Percutaneous Gastrostomy of the Excluded Gastric Segment after Roux-en-Y Gastric Bypass Surgery

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A new technique for percutaneous gastrostomy of a decompressed excluded gastric segment after Roux-en-Y gastric bypass (RYGBP) surgery is described and the results in a single institution are reviewed. Computed tomography guidance was used to place a 21- or 22-gauge needle into the lumen of the stomach and distend it to allow placement of a feeding catheter. Ten women underwent the procedure, and despite only three patients having clear access windows, gastrostomy placement was ultimately successful in all 10 patients. Percutaneous gastrostomy of the decompressed excluded gastric segment after RYGBP surgery can be challenging, but a high rate of success can be achieved.

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Abbreviation: RYGBP = Roux-en-Y gastric bypass

ROUX-en-Y gastric bypass (RYGBP; **Fig 1**) produces lasting weight loss in patients with morbid obesity (1). As a result of the surgery, there is a smaller gastric pouch, which forces decreased consumption. Consumed food bypasses the gastric body, antrum, duodenum, and proximal segment of jejunum and therefore has limited absorption into the body. However, complications may arise that require access to the excluded stomach or duodenum. In such cases, antegrade access is precluded, and image-guided percutaneous gastrostomy is often the only option short of laparotomy or laparoscopy.

Two late complications of gastric bypass surgery for which immediate access to the excluded stomach is needed are distention of the gastric remnant and malnutrition secondary to stricture or ulceration at the proximal gastrojejunal anastomosis (2). Percutaneous gastrostomy for the distended excluded segment has been well described previously (3). Percutaneous gastrostomy to access the nondistended excluded segment of stomach and provide enteral nutrition presents a different challenge that has not been well addressed in the literature. The excluded stomach is usually difficult to access because it can be deep in the abdomen with bowel or liver overlying it. Previously, techniques for identifying and accessing the excluded stomach relied on the presence of preexisting markers, like hemoclips or radiopaque silastic rings placed during the original gastric bypass surgery, to help delineate the location of the stomach (4–6). Here, we present our experience with 10 consecutive cases of computed tomography (CT)–guided percutaneous gastrostomy to access the decompressed excluded stomach in malnourished patients who had undergone a RYGBP that later became complicated by ulcer or stricture at the proximal anastomosis.

MATERIALS AND METHODS

Permission was granted by the institutional review board before the study and informed consent for the record review was waived. Records from our department were reviewed to identify cases of percutaneous gastrostomy from January 2002 to December 2003. Patients were included in the study if the patient had received a RYGBP, the target of the gastrostomy was the excluded gastric segment, and the gastric segment was not distended. Ten women were identified (**Table**), ranging in age from 30 to 57 years (mean age, 38 y). The interval between the RYGBP and the gastrostomy placement ranged from 1 to 60 months (mean duration, 15 months). The patients all presented with vomiting, abdominal pain, and malnutrition, and all 10 women were unable to tolerate oral alimentation. Seven of the 10 women had an albumin level less than 3 g/dL (mean albumin level, 20.0

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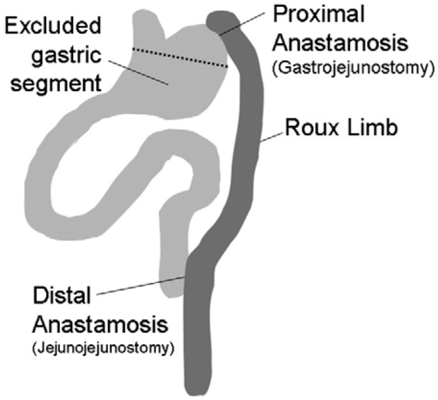

Figure 1. Diagram of bowel after RYGBP surgery. A suture line (dashed line) separates the gastric pouch from the excluded gastric segment. A loop of jejenum (Roux limb) is brought up to the stomach and connected to the new gastric pouch at the proximal anastomosis. The jejunum is then connected to the bypassed segment of small bowel by a side-to-side connection at the distal anastomosis. In several of the cases described in the present report, the patients became malnourished because ulcers or other complications at the proximal anastomosis prevented normal eating.

g/dL). This low albumin level was objective evidence suggesting that these women had malnutrition even though they had high body mass indexes. Five of the 10 women had endoscopically demonstrated ulcers or strictures of the gastric remnant/jejunal anastomosis. Four had unexplained vomiting attributed to an occult stricture. One patient had undergone a revision of the RYGBP 2 months earlier and had a leak at the proximal anastomosis. The 10 cases presented consecutively and no qualifying cases were excluded from the study.

Informed consent for percutaneous gastrostomy was obtained from each patient after discussion of risks and benefits associated with the procedure. All the procedures were performed while the patient was under moderate sedation. Before and after gastrostomy, the patients were monitored with thorough clinical examinations, liver function tests, amylase level measurements, and abdominal imaging.

