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Intragastric gastric band migration: erosion: an analysis of multicenter experience on 177 patients

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Abstract
Background Laparoscopic adjustable gastric banding (LAGB) has proven to be a safe and effective surgical treatment for morbid obesity. It can be a simple, fast, reversible, anatomy-preserving procedure. Despite these advantages, its long-term efficacy came into question by the occurrence of complications such as intragastric band migration. Consistent information regarding this complication is still lacking. Treatment for migration is still being debated as well. Most of the inconsistencies of these data stem from the very low number of patients reported in single-center experiences or case reports. Lack of multicenter experience is evident. The aim of this study was to perform a retrospective analysis of data on intragastric migration in a large multicenter cohort of patients who underwent LAGB.
Methods A retrospective multicenter study on LAGB patients was performed. Data had been entered into a prospective database of the Italian Group for LapBand® (GILB) since January 1997. Pars flaccida and perigastric positioning were considered along with different kinds of gastric bands by the same manufacturer. Time of diagnosis, mean body mass index (BMI), presentation symptoms, and conservative and surgical therapy of intragastric migration were considered.
Results From January 1997 to December 2009, a total of 6,839 patients underwent LAGB and their data were recorded [5,660 females, 1,179 males; mean age 38.5 ± 18.2 years (range 21–62 years); mean BMI = 46.7 ± 7.7 kg/m^2 (range 37.3–68.3); excess weight (EW) 61.8 ± 25.4 kg (range 36–130); %EW 91.1 ± 32.4 % (range 21–112 %)]. A total of 177 of 6,839 (2.5 %) intragastric erosions were observed. According to the postoperative time of follow-up, the diagnosis of intragastric migration was made in 74 (41.8 %), 14 (7.9 %), 38 (21.4 %), 40 (22.6 %), 6 (3.4 %), and 4 (2.2 %) banded patients at 6–12, 24, 36, 48, 60, and 72 months after banding, respectively. Most of intragastric band migration during the first 2 years occurred in bands with no or a few milliliters of filling. In patients with late erosion, the bands were adjusted several times; no band was overfilled but one was filled to the maximum or submaximum with a maximum of two adjustments. Erosions diagnosed during the first 24 months were related to the experience of the surgical staff, while late erosions were not.
Conclusions Intragastric band migration or band erosion is a rare, disturbing, and usually not life-threatening complication of gastric banding. Its pathogenesis is probably linked to different mechanisms in early (technical failure in retrogastric passage) or late (band management) presentation. It is usually asymptomatic and there is no pathognomonic presentation. A wide range of therapeutic options are available, from simple endoscopic or laparoscopic removal to early or late band replacement or other bariatric procedure. More experience and more studies are needed to lower its presentation rate and definitively clarify its pathogenesis to address the right therapeutic option.

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Laparoscopic adjustable gastric banding (LAGB) has proven to be a safe and effective surgical treatment for morbid obesity. LAGB, in the hands of an experienced surgeon, can be a simple, fast, reversible, anatomy-preserving procedure. For this reason it is nowadays one of the most popular techniques for the surgical treatment of obesity [1–3]. Despite these advantages, its long-term efficacy has come into question because of complications such as gastric pouch dilation and intragastric band migration directly linked to the erosion of the gastric wall caused by the prosthesis [4–6].

The use of prosthetic devices around the stomach is not a new concept: different materials such as silicone, Silastic®, Marlex®, Dacron, and Gore-Tex were used for different surgical approaches. One of the complications of these prosthetic devices is intragastric migration, usually called band migration [7–10]. Symptoms associated with intragastric band migration are retrograde port infection, loss of satiety, and stop of weight loss. Consistent information regarding intragastric migration is still lacking and there is considerable controversy about the still unclear incidence rate and etiology [1, 11–13]. The treatment for these complications is still being debated as well. Most of the inconsistencies of these data stem from the very low number of patients reported in single-center experiences or case reports. Lack of multicenter experience is evident.

The aim of this study was to perform a retrospective analysis of data on intragastric migration in a large multicenter cohort of patients who underwent LAGB.

Patients and Methods

A retrospective multicenter study on LAGB patients was performed. Data were entered into the prospective database of the Italian Group for LapBand® (GILB) starting in January 1999. Also in this database are data of patients operated on since January 1997. Surgeons who are members of GILB have to enter into the database all data about patients who are in follow-up also if they were operated on in other centers.

