Imaging: What Are the Evidence-Based Strategies for Imaging the Bariatric Patient?

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Pearls and Pitfalls

- CT is generally considered the first-line imaging modality; however, it is only necessary to diagnose gastric or anastomotic leak, intra-abdominal infection, or obstruction.
- Fluoroscopy can be used to assess band slippage, anastomotic narrowing, strictures, pouch dilation, and gastric outlet obstruction.
- Radiologic evaluations can be used in conjunction with each other as well as endoscopy.
- Up to 20% of CTs can be falsely [not false] negative when assessing for obstruction in bariatric patients.

Patients who have undergone bariatric surgery are at risk for a myriad of perioperative and postoperative complications that physicians need to be able to efficiently and effectively recognize and diagnose. Each bariatric procedure comes with a set of unique complications, and even vague complaints such as heartburn, nausea, abdominal pain, or failure to lose weight can have a potential lethal etiology; subsequently, prompt imaging studies should always be thoughtfully considered by the clinician [1, 2]. The aforementioned complaints in a postoperative bariatric surgery patient may trigger an instant reflex to order a computed tomography (CT) scan. However, the physician should recognize that plain films, fluoroscopy, and CT each have a role in the evaluation of abdominal pain in a bariatric patient, depending upon the type of bariatric surgery that was performed, the suspected complication, and the resources available at a specific hospital.

Computed Tomography

CT is generally considered the first-line imaging modality for many potential complications from bariatric surgery [3, 4] as it is widely available and can rapidly scan the entire abdomen for the detection of abdominal catastrophes [5]. Specifically, CT is the optimal imaging modality when searching for gastric or anastomotic leak, intra-abdominal infection, and bowel obstruction [6–8]. In recent years, radiologic protocols have eliminated the use of oral contrast for many abdominal CT imaging studies. However, in the bariatric patient, oral contrast is indicated so as to optimize images and the sensitivity of such scans.

Gastric or Anastomotic Leak

Gastric or anastomotic leak is one of the most common complications after Roux-en-Y gastric bypass (RYGB) or sleeve gastrectomy with an incidence estimated to be as high as 6% [7, 9–12]. Moreover, it is also one of the most feared and potentially lethal complications of bariatric surgery [13]. With sleeve gastrectomy, leaks can occur at the staple line or gastroesophageal junction. After Roux-en-Y gastric bypass, leaks can occur at the proximal gastrojejunal anastomosis or the distal jejunojejunal anastomosis. Of note, the majority of leaks occur within the first postoperative week [7, 9]. Studies indicate that persistent tachycardia with a pulse greater than 120 beats per minute in a postoperative bariatric surgery patient should prompt immediate evaluation for a leak [11, 14]. This involves a CT with intravenous (IV) and water-soluble oral contrast and may include an upper gastrointestinal (UGI) series with endoscopy if the CT is negative (Figs. 121.1 and 121.2).

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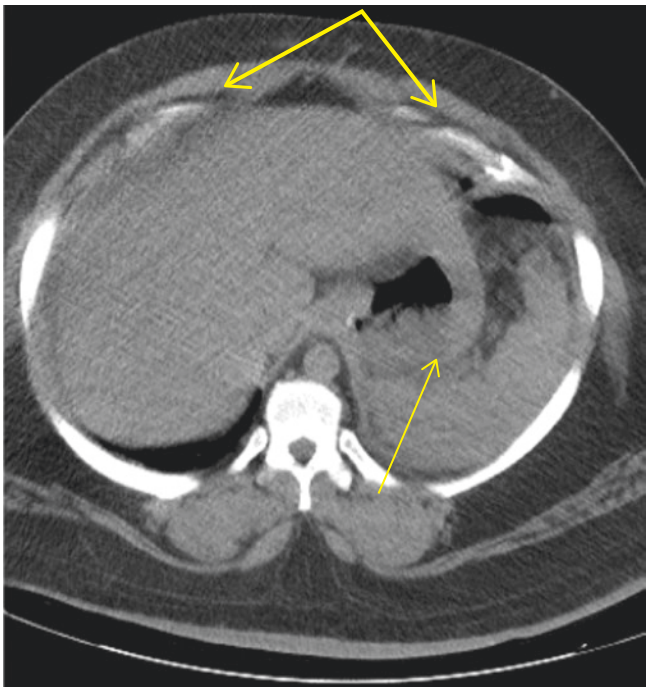

