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### Intra-gastric Band Erosion After Laparoscopic Adjustable Gastric Banding for Morbid Obesity: Imaging Characteristics of an Underreported Complication

**OBJECTIVE.** Our purpose was to describe the imaging findings of intra-gastric band erosion, an underreported complication after laparoscopic adjustable gastric banding for the treatment of morbid obesity. In this long-term complication, the gastric band fastened around the upper stomach to create a small proximal gastric pouch gradually erodes into the stomach wall and can extend into the gastric lumen. We present three cases of patients with band erosion in whom findings on an upper gastrointestinal series and CT established the diagnosis.

**CONCLUSION.** Diagnosis of intra-gastric band erosion after gastric banding is usually made with endoscopy. However, the radiologic appearance of band erosion when visualized on an upper gastrointestinal series is pathognomonic and allows initial imaging diagnosis. In patients with extraluminal air or prosthesis infection, CT findings also are suggestive of this postoperative complication.

**T**he increasing prevalence of obesity is a major public health problem in all Western countries. Morbid obesity is associated with several chronic diseases such as hypertension, diabetes, hyperlipidemia, degenerative arthritis, and sleep apnea that lead to increased morbidity and mortality. The U.S. National Institutes of Health Consensus Conference [1] concluded that most patients who were morbidly obese failed to achieve acceptable long-term weight loss after behavioral modification or drug therapy. Therefore, surgery might be considered in the treatment of morbidly obese patients. Gastric banding was developed as a minimally invasive alternative to gastric bypass or gastroplastic procedures. Since its introduction in 1992 [2], laparoscopic adjustable gastric banding has been used extensively around the world, first in Europe and since 2001 in the United States after the procedure was approved by the U.S. Food and Drug Administration (FDA). To date, the gastric

band has been placed in more than 80,000 patients [3]. Intra-gastric prosthesis migration has only recently been described as one of the major long-term complications. Diagnosis is usually made with endoscopy [4], and to our knowledge, only one case of band erosion visualized on an upper gastrointestinal examination has been reported previously in the radiology literature [5]. We present three cases of patients with intra-gastric band erosion in whom diagnosis was based on findings of upper gastrointestinal series and CT and describe the imaging characteristics of this postoperative complication.

#### Subjects and Methods

Since October 1992, 537 morbidly obese patients have been treated at our institution by laparoscopic adjustable gastric banding. The procedure consists of placement of an implantable silicone band (BioEnterics LAP-BAND System, INAMED Health) around the upper stomach, creating a channel between a small proximal pouch and the distal

Received March 4, 2004; accepted after revision May 11, 2004.

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AJR 2005;184:109-112

0361-803X/05/1841-109

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stomach. The device is prevented from slipping by placing stitches between the serosa of the stomach just proximal and distal to the band and wrapping the gastric fundus around the device. The inner surface of the band is inflatable and connected through a catheter to a subcutaneous access port. This arrangement allows postoperative adjustment of the size of the stoma by percutaneous injection or withdrawal of saline solution via the port.

Initial imaging diagnosis of intragastric band erosion was made in three patients. All three underwent single-contrast-enhanced upper gastrointestinal examinations using water-soluble contrast material (meeglumine amidotrizoate, Gastrografin, Schering). Examinations were performed on digital fluoroscopy equipment (Siegraph 2, Siemens Medical Systems). Two patients also underwent abdominal MDCT (Somatom Plus Volume Zoom scanner, Siemens Medical Systems) after receiving 120 mL of iohexol (Omnipaque 350 mg I/mL; Amersham Health) via a power injector. The MDCT examination was performed as a simultaneous acquisition with parameters of 4 × 2.5 mm collimation, table speed of 14 mm/sec, 120 kV, and 150 effective mAs.