Band Positioning

Different kinds of gastric bands produced by Allergan (Irvine, CA, USA) were used in these patients. Bands were implanted by a pars flaccida or a perigastric route with the patient in an anti-Trendelenburg position; antibiotics and antithrombotic prophylaxis were given [14]. Until 1997 the vast majority of centers whose patients participated in this study used the perigastric approach, while after 2005 almost all moved to the pars flaccida route.

Laparoscopic Band Removal

Laparoscopic removal of the migrated intragastric band usually starts with identifying the connecting tube, separating it from the port, and eventually freeing omental adhesions. The band is cut in the esogastric portion, gently pulled out, and removed, making sure that the band ring is complete. In case of partial ring migration, a short (4–6 cm) longitudinal anterior gastrotomy can be performed immediately below the position of the band. The band is grasped, divided, and pulled out. The gastrotomy is then closed with various techniques.

Endoscopic Band Removal

The first step in endoscopic band removal is the identification of the inner part of the partially migrated band. The band is not removed if the migration is less than 50 % and if the lock has also not migrated. In these cases, a "watch and wait" period is suggested. The residual gastric bridge over the band is not removed to avoid gastric perforation or fistulas. The metallic thread of a gastric band cutter is inserted into the operative channel of the endoscope. The metallic thread is passed around the band and then inserted into a metal tube external arrow connected to and handgrip with tourniquet. By turning the handgrip the band is strangulated and broken into sections by the metal loop under direct vision. Then the band is freed from the gastric wall bridge and from the connecting port tube and is gently extracted with a polypectomy loop.

Statistical Analysis

Data from our experiences were expressed as mean ± standard deviation (SD), except when otherwise indicated. Statistical analysis was done by means of Student's t test or χ^2 test or Fisher's exact test, and $p < 0.05$ was considered significant.

Results

From January 1997 to December 2009, a total of 6,839 patients underwent laparoscopic adjustable gastric banding with devices produced by Allergan (Table 1). The patients' data were entered into the database of the Italian Group for LapBand [5,660 females, 1,179 males; mean age = 38.5 ± 18.2 years (range 21–62); mean BMI = 46.7 ± 7.7 kg/m^2 (37.3–68.3); excess weight loss (EW) 61.8 ± 25.4 kg

Table 1 Basic characteristics of a gastric band: size, positioning, and maximum filling volume according to manufacturer's indications

Band	Band positioning	Maximum filling (ml)
9.75 cm	Perigastric	4
10 cm	Perigastric	4
11 cm	Pars flaccida	9
AP small	Pars flaccida	10
VG	Pars flaccida	11
AP large	Pars flaccida	14

(36–130); %EW 91.1 ± 32.4 % (21–112)]. The overall percentage of follow-up was 75.8 % and all data were inserted into the database. A total of 177 (2.5 %) intragastric erosions were observed. According to the postoperative time of follow-up, the diagnosis of intragastric migration was made in 74 (41.8 %), 14 (7.9 %), 38 (21.4 %), 40 (22.6 %), 6 (3.4 %), and 4 (2.2 %) banded patients at 6–12, 24, 36, 48, 60, and 72 months after banding, respectively (Fig. 1). During the first 6–12 months all kinds of bands were used, most of which (53/74; 71.6 %) were positioned via the perigastric route. In the later erosions (79/103; 76.7 %), the perigastric-placed 9.75-cm band was prevalent (Table 2). At 6–12-month follow-up, erosions were diagnosed in 32/74 (43.2 %) by port-system infection, in 15/74 (20.3 %) by intractable digestive symptoms, and 27/74 (36.5 %) were asymptomatic. Almost all (90/103; 87.4 %) late erosions were asymptomatic and diagnosed by routine follow-up exams during band adjustment. The differences in clinical presentation between the early- and late-diagnosis groups are reported in Table 2. The erosion site was reported in 147 of the 177 (83.0 %) cases and it corresponds to the left posterior gastric wall without peritoneum.

Most of intragastric band migration that occurred during the first 2 years involved bands with no or a few milliliters of filling. In patients with late erosion, the band was adjusted several times. No band was overfilled, but one was filled to the maximum or submaximum with a maximum of two adjustments.

