

# Laparoscopic Adjustable Silicone Gastric Banding Leakage Assessed by $^{99m}\text{Tc}$ -Pertechnetate Scintigraphy

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The purpose of this study was to assess the value of  $^{99m}\text{Tc}$ -pertechnetate scanning in the diagnosis of gastric banding leaks. **Methods:** Three patients with morbid obesity received laparoscopic adjustable silicone gastric banding (ASGB), but no significant weight reduction was obtained. To exclude band leakage as the cause, four scintigraphic procedures were performed, consisting of imaging the upper abdomen 30 min and 3 h after injection of 3 mL (111 MBq) pertechnetate solution into the ASGB reservoir. In one patient, the integrity of the ASGB device was first assessed radiologically after injection of a water-soluble contrast agent into the ASGB reservoir. **Results:** In two normally functioning ASGB devices, radiotracer was observed within the device on both early and late images. In two patients with a surgically proven small leak in the reservoir or the connecting tube, late images showed little tracer in the reservoir and the connecting tube. However, intense tracer accumulation was observed in the stomach as a result of resorption of pertechnetate in the subcutaneous or peritoneal blood vessels and subsequent gastric uptake. In one of the latter patients, radiographic assessment of the ASGB device revealed no abnormalities. **Conclusion:**  $^{99m}\text{Tc}$ -pertechnetate scanning is a valuable technique to diagnose small leaks in an ASGB device.

**Key Words:** gastric banding; complications; obesity;  $^{99m}\text{Tc}$ -pertechnetate scanning

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**O**besity is an increasing problem in western countries. One of five adult Americans is overweight, and one third of them are morbidly obese. This means that their weight exceeds their ideal weight by at least 50 kg or that their body mass index (BMI)  $\geq 40 \text{ kg/m}^2$  (BMI = weight [kg]/squared height [ $\text{m}^2$ ], normally 20–25  $\text{kg/m}^2$ ) (1,2). Morbid obesity decreases life expectancy and is associated with early development of disorders such as cardiopulmonary disease, arterial hypertension, diabetes, dyslipidemia and socioeconomic and psychosocial impairments (3–5).

Nonsurgical treatment of morbid obesity, such as exercise

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and dietary and pharmaceutical regimens, rarely results in permanent weight reduction (5). Numerous surgical procedures such as vertical banded gastroplasty, malabsorptive operation and gastric banding have been suggested and are more successful. The least-invasive surgical procedure, adjustable silicone gastric banding (ASGB), was introduced by Kuzmak (1) in the early 1980s and had a reported success rate of 64.3% of excess weight loss after a 3-y follow-up period (5–7). Since then, the surgical technique has improved, and nowadays, the gastric banding procedure can be performed laparoscopically (8,9). Nevertheless, immediate and late complications still occur (9–12). One of the late complications is leakage of the gastric banding device. To our knowledge, a scintigraphic procedure to assess these leaks has not been previously described. We report on three patients with an inadequately functioning gastric banding, who subsequently underwent  $^{99m}\text{Tc}$ -pertechnetate scintigraphy and discuss the use of this procedure in the assessment of gastric banding leaks.

## MATERIALS AND METHODS

Three female patients (Table 1) with morbid obesity received laparoscopic ASGB, but no significant weight reduction was obtained after a 1-y follow-up period. In patient 1, the integrity of the ASGB device was assessed radiologically. A water-soluble contrast agent (Urografin; Schering, Erlangen, Germany) was injected into the ASGB reservoir under fluoroscopic guidance, and anterior and lateral images were obtained. Four scintigraphic studies were performed on the three patients. Three milliliters of a pertechnetate solution containing 111 MBq were injected into the gastric banding reservoir under ultrasonographic guidance. Anterior and lateral images of the upper abdomen were obtained at 30 min and 3 h after injection by a single-head gamma camera (GCA 901A; Toshiba, Tokyo, Japan) equipped with a low-energy all-purpose collimator. The matrix size was  $64 \times 64$ . The acquisition time was 4 min.