Fig. 121.1 Non-contrast CT of the abdomen and pelvis of patient with abdominal pain 10 days after sleeve gastrectomy. Large arrows, intraperitoneal free air; small arrow, suspected gastric content outside of the stomach, concern for staple line leak

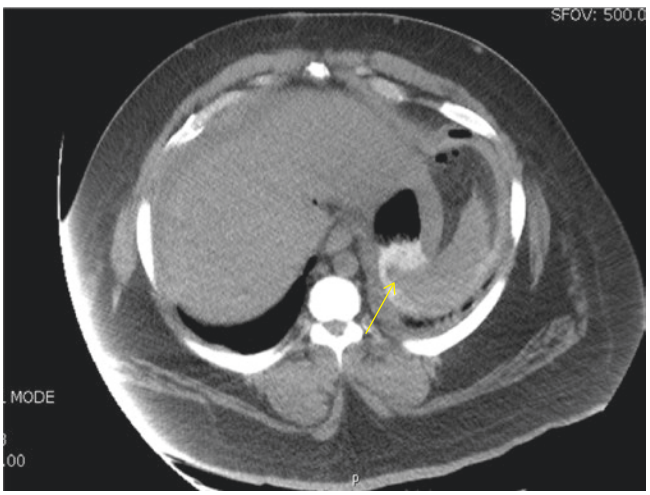

Fig. 121.2 With addition of oral and IV contrast, the gastric leak is illustrated by the yellow arrow

The sensitivity of CT for gastric or anastomotic leak is approximately 56%. When CT is combined with fluoroscopy, the sensitivity only improves to 70% [10]. A negative CT scan for this complication does not rule out the diagnosis and some patients will still require surgical exploration despite negative imaging. The most feared complication of gastric or anastomotic leak is the development of intra-abdominal abscess and sepsis. However, intra-abdominal abscesses may have other etiologies in bariatric patients, including infection of bariatric hardware. If the physician has any suspicion of intra-abdominal infection or abscess, an intravenous and oral contrast-enhanced CT must be obtained [3, 8].

Bowel Obstruction

Bowel obstruction is one of the most common causes of abdominal pain after Roux-en-Y surgery [3], with an incidence of approximately 3–5% [9, 10, 12]. It can also occur after biliopancreatic diversion with duodenal switch. Internal hernias after Roux-en-Y gastric bypass are a potentially devastating cause of bowel obstruction. There are three main types of mesenteric defects with laparoscopic RYGB: Petersens, mesocolic, and jejunojejunal [9, 10, 12, 13, 15], and the incidence of a hernia in this population is 0.9–4.5% [16]. Intravenous and oral contrast-enhanced CT is the preferred method of radiologic evaluation, and a positive scan will often show the classic mesenteric "swirl" or "whirl" sign which is caused by rotation of the mesentery (Fig. 121.1). This has an 83% specificity for a Petersen hernia [17]. Unfortunately, the sensitivity of such a sign is approximately 80% [13]. Thus, a high index of suspicion should be maintained, and patients with symptoms of obstruction should be considered for urgent surgical exploration if negative imaging and concerning signs or symptoms [11, 13] (Fig. 121.3).

Fluoroscopy

Fluoroscopy is indicated when the physician is concerned about pouch dilation, band slippage, stricture, or gastric outlet obstruction [1, 7, 8]). Many physicians also start the evaluation for gastric or anastomotic leak with an UGI series under fluoroscopy, but its sensitivity can be as low as 22–30% [8, 10–12]. Fluoroscopy may not have as widespread availability as CT, which is a significant limitation of its use (Fig. 121.4).

Gastric band surgery may lead to several complications that can be easily diagnosed with fluoroscopy. Strictures and anastomotic narrowing can both be readily diagnosed with fluoroscopy, as can gastric outlet obstruction and pouch dilation [1, 7]. The diagnoses may present with similar complaints, including odynophagia, abdominal pain, vomiting, and regurgitation. Many bariatric physicians routinely obtain fluoroscopic studies in the immediate postoperative period before patient discharge. This can provide easy access to images for comparison when the clinician decides to obtain repeat fluoroscopic studies [6, 13, 15]. Fluoroscopy for this purpose does require that the patient be cooperative and capable of standing [15].

