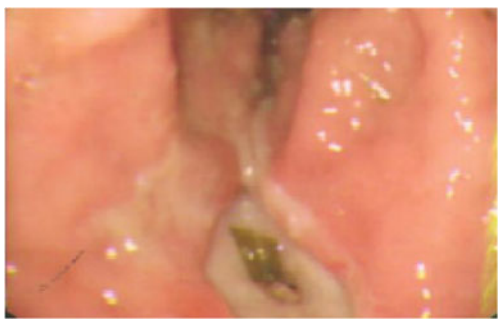

Fig. 2 Upper endoscopy showing deep gastric ulcer with perforation in the stomach (case number 1)

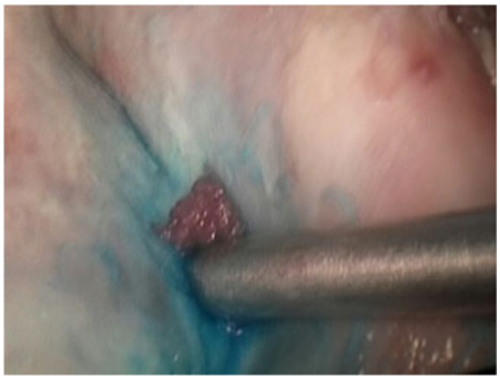

Fig. 3 Diagnostic Laparoscopy showing gastric perforation in the stomach (case number 1)

- Almost complete obstruction of the stomach due to the over distended the balloon in the stomach
- Evidence suggestive of perforation of the stomach with extravasation of the oral contrast and air into the abdomen
- Free fluid in the abdomen and pelvis

She was started on intravenous antibiotics and proton pump inhibitors, and shifted to the operating room.

Simultaneous upper endoscopy and diagnostic laparoscopy were done.

Upper endoscopy using CO_2 insufflation showed a linear fissure of the stomach with a perforation near the greater curvature and a hugely distended balloon. Diagnostic laparoscopy confirmed the presence of gastric perforation on the anterior wall of the stomach with turbid fluid in the abdomen and pelvis.

Fig. 4 CT scan of the abdomen and pelvis with oral and intravenous contrast showing almost complete obstruction of the stomach by balloon and suggestive of gastric perforation (case number 2)

The balloon was removed endoscopically; then, the perforation was repaired using 2/0 PDS interrupted sutures and an omental patch was applied laparoscopically. Irrigation and wash of the abdominal and pelvic cavities was done and a drain was kept.

The postoperative course was uneventful; started on diet after 3 days and was discharged home on the fifth postoperative day.

Case Number 3

A 34-year-old male, obese (BMI = 37 kg/m^2) presented to the emergency department because of diffuse abdominal pain of 6 h duration. Pain was severe with no other associated symptoms. No history of trauma or medication intake.

The patient had no previous surgery, but he had an endoscopic IGB (Orbera) insertion done in another hospital 7 months prior to presentation and he lost 25 kg (%TWL = 18.5 %). He was maintained on PPI but he stopped them 3 months prior to presentation.

On examination, the patient was conscious, oriented, and in pain. Vital signs showed T = 37.1 °C, P = 102/min, and BP = 110/75 mmHg.

Abdominal examination showed active bowel sounds, tenderness, and guarding.

Laboratory investigations showed WBC = 17,500, Neu = 91 %, and Hgb = 15.6 g/dl.

Plan abdominal X-ray showed pneumoperitoneum.

The patient was resuscitated by intravenous fluids, started on antibiotics, pain killers, and proton pump inhibitors and then was shifted to the operating room.

Under general anesthesia, upper endoscopy and diagnostic laparoscopy were done simultaneously. Upper endoscopy using CO_2 insufflation showed IGB in place and was removed smoothly. Diagnostic laparoscopy showed a small perforation in the posterior wall of the stomach with 1 l of turbid fluid in the abdomen.

The perforation was repaired with 2/0 PDS interrupted sutures and an omental patch. Peritoneal wash was done and a drain was kept.

The patient did well in the postoperative period, tolerated diet, and was discharged in a stable condition after 4 days.