The relationship between early erosions and the surgical skill of the operator was confirmed by the learning curve diagram (Fig. 2). Erosions diagnosed during the first 24 months were related to the experience of the surgical staff ($p < 0.001$), while late erosions were independent of (p = ns).

Follow-up of patients with intragastric migration was complete. Patients seen or operated on for this complication in different centers where the band was placed were also entered into the database. Early in the study period, diagnosed erosion was treated by immediate laparotomic band removal. With increasing experience, the laparoscopic approach was preferred, and in the later part of the study period, endoscopic removal gained wide consensus in many centers of the GILB. During the initial experience with this complication, the gastric band was removed immediately after diagnosis. In the following years, if patients continued to lose weight and/or the band was not completely migrated into the stomach, a "watch and wait" period was assumed (Table 3). After recovery from the removal procedure, a new bariatric procedure was performed in 24/65 patients.

The band was removed in 165/177 (93.2 %) patients with intragastric erosion, and the remaining 12 are still under clinical observation. The gastric band was removed via laparotomy, laparoscopy, or endoscopy in 44 (27.7 %), 69 (41.8 %) and 52 (31.5 %) patients, respectively. There was no mortality. The conversion rate to laparotomy in patients who underwent the laparoscopic approach was 2/88 (2.3 %); the conversion was due to anatomosurgical problems. Conversion to a laparoscopic approach during endoscopic removal was 6/50 (12 %) and due to band cutter failure ($n = 4$) or connecting tube adhesions ($n = 2$). In 2/3 (66.6 %) patients in which the remnant gastric bridge over the port was sectioned, a gastric fistula developed. This complication was successfully resolved with endoscopy.

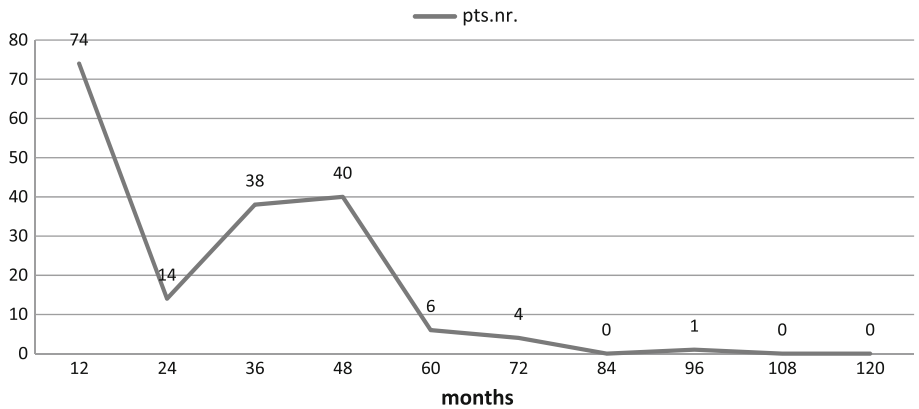

Fig. 1 Intragastric migration according to follow-up presentation

Table 2 Kind of band involved in intragastric migration and clinical presentation according to months of diagnosis after band positioning

Months	No. patients	Kind of band involved	Clinical presentation [*n* (%)]
6–12	69	All	Port infection: 32 (46.4)°
			Asymptomatic : 15 (21.7)[a]
			Digestive symptoms: 22 (32.9)
			Satiety loss: 7 (10.1)
13–24	16	All	Asymptomatic: 9 (56.2)
			Digestive symptoms: 7 (43.8)
			Satiety loss: 2 (12.4)
25–36	33	9.75, 10, 11, VG	Asymptomatic: 21 (63.6)
			Digestive Symptoms: 11 (33.4)
			Port infection: 1 (3.0)
			Satiety loss: 2 (6.0)
37–48	34	9.75, 10, 11	Asymptomatic: 24 (70.6)[b]
			Digestive Symptoms: 9 (26.5)
			Port infection: 1 (2.9)
			Satiety loss: 2 (5.8)
49–60	5	9.75, 10, VG	Asymptomatic
61–72	4	9.75	Asymptomatic
85–96	1	9.75	Asymptomatic

[a] Significantly lower ($p < 0.001$) with respect to 3 and 4 years of follow-up presentations

[b] Significantly higher ($p < 0.001$) with respect to the other follow-up presentations