All patients underwent percutaneous gastrostomy with the intention of placing a drainage catheter sufficient for alimentation. For the 10 cases reviewed, the excluded stomach was identified on CT. In those patients who could tolerate it, confirmation of the identity of the excluded stomach was aided by administration of small quantities of dilute oral Gastrografin (Bracco Diagnostics, Princeton, NJ) during the CT-guided procedure to highlight the gastric pouch and the Roux loop that drains the ingested contents distally. Those structures that do not opacify in the region of the proximal anastomosis can be safely assumed to be excluded. Then, under CT guidance and with sterile technique, a 21- or 22-gauge needle was introduced into the lumen of the excluded stomach, and contrast medium and air were injected to document the location of the needle and to distend the gastric lumen. Access to the gastric lumen was determined by the formation of an air/fluid level. If an adequate window was not present on the original CT scan, the needle was passed into the decompressed gastric lumen by the most direct approach, even if it meant traversing overlying bowel or other viscera. After distension with air and contrast medium, an adequate window was identified and a new 21- or 22-gauge needle was passed into the excluded stomach. A 0.018-inch guide wire was then passed into the stomach through the needle. The inner portion of a Neff set (Cook, Bloomington, Ind) was then advanced over the 0.018-inch wire. The catheter was used to distend the stomach and to further document the position of the catheter within the gastric lumen. The patient was then transferred to a fluoroscopy table. The complete Neff set was then introduced over the 0.018-inch wire and exchanged for a 4-F Berenstein catheter (Boston Scientific, Natick, Mass) over a 0.035-inch Amplatz Super-stiff wire (Boston Scientific). This catheter was then used to further opacify and dilate the stomach with a combination of contrast medium and air sufficient to bring the excluded segment into apposition with the abdominal wall. Two to four anchors from a Ross Flexiflow gastrostomy set (Abbott Laboratories, North Chicago, Ill) were then placed surrounding the original puncture site. When the stomach was anchored to the abdominal wall, the original puncture site was serially dilated over the 0.035-inch Amplatz Super-stiff wire to allow placement of a pigtail drainage catheter sufficient for feeding. A stiff hydrophilic wire can be substituted for the Amplatz wire but special care must then be taken to not lose access during the catheter exchanges.

RESULTS

All 10 patients had successful placement of a drainage catheter that could be used for feeding. In five of the 10 patients, a 12-F catheter was placed. In one case, a 10-F catheter was placed, and in three cases, an 8-F catheter was initially placed and then upsized to a 12-F catheter 48 hours later. In one case, an 18-F catheter was placed.

The 10 procedures are summarized in the **Table**. A clear window into the excluded stomach for the initial needle placement was available in only three cases (**Fig 2**). In the remaining seven cases, the initial needle pass went through the liver, small bowel, or colon. The procedure was uneventful in eight cases. Two cases developed complications as discussed in further sections of this report.

In one case without an adequate window (patient 9), the initial insufflation of air did not produce an air/fluid level in the excluded stomach, indicating that the gastric lumen had not been entered. The injected air instead appeared to displace the excluded stomach. After reexamining the obtained images, it was evident that the air had been injected into the gastric wall, dissecting the planes of the gastric wall and making identification of the true gastric lumen difficult (**Fig 3**). There was a concern that, in this setting, the feeding tube could accidentally be placed in the pseudolumen. Rather than risk this, we decided to bring the patient back 3 days later, after the air had resorbed, for a second attempt. The patient remained in stable condition for the 3 days and the second attempt was successful and unremarkable.

A second patient (patient 7) without an adequate window had multiple passes to enter the stomach while attempting to avoid overlying bowel. Eventually, the stomach was entered and distended and a clear window was identified. A 12-F gastrostomy catheter was placed under fluoroscopic guidance after three anchors

Procedural Data for 10 Patients who Received a CT/Fluoroscopy–guided Percutaneous Gastrostomy into a Nondistended Excluded Gastric Segment after RYGBP