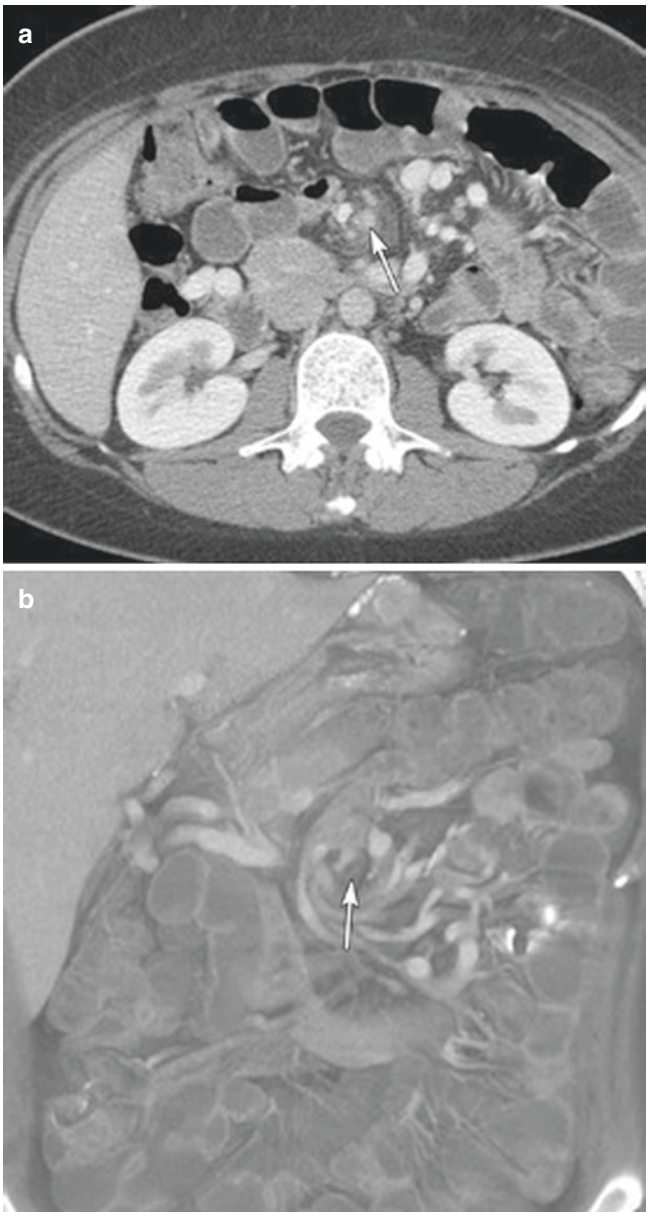

Fig. 121.3 The swirl or whirl sign on CT is seen approximately 80% of the time in patients with a Petersen hernia. (**a**) Coronal view, (**b**) transverse view. (From Gaetke-Udager et al. [15])

Band slippage, which has an incidence of approximately 15% [12], is diagnosed by assessing the phi angle on either plain films or fluoroscopy. This is the angle made by the vertical axis of the spine and the intersection of the long axis of the gastric band [1, 15]. The phi angle should typically be between 4° and 58°; if the angle is less than 4°, the band has slipped posteriorly, and if the angle is greater than 58°, the band has slipped anteriorly [10, 15] (Fig. 121.5).