## Results

Of the 537 patients treated, 437 (81%) were available for follow-up, with a median follow-up period of 33 months (range, 12–109 months). The diagnosis of intragastric band erosion was established by endoscopy in 18 patients (3%). The most common symptom was epigastric or abdominal pain (13 patients). Clinical findings also included gastrointestinal bleeding (two patients), cessation of weight loss (three patients), access port infection (three patients), and abdominal abscess (one patient). Some patients presented with more than one symptom. One patient was asymptomatic. Laparoscopic band removal and closure of the defect in the gastric wall were performed in all 18 patients without complication.

In three of the 18 patients with band erosion, diagnosis was first established radiologically and then confirmed with endoscopy. The clinical and radiologic findings in these three patients are summarized in Table 1. The first patient was asymptomatic, with the diagnosis of band erosion made at radiologic evaluation performed before

band adjustment. The second patient experienced mild abdominal pain for a period of 3 months and acute pain only on the day of admission to the hospital. The third patient was hospitalized for access port infection. Upper gastrointestinal series performed in the three patients showed a pathognomonic aspect of intragastric band erosion, with contrast material surrounding the part of the band that lies in the lumen of the stomach (Fig. 1). MDCT was performed in the second and third patients. In the second patient, MDCT showed the intragastric position of the eroded section of the band. The lesion was associated with small amount of peritoneal fluid and a few extraluminal bubbles of air (Fig. 2). MDCT of the third patient showed an abscess surrounding the gastric wall and along the catheter toward the access port (Fig. 3).

## Discussion

Bariatric surgery is widely recognized as an effective treatment for morbidly obese patients. Several surgical methods have been introduced, including gastric bypass and vertical banded gastroplasty [6]. Laparoscopic adjustable gastric banding was first described in 1992 and is today the most commonly performed bariatric procedure in Europe and Australia [7]. The procedure was approved for use in the United States by the FDA in June 2001. In the gastric banding procedure, a silicone band is placed around the proximal part of the fundus to create a small gastric pouch. The band is connected through a catheter to a subcutaneous access port. Percutaneous puncture of the access port allows postoperative adjustment of the stoma diameter of the band by adding or removing saline solution and inflating or deflating a section of the band.

Complications after laparoscopic adjustable gastric banding reported in the radiology literature include pouch dilatation, band slippage, and access port complications [5, 8, 9]. As the results of long-term follow-up have become available, a new complication has appeared: intragastric band erosion, in which the silicone ring penetrates the gastric wall and, in some patients, the lumen of the stomach [4, 10]. Erosion of pros-

thetic material previously had been reported after other bariatric procedures such as vertical banded gastroplasty [11]. It typically is a late-stage complication caused by chronic ischemia due to pressure applied to the gastric wall.

In a review of literature, the reported prevalence of intragastric band erosion varies from none to as much as 11% [4]. These variations could be due to differences in the length of follow-up and the type of routine studies performed during follow-up. In a series of 119 patients reported by Silecchia et al. [4] with a minimum follow-up period of 12 months (mean follow-up, 32 months), the rate of band erosion was 7.5% because all patients, even if asymptomatic, underwent routine gastrointestinal endoscopy. In that series, all patients with eroded intragastric bands were asymptomatic at the time of endoscopic diagnosis. However, if routine endoscopy had not been performed, it is likely that the observed prevalence of erosion would have been lower, with more salient clinical symptoms in most diagnosed cases. Clinical manifestations include nonspecific epigastric or abdominal pain, cessation of weight loss, gastrointestinal bleeding, abdominal abscess, and abscess at the port site. One of our patients presented with peritonitis and pneumoperitoneum. The appropriate treatment of intragastric band erosion is still controversial, including endoscopic follow-up in asymptomatic patients, intragastric endoscopically assisted removal of the band, or laparoscopic band removal (as performed in our series).

A prospective evaluation of intragastric band erosion using barium swallow and upper gastrointestinal endoscopy found that gastrointestinal series could not reveal band erosion in its early stages [4]. However, the radiologic appearance of later-stage intragastric band erosion on upper gastrointestinal series is pathognomonic. Barium swallow shows a flow of contrast material around the part of the band that has eroded into the stomach. If symptoms suggest intraabdominal abscess or open perforation, CT should be used to assess the presence of perigastric abscess or extraluminal air associated with the erosion.