Patient No.	Age (y)	Months since RYGBP	Indication(s) for Gastrostomy	Catheter Size (F)	Viscera Traversed by 21- or 22-gauge Needle; Complications
1	35	60	Malnutrition, pain, vomiting; ulcer on endoscopy	18	Clear window
2	31	3	Malnutrition, pain, vomiting; ulcer on endoscopy	8, then 12	Small bowel
3	44	10	Malnutrition, pain anastomotic leak	10	Clear window
4	33	14	Malnutrition, pain, vomiting	8, then 12	Small bowel
5	47	18	Malnutrition, pain, vomiting; ulcer on endoscopy	8, then 12	Small bowel
6	57	16	Malnutrition, pain, vomiting; ulcer on endoscopy	12	Liver
7	34	5	Malnutrition, pain, vomiting	12	Small bowel and colon; sepsis
8	30	1	Malnutrition, pain, vomiting	12	Clear window
9	37	10	Malnutrition, pain, vomiting; ulcer on endoscopy	12	Gastric wall dissected by air
10	34	10	Malnutrition, pain, vomiting	12	Liver, small bowel, colon

were used to anchor the stomach to the abdominal wall. Twenty-four hours after leaving the interventional suite, the patient developed a fever and increased white blood cell count and became hypotensive. The patient was administered broad-spectrum antibiotics and transferred to the intensive care unit. The patient's condition improved and she was discharged approximately 2 weeks after the procedure with a functioning feeding tube through which she was receiving adequate nutrition.

DISCUSSION

Gastric bypass was first performed by Edward Mason in 1966 (7). The operation creates a small (50 mL) gastric pouch from the cardia and fundus. Additionally, a Roux-en-Y jejunojejunostomy is constructed and the free end of the jejunum is brought up to the new gastric pouch and anastomosed to it (8). Weight loss results from two main consequences. First, the smaller gastric cavity forces less consumption, and second, by bypassing the distal stomach, duodenum, and proximal segment of jejunum, there is reduced absorption (9). Long-term weight loss has been documented to extend to longer than 10 years (10). In 1994, the first laparoscopic RYGBP was performed and results have been equivalent to those of open surgery (11).

Stomal ulceration and stomal stenosis are the most common complications of gastric bypass (12). Rates of stomal ulceration after undivided gastric bypass have been reported as 12%–15% (15). The etiology of this is unclear. It has been suggested that acid may leak through the staple line and into the pouch or that there may be subclinical staple line breakdown (13). However, it is likely that the cause of stomal ulcer is multifactorial and may be related to a combination of acid from parietal cells in the pouch, ischemia of or tension on the Roux-en-Y limb to the pouch, and association with nonsteroidal antiinflammatory drug use (14). Patients usually present with stomal ulcer in the first 3 months after gastric bypass. Symptoms include severe dyspepsia, burning retrosternal pain, and vomiting. Diagnosis is made by endoscopy. It is important to rule out *Helicobacter pylori* as an etiological factor. Prolonged and protracted stomal ulcer may eventually lead to stomal stenosis resulting from cicatrization (16). Symptoms of stomal stenosis include postprandial epigastric pain and vomiting. If the patient does not seek treatment, prolonged vomiting may lead to protein calorie malnutrition and vitamin deficiency (16). The need for a reliable source of nutrition is especially required after gastric bypass surgery, as protein intake needs to be increased because endogenous nitrogen loss by the intestine is increased (15). It is therefore occasionally necessary in cases of stomal ulceration and stricture with anorexia to gain access to the excluded stomach for feeding purposes.

Some surgeons place gastrostomies in the excluded stomach routinely during the gastric bypass surgery to prevent distension and remove it after a number of weeks when there is little chance of acute distension (4). However, it has been demonstrated that routine gastrostomy tube placement at the time of gastric bypass is not necessary or even beneficial in the vast majority of patients (16). An alternative suggestion was proposed in which a radiopaque silastic ring is placed around the surgical gastrostomy site. This would enable easier percutaneous access to the stomach if needed at a future occasion (4). Other authors have described techniques involving the use of radiopaque surgical clips left during open gastric bypass procedures (5,6).

A survey of the interventional radiology literature reveals very few descriptions of techniques to access the excluded stomach without reliance on preexisting radiopaque markers. Two case reports (9,17) described the use of ultrasonography (US) and fluoroscopic guidance for percutaneous gastrostomy. However, in our opinion, identifying the collapsed excluded stomach on US is difficult. Additionally, a study by Kanazawa et al (18) describes access to the excluded stomach through the left lobe of the liver. Although our approach permits traversal of the liver with a 21-gauge or