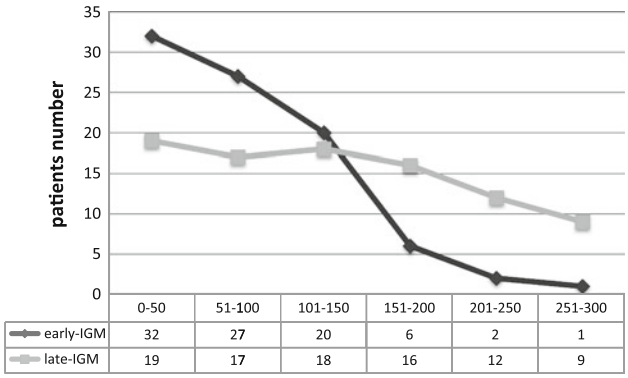

Fig. 2 Learning curve of intragastric migration according to early and late migrations

Discussion

Intragastric band migration can be considered a gray area of gastric banding history and results. The reported incidence of this complication is varies widely: 0.2 % in a US center of excellence, 0.6 % with perigastric positioning, 1.6 % with a different kind of silicone gastric band, 2.3 % in our experience with different generations of the Lap-Band System, 3.2 % with both perigastric and pars-flaccida positioning, 11.1 % reported by Westling using the Swedish Adjustable Gastric Banding in patients in whom band inflation exceeded the maximum recommended by the manufacturer [1–4, 15].

Timing of diagnosis of intragastric migration was also wide ranging. Through the years different experiences were reported. Vertruyen and Paul [16] observed 10/727 (1.4 %) patients with intragastric migration on the posterior gastric wall at mean follow-up of 27 months (range 17–29). Niville et al. [17] described 10 patients with intragastric migration at the level of the gastrogastric suture on the left side of the stomach and which occurred between 14 and 25 months after band positioning. Kurian [18] reported erosion in 9/2,437 (0.39 %) primary procedures at 10–45 months of follow-up. Christou and Efthimiou [19] reported six erosions observed during the first 18 months after surgery. Cherian et al. [6] reported presentation of erosion in 10/17 patients during the first year and only 2 after the second year from band positioning. These authors support the hypothesis that intragastric migration is multifactorial, suggesting a different etiology depending on the timing of complication: early erosion could be related to iatrogenic microinjuries at the time of band insertion, while a delayed appearance could be due to a combination of insults to the gastric serosa, including ischemia and foreign body reaction or high internal pressure as a result of ingestion of excessively large food boluses early after surgery. Abu Abeid et al. [20] hypothesized a different pathophysiology for early (6–12 months) and late (>12 months) intragastric band migration immediately below the esophagogastric junction. They concluded that early erosions could be linked to minor damage to the gastric wall at the time of surgery, while late erosions may be due to a slower destructive process that occurs over a long period of time, allowing for apparent self-healing of the gastric wall [20].

Table 3 Intragastric migration kind of treatment

Procedure	Associated procedure	Associate delayed procedure	No. patients
Laparotomic removal			40
Laparotomic removal		RY gastric bypass	5
Laparotomic removal		Biliopancreatic diversion	1
Laparoscopic removal			20
Laparoscopic removal	Rebanding via pars flaccida		15
Laparoscopic removal		LRY gastric bypass	5
Endoscopic removal			8
None		Laparoscopic removal	28
None		Endoscopic removal	42

RY Roux-en-Y; *LRY* laparoscopic Roux-en-Y

Basic considerations from our observation is that during the first 12–24 months after surgery all kind of bands were involved in migration. This indirectly indicates a surgical technical problem during the preparation of the retrogastric tunnel or the band passage or positioning. The relationship of band migration with the surgical procedure was also confirmed by the learning curve. Erosions diagnosed during the first 24 months were significantly ($p < 0.001$) related to the experience of the surgical staff. Late erosions were not related to staff experience (Fig. 2).

In the late erosions, the ≥10-ml bands were rarely involved. It has to be stressed that in the later years of the study period, not only did the band position switch from perigastric to pars flaccida, but the bands themselves changed considerably from their initial shape. Manufacturers have progressively introduced modifications, one of which has been a larger band volume up to 10 ml. Fried [21] observed that high-pressure/low-volume bands provide major pressure per square units of gastric surface during food passage as compared to low-pressure/high-volume bands. This fact surely has something to do with the low incidence of late erosions, if it is not the only reason. In the present study, late erosions were observed in patients in whom the maximum or submaximum volume was reached in one or two adjustments, and in a patient who underwent a surgical procedure for port complication 6 months before erosion.