In conclusion, intragastric band erosion is a major complication of laparoscopic adjustable gastric banding, often leading to additional surgery. The prevalence of this complication will probably increase over time because patients may remain asymptomatic for long periods and because band erosion occurs long after band placement. Radiologists in charge of postoperative evaluation of patients after bariatric surgery should be aware of the characteristic imaging findings of this underreported complication to detect it at the earliest possible stage.

**TABLE 1** Summary of Clinical and Radiological Findings

Patient No.	Age (yr)	Sex	Postoperative Delay (mo)	Symptoms	Upper GI Series	CT	Treatment
1	23	F	14	Asymptomatic	Band erosion	Not performed	Band removal
2	39	F	35	Acute epigastric pain	Band erosion	Extraluminal air	Band removal
3	26	F	23	Access port infection	Band erosion	Abscess along band system	Band removal

Note.—GI = gastrointestinal.

Fluoroscopy and CT of Gastric Band Erosion

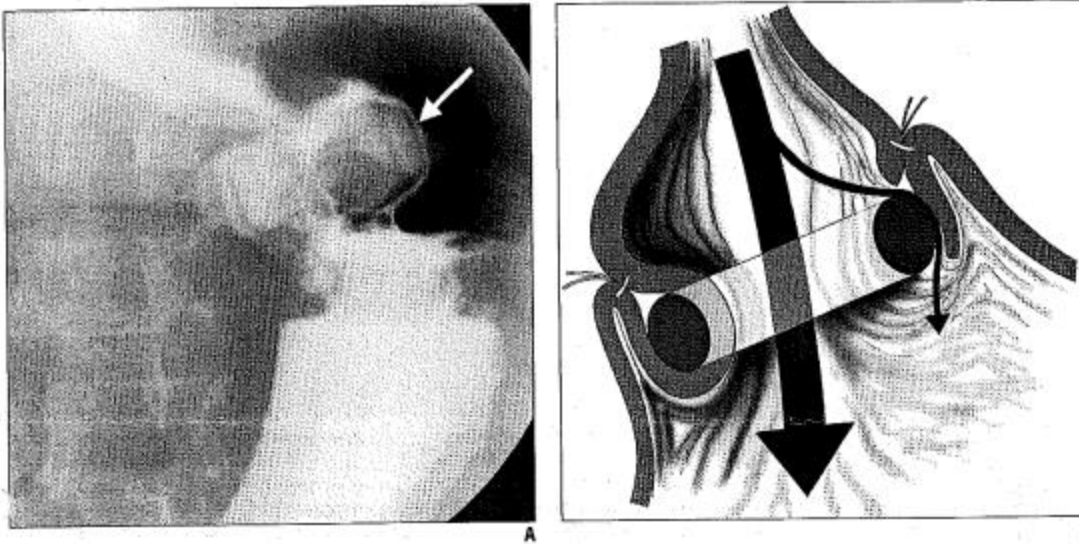


Fig. 1.—Intra-gastric band erosion in 23-year-old woman.

**A.** Radiograph from upper gastrointestinal series shows characteristic appearance of intra-gastric band erosion. Note contrast material on both sides of penetrating portion of band (arrow).  
**B.** Drawing of radiographic findings shown in **A** illustrates passage of contrast material through stoma of band (large arrow) and around left section of band that has eroded into stomach (small arrow). Note normal aspect of right section of band with gastric fundus wrapped around it.