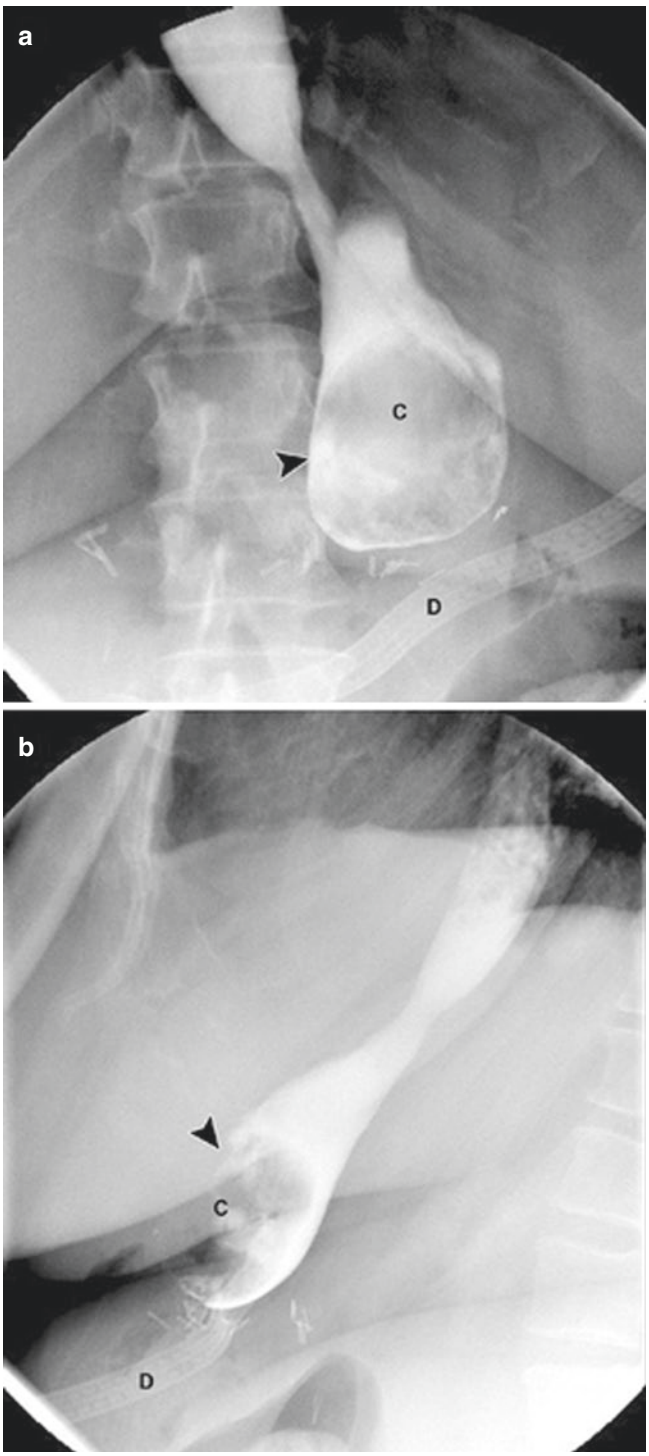

Fig. 121.4 Obstruction of gastric pouch following Roux-en-Y gastric bypass surgery. (**a**) Frontal and (**b**) right lateral images from an upper GI fluoroscopic image show holdup of water-soluble iodinated contrast in the gastric pouch (*arrowheads*), with a large filling defect (C confirmed as clot on endoscopy) and no discernible gastric emptying. D surgical drain. (From Gaetke-Udager et al. [15])