Discussion

Obesity is a serious disease, with substantial morbidity and mortality. Obesity has become a First World epidemic and is also rapidly increasing in the Third World [1].

In the United Arab Emirates, obesity is a growing health concern with health officials stating that obesity is one of the leading causes of preventable deaths in the United Arab Emirates. According to Forbes, United Arab Emirates ranks 18 on a 2007 list of fattest countries with a percentage of 68.3 % of its citizens with an unhealthy weight [2].

Obesity, particularly abdominal obesity, is associated with an increased risk of hypertension, diabetes, hyperlipidemia, sleep apnea, coronary heart disease, and stroke [1].

The first step among the various therapeutic options currently available consists of combining a low-calorie diet with changes in lifestyle [3, 4] and temporary drug therapy.

IGBs are used not only to obtain weight loss in obese patients but also as a means to reduce risk factors associated with obesity prior to bariatric surgery [5]. IGBs have been suggested for the following indications [6, 7]: (a) obese patients with diet therapy refractoriness; (b) preoperative temporary use to achieve weight loss and reduce the risks of surgery [8, 9]; and (c) severely obese patients non-candidates for obesity surgery. The efficacy of IGB is reported in the literature, which is generally modest [10].

There are several contraindications, however, to IGBs, including allergy to the implantable device; anatomic abnormality of the upper gastro-intestinal tract; active esophagogastric disease, such as severe esophagitis, hiatal hernia, peptic ulcer disease, Crohn disease, potentially bleeding lesions, and so on; institutions without experience, accreditation, or the ability to resolve complications; and, most importantly, prior gastric surgery, as it increases the risk of gastric perforation after implantation (grade A recommendation) [11, 12].

Although most patients tolerate balloons well, IGBs can sometimes cause complications. These are usually mild, although rarely they can be severe. Mild complications include abdominal and back pain or discomfort, nausea, and vomiting. These tend to last only for a short period after balloon insertion and are usually self-limiting. More severe complications include dislocation of the balloon causing intestinal obstruction and upper gastro-intestinal bleeding and perforation, especially during balloon insertion or removal [13].

The largest meta-analysis (12 studies, 3429 patients) found an obstruction rate of 0.8 % and a gastric perforation rate of 0.1 % [14]. However, gastric perforation is not mentioned as a complication in the BIB system pamphlet on the Cochrane Database of Systematic Reviews [15]. The mechanism of perforation is not well known; due to continuous contact of the balloon with the gastric wall, it is possible that the balloon exerts a constant pressure on the gastric wall. Eventually, this could end up with perforation of the gastric wall. This complication should not be frequent as the balloon is supposed to move from a compartment to another inside the stomach. Indeed, this movement is responsible for the noxious sensation described by most patients. When the balloon mobility is restricted due to impingement with the gastric wall, an ulcer could develop. A gastric ulcer could perforate, particularly when patients have poor compliance to proton pump inhibitors, and the development of peritoneal complications could be lethal [10]. In order to decrease the risk of complications, these balloons are not recommended to stay in place for more than 6 months as their durability is limited [16], and studies that evaluated efficacy at 24 months are either retrospective [10] or had small numbers of patients [6]. Yet, this timing is not absolute since most of the cases of perforation reported in the literature occurred during the first 6 months after balloon insertion (Table 1).

Other risk factors that may increase the risk of perforation are not well documented in the literature. However, many cases [10, 16, 18] were reported to have perforation in patients with previous gastric surgery and some authors [10] considered that previous gastric surgery should be an absolute contraindication to placing a BIB, as the compliance of the stomach wall would have been modified. The first case of gastric perforation following balloon insertion was reported in 2003 [17]. Since then, ten more papers were published in English language literature reporting this complication (Table 1).

In our series, the three patients presented within a 7-month period. The first two patients in this series had balloon insertion at our institute and the third patient was referred from another hospital. In our own series, 153 patients had balloon insertion in our hospital over a period of 2 years. The complication rate was low; two patients had gastric perforation (1.3 %) and four patients had gastric ulceration that required removal of the balloon (2.61 %). No other complications were noticed.

