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LAPAROSCOPIC ADJUSTABLE GASTRIC BAND (LAGB) MIGRATION – ENDOSCOPIC TREATMENT MODALITIES

TOMASZ KLIMCZAK[1], TOMASZ SZEWCZYK[2], PRZEMYSŁAW JANCZAK[2], PIOTR JURAŁOWICZ[2]

Department of General and Oncological Surgery, Medical University in Łódź[1]
Kierownik: prof. dr hab. *L. Pomorski*
Department of Gastroenterological, Oncological and General Surgery, Medical University in Łódź[2]
Kierownik: dr n. med. *P. Jurałowicz*

Laparoscopic adjustible gastric binding (LAGB) is one of most common surgical methods of treating obesity. Gastric band migration (erosion) is a typical LAGB complication, with a frequency of about 1-4%.
The aim of the study was to present the possibilities of endoscopic diagnosis and treatment of this complication.
Material and methods. The study was carried out in the Department of Gastroenterological, Oncological and General Surgery in Łódź. Between 2008 and 2015, 450 gastric bands were implanted using the laparoscopic technique in 318 (71%) women and 132 (29%) men. In this period 7 cases of band migration were diagnosed – 3 cases in men (2.3%) and 4 cases in women (1.3%), what presents 1.56% of general number of complications. Five out of 7 eroded bands were qualified for endoscopic removal. Four out of 5 qualified eroded bands were removed using the gastric band cutting technique. In one case we used the musculo-mucosal incision technique. In order to diagnose early perforations all patients underwent control passage examinations with oral contrast (gastrografin) 3-6 hours after the procedure.
Results. All 5 out of 5 qualified eroded gastric bands were successfully removed with the endoscopic method, which gives 100% success rate in own material. Two endoscopic methods were used: 1) endoscopic gastric band cutting, 2) endoscopic musculo-mucosal incision.
Conclusions. Endoscopy gives a possibility of instant diagnosis of gastric band migration and early minimally invasive treatment. One of our endoscopic methods of removing the bands by making several incisions of the musculo-mucosal plicae has not yet been described in professional medical literature.
Key words: LAGB, gastric band erosion, endoscopic removal of gastric band

In some populations of the modern world, obesity is no longer only an aesthetic and social problem but is becoming a health issue. In 2014, the number of overweight adults (BMI 25-30) was estimated at 1.9 billion, and the number of obese individuals (BMI > 30) – at 600 million (1). Pathological obesity leads to other, life-threatening conditions such as diabetes mellitus, hypertension, sleep apnoea syndrome and atherosclerosis. No wonder that in addition to conservative treatment of obesity we witness a rapid development of interventional modalities, i.e. bariatric surgery which offers a wide range of procedures aimed at reducing body weight through the reduction in gastric volume and/or intestinal absorption surface. Surgical procedures which merely reduce gastric volume, such as gastric banding,

sleeve gastrectomy and vertical gastroplasty, are characterised by low complication rates and short postoperative recovery time. However, the expected long-term outcomes (weight loss) are worse as compared with the modalities in which the intestinal absorption surface is additionally reduced (e.g. gastric by-pass, commonly performed laparoscopic Roux-en-Y gastric by-pass LRYGB) (2, 3).

According to the 2011 data, laparoscopic adjustable silicone gastric banding (LASGB) was one of the most commonly performed bariatric surgery procedures in the world (17% of all bariatric procedures) (4). The method is characterised by low invasiveness as compared with other bariatric procedures and high effectiveness: mean 50% excess weight loss (6, 7). Nevertheless, the modality is associated with some disadvantages and complications, which include migration (also called erosion), i.e. partial displacement of the gastric band which is expelled into the gastric lumen. It is a dangerous and potentially life-threatening complication. The incidence of the complication is estimated at 1-4%, but in some centres it reaches up to 20% (8, 9) and usually necessitates urgent surgery. With the development of diagnostic and therapeutic endoscopy, more and more often successful attempts are made at removing migrated gastric bands in a less invasive and safer way (5), which we intend to prove in this paper.

The aim of the paper is to present diagnostic and therapeutic options offered by endoscopy in the case of complications following laparoscopic gastric binding (LAGB), manifested as gastric band migration to the gastrointestinal lumen. The study was conducted between 1 December 2008 and 30 November 2015 at the Department of Gastroenterologic and General Surgery and Surgical Oncology of Medical University in Łódź.