## RESULTS

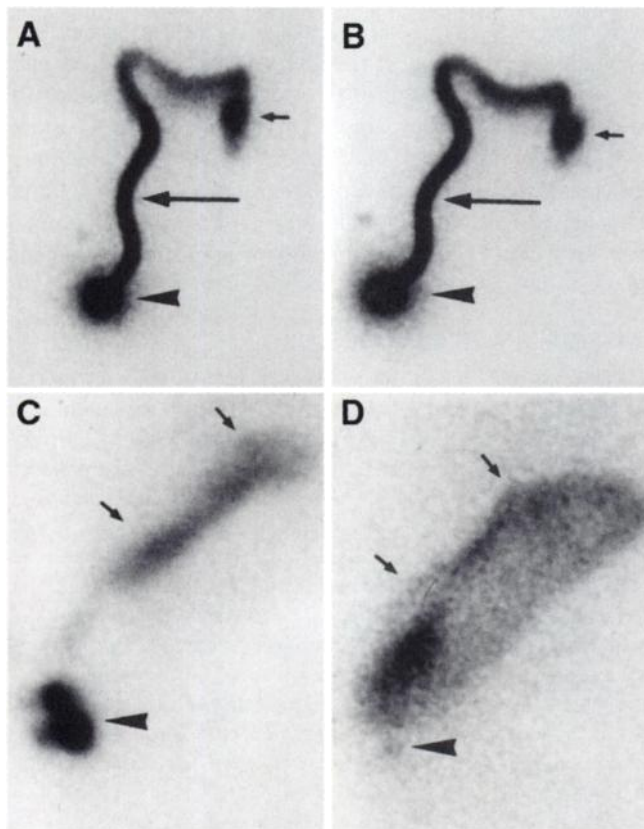
In patient 1, a leak at the junction of the reservoir and the connecting tube was surgically proven. Radiographic examination 1 d before scintigraphy had revealed no extravasation of contrast material out of the gastric banding device.  $^{99m}\text{Tc}$ -pertechnetate scintigraphy showed not only tracer

**TABLE 1**  
Patient Data

Characteristic	Patient 1	Patient 2	Patient 3
Age (y)	54	31	54
Weight (kg)	125	125	130
Height (m)	1.60	1.65	1.58
Body mass index	48.8	45.9	52.1
Radiological assessment	Yes	No	No
Number of scintigraphic examinations	2	1	1
Scintigraphically proven band leakage	1/2	1/1	0/1

distribution in the reservoir but slightly enhancing the gastric mucosa in the early phase. After 3 h, an intense tracer accumulation was observed in the gastric mucosa, whereas most of the tracer had faded out of the reservoir (Figs. 1C and 1D). A similar result was obtained in patient 2.

In two normally functioning ASGB devices (in patient 1 after surgical revision and in patient 3), radiotracer was observed within the reservoir, connecting tube and gastric band on both early and late images (Figs. 1A and 1B).

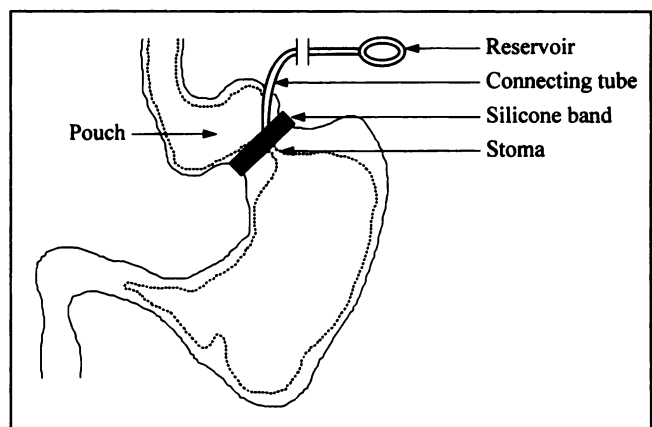


**FIGURE 1.** Anterior image of normal tracer distribution in reservoir (arrowhead), connecting tube (long arrow) and gastric band (short arrow) in early phase (A) and after 3 h (B). (C) Lateral image of tracer distribution in reservoir (arrowhead) and slight enhancement of gastric mucosa (short arrows) in early phase. (D) Intense tracer accumulation in gastric mucosa (short arrows) after 3 h. Tracer in reservoir has faded (arrowhead).