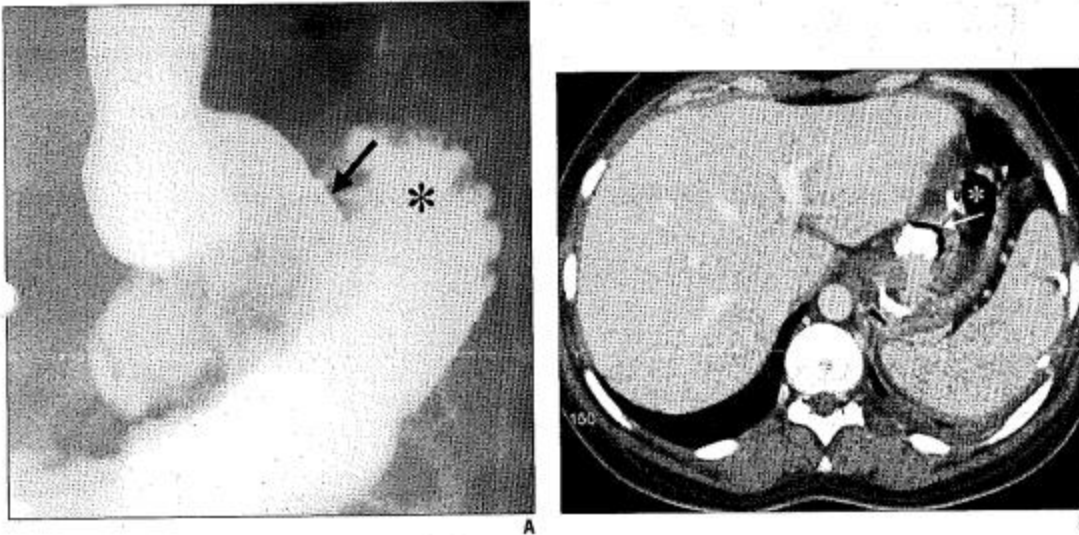
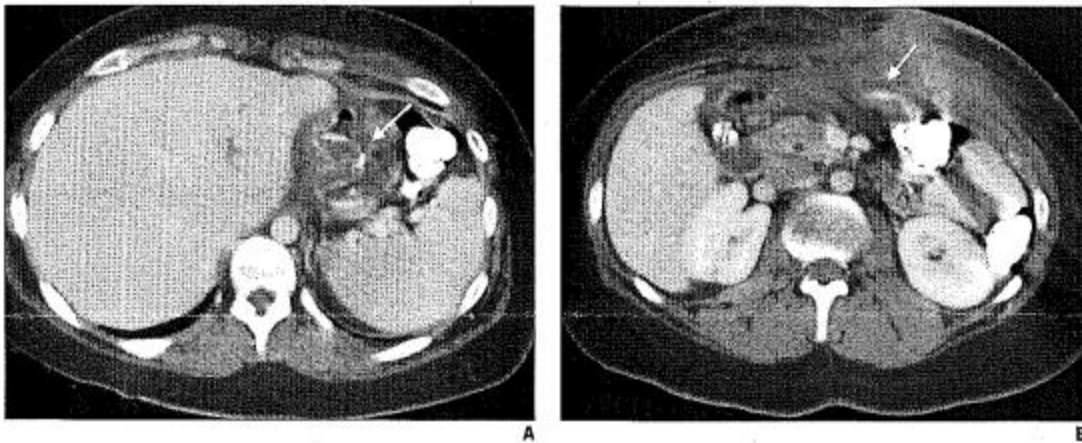


Fig. 2.—Intra-gastric band erosion in 39-year-old woman.

**A.** Radiograph from upper gastrointestinal series shows typical image of intra-gastric band erosion. Contrast material surrounds part of band that has eroded through wall of stomach (arrow). Gastric fundus is indicated by asterisk.  
**B.** Axial CT scan obtained at level of gastric banding shows good correlation with fluoroscopic view in **A**. Air around eroded band (arrow) corresponds to contrast material around band seen on gastrointestinal series. Gastric fundus is indicated by asterisk.



**Fig. 3.**—Intragastic band erosion in 28-year-old woman.  
**A.** Axial CT scan obtained at level of stomach shows abscess (arrow) around gastric wall.  
**B.** Axial CT scan obtained near level of access port shows inflammatory reaction along catheter (arrow) and in anterior gastric wall.

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