MATERIAL AND METHODS

Between December 2008 and November 2015, 450 gastric bands were laparoscopically implanted in 318 females (71%) and 132 males (29%). The patient age ranged between 17 and 65 years, with mean age being 35 years (females: between 17 and 62 years, mean 32 years; males: between 21 and 65 years, mean 37 years). The indications for the procedure included visceral obesity and BMI of > 40 kg/m^2 or > 35 kg/m^2 in the presence of comorbidities related to pathological obesity (diabetes mellitus, cardiomyopathy, arthritis, sleep apnoea syndrome). Following surgery, the patients underwent chronic treatment with an oral proton pump inhibitor at 40 mg, received in the morning on an empty stomach. In addition, radiographic assessment was performed on a monthly basis to adjust the gastric band. Patients who reported abdominal pain, vomiting, dysphagia or heartburn or did not lose weight, underwent follow-up gastroscopy. If endoscopy revealed band migration to the gastrointestinal lumen, the patient was qualified for band removal. Endoscopic removal of the band by band cutting or multiple-step musculomucosal fold undercutting was the modality of choice. Band cutting was applied in the event of marked migration (of over two-thirds of band circumference) into the gastric lumen. In other cases, musculomucosal fold undercutting was applied to accelerate band migration.

Prior to every procedure, under local anaesthesia with 1% lidocaine solution, the access port was removed from the subcutaneous tissue and the wire connecting it with the gastric band was cut.

For both endoscopic procedures, therapeutic endoscopes (PENTAX EG-3490K and Olympus GIF-1TQ160) were used. The procedures were performed after intravenous premedication with 5 mg of midazolam, 2 mg of fentanyl and 20 mg of hyoscine butylobromide, with continuous monitoring of the heart rate and blood oxygen saturation.

The endoscopic band cutting consisted in passing a steel wire (Wilson-Cook Metro wire guide) through the intragastric fragment of the band, which was subsequently evacuated through the patient's mouth, thus forming a loop. Both ends of the steel loop were introduced into the lithotriptor cable (14Fr Wilson-Cook) and installed on the endoscopic shaft. Then, by rotating the lithotriptor crank and tightening the steel loop intensely, the entire band was cut. Cutting was the only step of the procedure which was not performed under endoscopic guidance due to a high risk of damage to the device. Subsequently, using a steel diathermy loop, the free end of the cut band was captured and – under endoscopic guidance – the band was evacuated by manual tightening of the loop (fig. 1-5).

The other endoscopic modality consisted in multi-step undercutting of the band-supporting musculomucosal fold using hot biopsy forceps (Olympus ED-6C-1) and needle papillotome (Olympus KD-31C-1), until the band spontaneously dropped into the gastric lumen. Endoscopic sessions were held at two-week intervals, and the entire therapy lasted seven months (fig. 6, 7, 8).

Within three to six hours of endoscopic band removal, every patient underwent a follow-up transit test with barium oral contrast to rule out iatrogenic gastric perforation.

If an endoscopic modality failed, the patient was offered a procedure aimed at removing the migrated band and possibly other bariatric procedures, such as sleeve gastrectomy or laparoscopic Roux-en-Y gastric by-pass (LRYGB).

RESULTS

In the study period, of all 450 successfully implanted bands, seven migrated – three in males (2.3%) and four in females (1.3%), which translates into 1.56% incidence of the complication in our material. Of all bands qualified for endoscopic removal, 100% were successfully removed, which represents 100% effectiveness in our material Mean time from gastric band implantation to its migration ranged between 24 and 60 months (mean 38 months). Detailed results are presented in tab. 1.

Fig. 1. Migrated gastric band

Fig. 2. Steal wire guide

Fig. 3. Band after being cut

Fig. 4. Removal of a cut band with a diathermy loop

Fig. 5. Successful removal

Fig. 6. Migrated gastric band

Fig. 7. Initial stage of the musculomucosal fold cutting

Fig. 8. Final stage of the musculomucosal fold cutting

The most common evidence of migration was the lack of weigh loss or slower weight loss. In addition, some patients reported moderate dysphagia. One patient (case 2) reported severe abdominal pain and was immediately qualified for surgery for suspected gastric perforation. The patient underwent laparoscopic removal of the migrated gastric band followed by laparoscopic Roux-en-Y gastric by-pass (LRYGB).

Five patients were qualified for endoscopic procedures – one for musculomucosal fold cutting and four for endoscopic gastric band cutting. In four of those patients, the band was removed successfully, with no complications. In one patient (case 1), due to massive inflammatory infiltration in the subcardial region caused by migration, multiple endoscopic procedures were necessary to remove the band. Initially, the band was cut and due to major difficulties in band evacuation, the procedure was abandoned. An empirical antibiotic therapy was started and – as the patient was stable – endoscopic removal was attempted every three weeks. The band was removed at the fifth attempt. One patient (case 3) was disqualified from interventional treatment due to an acute non-surgical incident – ischaemic cerebral stroke. The patient continued treatment at the Department of Neurology at another healthcare facility. No follow-up data on further treatment could be obtained.

DISCUSSION

Band migration (erosion) to the stomach following laparoscopic gastric banding is a rare complication, although world's literature provides varied incidence rates ranging between 0.6% and 11% (12, 13). The incidence data for this complication as provided in the world medical literature are compared with our data in tab. 2 (5, 6, 8, 11, 14-17).