## DISCUSSION

The ASGB is placed laparoscopically by fastening an extensible silicone band around the gastric fundus (Fig. 2), thereby creating a small gastric pouch. The band is connected to a saline-filled reservoir, which is placed in the subcutaneous tissue adjacent to the anterior layer of the rectus fascia. This location permits easy percutaneous access to inflate or deflate the reservoir and consequently to adjust the caliber of the stoma for optimum performance. By limiting the capacity of the pouch (15–60 mL), the intake of food is restricted because of an early perception of satiety. Still, the digestive process remains unaffected.

Few studies have reported on the complications associated with the laparoscopic procedure (Table 2). The most frequent complications are esophagitis, pouch dilatation and surgical complications such as incisional hernia and wound infection. Band-related complications are less frequent and include rotation of the reservoir, penetration of the band into the gastric mucosa and band slippage. When no weight reduction is observed or if the patient suddenly is able to eat a larger amount of food, a leak in the connecting tube or the reservoir can be suspected. In that case, no saline will be present in the silicone band, and any attempt to adjust the caliber of the stoma will fail. Furthermore, any saline injected into the reservoir cannot be retrieved. Radiological study or  $^{99m}\text{Tc}$ -pertechnetate scanning can be performed to assess the leak. Large leaks can be easily detected by visualizing water-soluble contrast agents rapidly extravasating out of the gastric banding device. However, in small leaks, the contrast agent escapes out of the device at a much slower rate. The concentration of the extravasated contrast agent will therefore be too low to be detected fluoroscopically or even radiographically, so the leak will remain unnoticed. On the contrary, with  $^{99m}\text{Tc}$ -pertechnetate, the slowly extravasating radiotracer will be resorbed by the subcutaneous or peritoneal blood vessels and subsequently



**FIGURE 2.** Schematic illustration of gastric banding. Silicone band is fastened around gastric fundus, thereby creating gastric pouch. Small tube connects gastric band to saline-filled reservoir.

**TABLE 2**  
Early and Late Complications After Laparoscopic Gastric Banding Procedure

Fried and Peskova (9) 59 patients		Chelala (10) 185 patients		Morino et al. (11) 15 patients		Belachew et al. (12) 320 patients	
Complication	%	Complication	%	Complication	%	Complication	%
<b>Early complications</b>							
Incisional hernia	8.6	Rotation of reservoir	1.7			Food intolerance	12.8
Wound infection	6.2	Gastric perforation	1.1			Gastric perforation	0.3
Gastric leakage	2.5	Band slippage	0.6			Infection	0.3
Penetration of the band	1.2	Infection	0.6				
		Pneumonia	0.6				
<b>Late complications</b>							
Esophagitis	12.6	Esophagitis	4.6	Esophagitis	60.0	Band slippage	7.2
		Pouch dilatation	3.4	Pouch dilatation	60.0	Pouch dilatation	5.0
		Band leakage	0.6				

absorbed in the stomach because of the high gastric affinity for pertechnetate. Therefore, gastric enhancement, in conjunction with the absence of radiotracer in the gastric banding device on late scans, is a sign of leakage of radiotracer from the gastric banding device (patients 1 and 2). The sensitivity of this procedure may therefore be higher than that with radiological examination, as supported by the findings in one of these patients. Obviously, injection of radiotracer into the reservoir must be performed accurately because any subcutaneously injected radiotracer will accumulate equally in the stomach. In that case, however, fading of the radiotracer out of the gastric banding device on late scans is not likely, because no leak is present. Nevertheless, to avoid false-positive results, it is preferable to inject the radiotracer under sonographic guidance.

### CONCLUSION

Leakage of the reservoir or the connecting tube is a late complication of the ASGB. <sup>99m</sup>Tc-pertechnetate scintigraphy is a valuable technique to diagnose these small leaks.

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