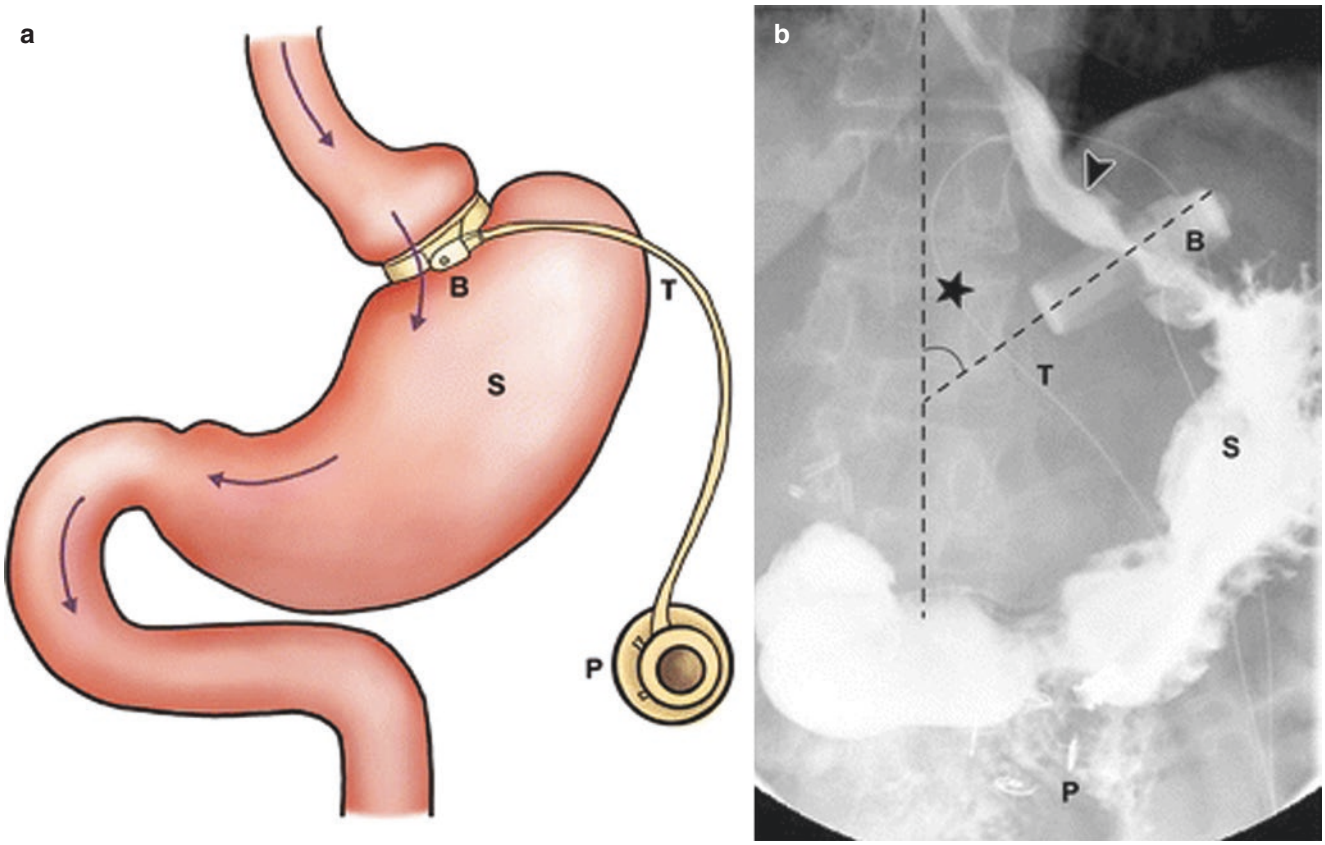

Fig. 121.5 The phi angle can be used to determine band slippage. (**a**) Normal adjustable gastric band placement. (**b**) This demonstrates a normal phi angle of between 4–58° on xray, Abnormal is greater than 58°. (From Gaetke-Udager et al. [15])

Radiation Exposure

With the exception of an abdominal radiograph series, the radiation exposure for the proposed diagnostic modalities is quite similar. Fluoroscopy for an upper gastrointestinal series is around 6 millisieverts, while abdominal and abdominal/pelvic CT scans are approximately 8 and 10 millisieverts, respectively (Table 121.1). The exposure difference between these is minimal, but it is important to remember that bariatric patients will likely be exposed to many radiologic studies over their lifetime. Moreover, many patients may require more than one test, which carries financial implications for the patient.

Table 121.1 Radiation doses in imaging modalities routinely used in postoperative bariatric imaging

Imaging modality	Estimated radiation exposure (millisieverts)
Abdominal X-ray	0.07 mSv
Upper GI series	6.0 mSv
CT abdomen	8.0 mSv
CT abdomen/pelvis	10.0 mSv

Summary and Recommendation

Given the availability and efficiency of CT, CT is often the first-line imaging modality for bariatric patients, especially for undifferentiated abdominal pain, fevers, tachycardia, or leukocytosis of unknown origin. However, negative CT scans in patients with concerning features for anastomotic leak, band slippage, obstruction, or infection should prompt further evaluation either with fluoroscopy, endoscopy, or urgent laparoscopy.

Suggested Resource

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