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Original article

# Abdominal imaging post bariatric surgery: predictors, usage and utility

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**Abstract**

**Purpose:** A lack of well-defined postoperative imaging guidelines for bariatric patients may lead to false-positive findings, radiation exposure, additional cost, and patient anxiety. We investigated our institutional usage and utility of nonroutine postoperative abdominal imaging.

**Methods and materials:** Laparoscopic gastric bypass and sleeve gastrectomy patients over a 5-year period were retrospectively identified. All bariatric-related nonroutine initial and all subsequent prompted abdominal and pelvic imaging was included.

**Results:** A total of 578 patients were included (399 gastric bypass, 179 sleeve gastrectomy); 907 nonroutine studies in 69% of patients were performed, and 36% patients underwent computed tomography (CT). Only 20.3% of findings were symptom-related, 26% had benign incidental findings, and 50% were negative. Incidental findings prompted 71 additional studies. Bypass procedure (sleeve versus bypass, odds ratio [OR] .3), older age (median 43 versus 48 years), and lower initial body mass index (BMI) (median 43 versus 45) increased the likelihood of imaging. History of prior abdominal surgery and dyspepsia increased the probability of undergoing CT by an odds ratio of 1.8 and 2.0, respectively ($P < .05$). History of ulcer (OR .6) or reflux on routine upper gastrointestinal imaging (OR .3) decreased probability ($P < .05$). Patients who underwent CT were more likely to undergo other abdominal imaging (3 versus 1 study per patient, $P < .01$).

**Conclusions:** Postoperative abdominal imaging in the bariatric population is common, with almost 70% of patients undergoing imaging and 70% of findings not related to patient symptoms. Bypass procedure, older age, and lower initial BMI were associated with a higher likelihood of patients undergoing imaging. Heightened understanding of this important subject is necessary to help streamline cost-effective imaging protocols for these patients. (Surg Obes Relat Dis 2017;▮:00–00.) Published by Elsevier Inc. on behalf of American Society for Metabolic and Bariatric Surgery.

*Keywords:* Gastric bypass; Sleeve gastrectomy; Postoperative imaging; CT; UGI series

## Introduction

Bariatric surgery is an increasingly performed procedure for morbid obesity after failed medical treatment [1,2]. Consequently, imaging has acquired an increasingly important role in postoperative evaluation and management [3–5]. However, chief abdominal complaints postsurgery, most commonly abdominal pain in over half of cases, as well as

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bloating, nausea, and vomiting, are often interrelated and nonspecific [1,6,7]. In addition, the clinical examination is often difficult or limited due to patient size [3]. Therefore, patients may be referred for radiological investigations to exclude complications such as leak and internal hernias not only in the early postoperative period but many months later [3,6,8,9]. Indeed, one of the American College of Radiology indications for abdominal computed tomography (CT) includes "detection of complications following abdominal and pelvic surgery, e.g., abscess, lymphocele, radiation change, formation" [10], which specifically references 2 papers related to laparoscopic gastric bypass and sleeve gastrectomy [11,12]. Therefore, there is a clear role for imaging of these patients [13].

However, there is a lack of well-defined postoperative imaging guidelines. Imaging is therefore frequently obtained due to the co-morbidities and the often compromised cardiac and respiratory state of obese patients [1,14]. Detrimental aspects of postoperative imaging include the potential for false-positive findings leading to further and often unnecessary investigations, radiation exposure, and additional cost [10,15]. Furthermore, there is significant variation in the literature as to the sensitivity of imaging studies for the diagnosis of postbariatric complications. For example, the diagnostic accuracy of CT in patients with proven internal hernia ranges from 30% to as high as 100% [16]. Upper gastrointestinal imaging (UGI) series was the next most commonly performed test, with an accuracy of 0–100% for detection of leak [17].

Against this background, we sought to investigate our institutional usage, predictors, and utility of nonroutine postoperative abdominal imaging for bariatric patients, and whether these are warranted.

## Methods

### *Study population*

This study is a single-institution, Institutional Review Board–approved, retrospective review of nonroutine postoperative imaging studies for bariatric patients who underwent gastric bypass or sleeve gastrectomy surgery over a 5-year period between January 2008 and January 2013.

### *Inclusion and exclusion criteria*

All male or female patients 18 years or older who underwent gastric bypass or sleeve gastrectomy surgery between January 2008 and January 2013 were included in the cohort, identified from a surgical database. Patients with prior weight loss procedures were excluded, as including these patients could overestimate use of imaging due to a higher complication rate and lower threshold for imaging, and the possibility of investigations being ordered for reasons other than bariatric surgery. In addition, patients with $<6$ months follow-up were excluded, as it is unusual for patients not to be followed at a bariatric clinic for at least a 2-year period, and it is likely these patients were followed elsewhere. Patient demographic information (age at surgery, sex, and race/ethnicity), surgical procedure (gastric bypass or sleeve gastrectomy), and clinical information (co-morbidities and body mass index [BMI] at time of surgery) were analyzed.

### *Imaging studies and findings*

Postoperative imaging was defined as any nonroutine bariatric-related abdominal or pelvic imaging and all studies subsequently prompted by these initial studies. All presenting complaints were evaluated and assessed if they were bariatric-related. Our institution uses "routine" UGIs to evaluate for leak on postoperative day 1 before allowing oral intake, and these were not included in our analysis. Imaging studies included abdominal and pelvic fluoroscopy, X-ray, ultrasound (US), abdominal CT, magnetic resonance imaging (MRI), and magnetic resonance cholangiopancreatography (MRCP).

### *Outcome measures*

The principal outcomes of interest were the number of initial and subsequently prompted postoperative imaging studies performed for these patients and whether radiologic findings warranted these studies. Findings on imaging studies were categorized into 5 groups based on certain classifications in relation to relevance to bariatric surgery, relation to symptoms, and extrabariatric findings, similar to the classification for virtual colonoscopy studies (Supplementary Table 1). Studies were then placed into 5 main groups, with each study assigned to only 1 group as follows, in order of priority: related to bariatric surgery and symptoms (such as small bowel obstruction, leak, internal hernia); not related to bariatric surgery but does/may explain symptoms (such as hiatal hernia, renal stone, colitis, appendicitis); related to bariatric surgery but unlikely to explain symptoms (such as ventral hernia, seroma, small pleural effusion); benign and incidental findings (such as adrenal adenoma, renal cyst, diverticulosis, hepatic steatosis); and unremarkable or negative study. We were also interested in the detection rate of postoperative complications and how many interventions were prompted by these studies. Finally, predictors of postoperative imaging were also analyzed.

### *Data handling and statistical analysis*

Data were entered into Microsoft Excel worksheets. Categorical variables were compared using Pearson chi-square and Fisher's exact test as appropriate and continuous variables using t tests. Clinical covariates included age, sex (male, female), race (black versus Hispanic versus white), surgical procedure (bypass versus sleeve), and BMI and