The cause of perforation was not clear in these two patients. The first patient had balloon insertion twice and there is no literature regarding the possible increased of risk in patients who had balloon insertion more than one time. The second patient is a known case of pulmonary fibrosis, antiphospholipid syndrome, and rheumatoid arthritis and is maintained on steroids. There are no clear reports in the literature about the effect of balloon insertion in such patients with steroids whether it may increase the risk of perforation or not.

The usual treatment of similar perforations published in the English language literature is through laparotomy, removal of the balloon and repair of the gastric perforation. Genco A. et al. reported two cases in the Italian experience that were managed laparoscopically among five cases of gastric perforation [10], and later another case was reported showing the simultaneous procedure by an endoscopist and a surgeon in management [20]. On the other hand, Bekhit M. et al. reported

Table 1 Summary of 11 papers reporting cases of gastric following intragastric balloon insertion

Date	Author	Journal	Previous gastric surgery	Onset of perforation after balloon insertion	Management	Outcome
2003	Mr Graham Roche-Nagle [17]	Ann R Coll Surg Engl	–	2 months	Laparotomy	Recovery
2003	Cristiano Giardiello [18]	Obes Surg	Previous fundoplication	18 days	Laparotomy	Recovery
2005	Genco A [10]	Obes Surg (5 cases)	4 patients had previous gastric surgery	–	3 laparotomy 2 laparoscopy	2 death 3 recovery
2009	Ioannis Koutelidakis [19]	Obes Surg		2 days	Laparotomy	Death
2009	Jacek Arkadiusz Śmigielski [20]	Obes Surg	–	9 days	Laparoscopy + endoscopy	Recovery
2010	Reynard Knoetze [21]	CME	–	7 months	Laparotomy	Recovery
2011	R Baigel [22]	BMJ Case Rep	–	22 months	Laparotomy	Recovery
2011	Sánchez-Pérez MA [23]	Rev Gastroenterol Mex	–	2 months	Laparoscopy	Recovery
2012	Michalis P. Charalambous [13]	Surgery for Obesity and Related Diseases	–	2 months	Laparoscopy	Recovery
2014	Mohamed Bekheit [24]	Obes Surg	–	2 months	Conservative	Recovery
2015	El Hage Chehade HH [16]	Surgery for Obesity and Related Diseases	Previous sleeve gastrectomy	Same day	Laparotomy/subtotal gastrectomy	Recovery

one case of successful conservative management of gastric perforation secondary to intragastric balloon insertion and concluded that such perforations can be treated conservatively in highly selected patients [24]. However, after review of cases in the literature (Table 1), including the three cases in the present series, we found death of three out of 18 patients who presented with gastric perforation following IGB insertion (16.6 %). Such a high mortality rate raises doubts about the above recommendation by Bekhit M. et al. [24].

In our patients, combined efforts of an endoscopist and a surgeon were successful in removing the balloons and managing these perforations using a minimally invasive procedure and short operative time (35, 47, and 52 min consecutively). This was of great benefit especially in the second patient with restrictive lung disease that was difficult to tolerate a major long operation (laparotomy) under anesthesia. This allowed the patients to leave the hospital in a stable condition after tolerating diet within a short period of time (4, 5, and 4 days consecutively) with three small scars on the abdominal wall, minimal pain, and rapid return to social life and work.

All patients were successfully prepared for further laparoscopic bariatric procedures.

Conclusion

Gastric perforation following IGB insertion is a serious and life-threatening complication. Gastric perforation is to be considered in acute abdomen following IGB insertion. In the presence of an expert endoscopist and bariatric surgeon, it can be managed through a less-invasive combined endoscopic and laparoscopic procedure, with rapid recovery, less pain, and short hospital stay by avoiding a more invasive laparotomy. Such minimally invasive procedure can prepare the patient for further bariatric procedure in the future.

Compliance with Ethical Standards

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

A Statement of Informed Consent Informed consent was obtained from all individual participants included in the study.

Ethical Approval All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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