In their paper, Dogan et al. (case 5) reported an increased incidence of migration, which they considered to be most likely related to the time that the surgeon needs to master this surgical technique, i.e. the "learning curve", which is two years in the case of LAGB. In the literature referred to, they demonstrate that in new bariatric centres the incidence of this complication of LAGB, migration included, considerably exceeds the world norms (1-4%) and significantly decreases over several years (11). Himpens et al. (case 4), on the other hand, demonstrate that the high incidence of band migration (two times higher) is related to using a non-standard LAGB technique. Himpens adopts the "perigastric" tech-

Table 1. Patients with a migrated gastric band

Item	Sex	Implantation date	Band type	BMI prior to implantation	Symptoms	Time from implantation (months)	Removal modality
1	M	10.06.2011	MiniMizer Extra I st. / (1-degree)	50,58	no weight loss	24	endoscopic cutting of the musculomucosal fold
2	F	15.12.2008	MiniMizer Extra I st. / (1-degree)	49,83	no weight loss, dysphagia	60	endoscopic band cutting
3	F	27.10.2010	MiniMizer Extra II st. / (2-degree)	44,82	no weight loss	40	endoscopic band cutting
4	F	07.03.2011	MiniMizer Extra I st. / (1-degree)	51,82	no weight loss, dysphagia	37	endoscopic band cutting
5	M	15.10.2012	MiniMizer Extra II st / (2-degree)	48,22	no weight loss	18	endoscopic band cutting (case 1)
6	M	08.03.2009	MiniMizer Extra I st? / (1-degree?)	50,43	no weight loss, dysphagia, abdominal pain	38	LRYGB (case 2)
7	F	17.04.2009	MiniMizer Extra I st / (1-degree)	46,89	no weight loss	49	band was not removed (case 3)

Table 2. Comparison of gastric band migration rates

Study	Migration rates (%)
Neto et al.	1,6% (82/5125)
Himpens et al.	28% (23/82) – case 4
Yildiz et al.	5,8% (10/172)
Puzziferri et al.	5% (74/1489)
Oliver et al.	0,75% (1/132)
Hady et al.	3,63% (4/110)
Dogan et al.	12,7% (14/110) – case 5
Own material	1,56% (7/450)

nique which consists in applying a silicon band to the angle of His and the lesser curvature. It is an older technique, practically replaced by the *pars flaccida* procedure (17). However, in our material, the "perigastric" technique was also used for gastric banding and the incidence of band migration did not differ from the world norm.

Endoscopic removal of a migrated band, despite its novelty, appears to be an effective modality, safe for the patient's health and life. Following the review of world literature, our results were compared with the results of other studies assessing endoscopic removal of migrated gastric bands. Detailed data are presented in tab. 3. Thus, our results, although obtained in a smaller study group, are not significantly different from those obtained in extensive retrospective trials involving multiple research centres (5, 10, 11). High effectiveness reported by Neto et al. is probably related to considerable experience in endoscopic band removal. It may be surprising that in the papers referred to the bands were cut using a dedicated device, namely the gastric band cutter (GBC), while we were using a standard lithotriptor and a steel endoscopic wire guide.

Neto et al. (case 5) reported five cases of complications manifested as pneumoperitoneum and abdominal pain. Three of the patients were treated conservatively. One required decompression using the Veress needle, while another had to undergo laparoscopic suture repair of gastric perforation.

Table 3. Comparison of outcomes of endoscopic treatment for gastric band migration

Study	Efficacy	Complications
Dogan et al.	77% (10/14)	0%
Neto et al.	95% (78/82)	6,4% (5/78) – case 5
Aarts et al.	75% (6/8)	16,67% (1/6) – case 6
Own material	100% (5/5)	0%

Aarts et al. (case 6) reported one complication manifested as massive haemorrhage following endoscopic band removal, which was treated laparoscopically.

Due to a small number of reference research papers on endoscopic removal of migrated gastric bands, it is hard to estimate the modality effectiveness with precision. The exact results will be available once multicentre retrospective studies have been conducted.

It should be noted that one of our endoscopic modalities for band removal – endoscopic undercutting of the musculomucosal fold – has not as yet been described in medical literature. We consider it authors' original modality. Despite the fact that it is arduous and several or a dozen or so endoscopic interventions are required. It appears to be safer in the case of old migration with peritoneal adhesions and inflammatory swelling in the cardia region. In such a situation, we avoid band "pulling" when trying to introduce it into the gastric lumen, as is the case in endoscopic band cutting, which may play a role in injuries within the stomach and/or adjacent organs. Moreover, with rapid advancement of new endoscopic techniques and the related platforms (e.g. NOTES), the modality involving musculomucosal fold cutting offers a chance of significant improvement and might become the gold standard in endoscopic treatment of gastric band migration.

CONCLUSIONS

Migration of a silicone gastric band to the gastric lumen is a relatively rare (1-4%) but potentially life-threatening complication. Early detection and treatment of complications appear to be essential for improving the quality of bariatric surgery. Endoscopy offers quick diagnostic assessment for gastric band migration and early low-invasive treatment.

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Adress correspondence: 92-213 Łódź, ul. Pomorska 251
e-mail: tjjklimczak@gmail.com