Clinical presentation of band migration varies. A life-threatening event was rarely observed [22, 23]. Hypovolemic shock with massive upper gastrointestinal hemorrhage due to erosion into the celiac axis or in the left gastric artery has been reported, as well as small bowel obstruction due to intragastric band erosion [24–26]. In most cases, clinical symptoms are absent or mild and transient, and many authors agree that a pathognomonic manifestation of intragastric erosion is absent [1–6, 14].

Cherian et al. [6], in a study of 17 of 865 patients, indicated that the most common symptom was the epigastric pain (61 %) followed by "loss of weight loss" or weight regain (55.6 %) and by port-site or occult sepsis (44 %). Less common presentations were dysphagia, hematemesis, and early satiety.

In most cases the diagnosis of migration was made when the band appeared incorrectly positioned during fluoroscopy which was performed for band adjustment [27]. In our experience, the majority of patients were asymptomatic (Table 2) and the erosion was diagnosed during follow-up. The loss of satiety was observed only in 7 % of the patients, and more than 50 % continued to lose weight, causing a dilemma for the surgeon of whether to remove the band in the absence of a life-threatening situation.

The treatment of this complication is still a matter of concern. At the time of the first observed intragastric band migration, the only treatment conceived was its laparotomic removal [28–31]. Without the restriction of the band, most patients regained weight and gastric bypass or biliopancreatic diversion or sleeve gastrectomy was proposed [29–32]. Some surgeons started to remove the band via laparoscopy and place another band during the same session or several weeks later [33–35]. Initially, This was done for intragastric migration of band positioned via the perigastric pathway; pars flaccida positioning was used for the second band. For an initial pars flaccida-placed eroded band that was removed, the second band was placed on the same pathway. Recently, Egberts et al. [2], based on a literature review, reported that the rate of re-erosion with this strategy was low, with weight loss maintained at the same rate as that of other bariatric procedures. During the same period, the endoscopic band removal technique was developed [13, 36–38]. The endoscopic technique implies that 50 % or more of the band, together with its lock, had migrated into the gastric lumen. The presence of a mucosal bridge can cause very difficult band mobilization. When the gastric bridge is very thin, an alternative can be to inject a solution of adrenalin 1:10,000, then section with a needle cutter. This technique was used in three patients in this study, but it is no longer used because a gastric fistula developed in two of three patients [36]. During endoscopic removal in our study, the band was transected by a gastric band cutter and extracted with a polypectomy loop in 28/32

(87.8 %) patients. Because of instrument failure or breakage, a laparoscopic conversion was done in 4 (12.2 %) patients. Nieto [13], using a similar technique for gastric bands from several manufacturers, observed that 4/82 (5 %) of bands were transected without removal, and 19/82 (22.6 %) patients had a second endoscopy for total removal. O'Brien [39], commenting on the Nieto article, criticized the endoscopic removal technique as compared to laparoscopic removal because of its unclear cost/benefit ratio. In some case reports, the banding cutter was used without complications. In the present study, laparoscopic conversion was done in four cases in which the metallic thread broke in two near the tourniquet. This complication was not life-threatening.

A laser technique was described by Weiss et al. [40], who preferred to cut the sutures with endoscopic scissors and then burn through the silicone bridge of the closure site of the band with a laser. Other techniques have been described but their relevance was limited by the single-center provenance and limited number of patients [41].

Conclusion

Intragastric band migration or band erosion is a rare, disturbing, and usually not life-threatening complication of gastric banding. Its pathogenesis is linked to probably different mechanisms in early (technical failure in retrogastric passage) or late (band management) presentation. It is usually asymptomatic and there is no pathognomonic presentation. A wide range of therapeutic options are available, from simple endoscopic or laparoscopic removal to early or late band replacement or other bariatric procedures. More experience and more studies are needed to decrease the incidence rate and definitively clarify its pathogenesis to address the right treatment option.

Disclosures All authors declare to have no conflicts of interest or financial ties to disclose.

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