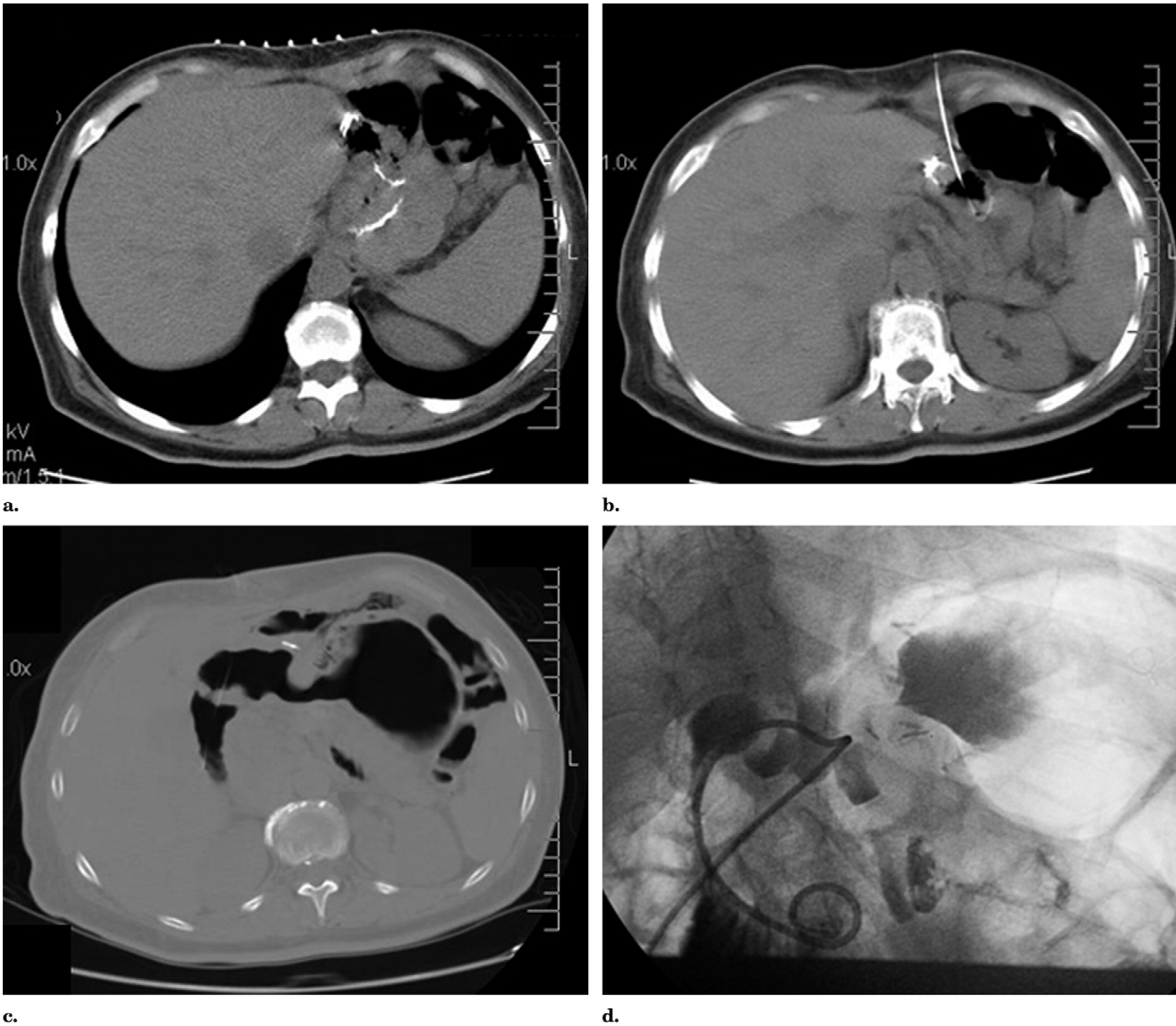

Figure 2. Select images from the percutaneous gastrostomy of patient 3. In this 44-year-old woman with malnutrition secondary to a leak at the proximal anastomosis, an unobstructed path to the excluded gastric segment was identified through the anterior abdominal wall allowing placement of a 22-gauge needle **(a)**. A guide wire and catheter were then passed into the stomach **(b)**. The catheter was used to distend the stomach and bring it into apposition with the abdominal wall **(c)**. The patient was then transferred to a fluoroscopy table, anchors were placed, and the gastrostomy site was dilated to allow placement of a feeding tube **(d)**.

22-gauge needle, we concluded that avoiding the potential complications of dilating an intrahepatic tract (eg, pain and hemorrhage) was preferable.

The techniques we describe for percutaneous placement of a gastrostomy tube into a collapsed excluded stomach does not rely on the patients having preexisting radiopaque markers. Furthermore, we have demonstrated that these techniques can be successful in the majority of cases and require only the use of CT for access, after which the procedure is completed under fluoroscopic guidance.

Unfortunately, complications may still be encountered. Identification of an adequate window to access the excluded stomach from the anterior abdominal wall is challenging when the excluded stomach is decompressed. Often, the stomach is empty, with the anterior and posterior walls opposing each other. One of our patients developed fever, leukocytosis, and hypotension after the procedure, possibly secondary to passing the needle through bowel. Despite the complication, our patient recovered swiftly and still benefited from the procedures. In an effort to further improve the technique and avoid a recurrence of this complication, we suggest administering bowel preparation and prophylactic antibiotics before attempting a gastrostomy in a decompressed, excluded stomach. Additionally, if patients can tolerate it, we would also administer oral barium

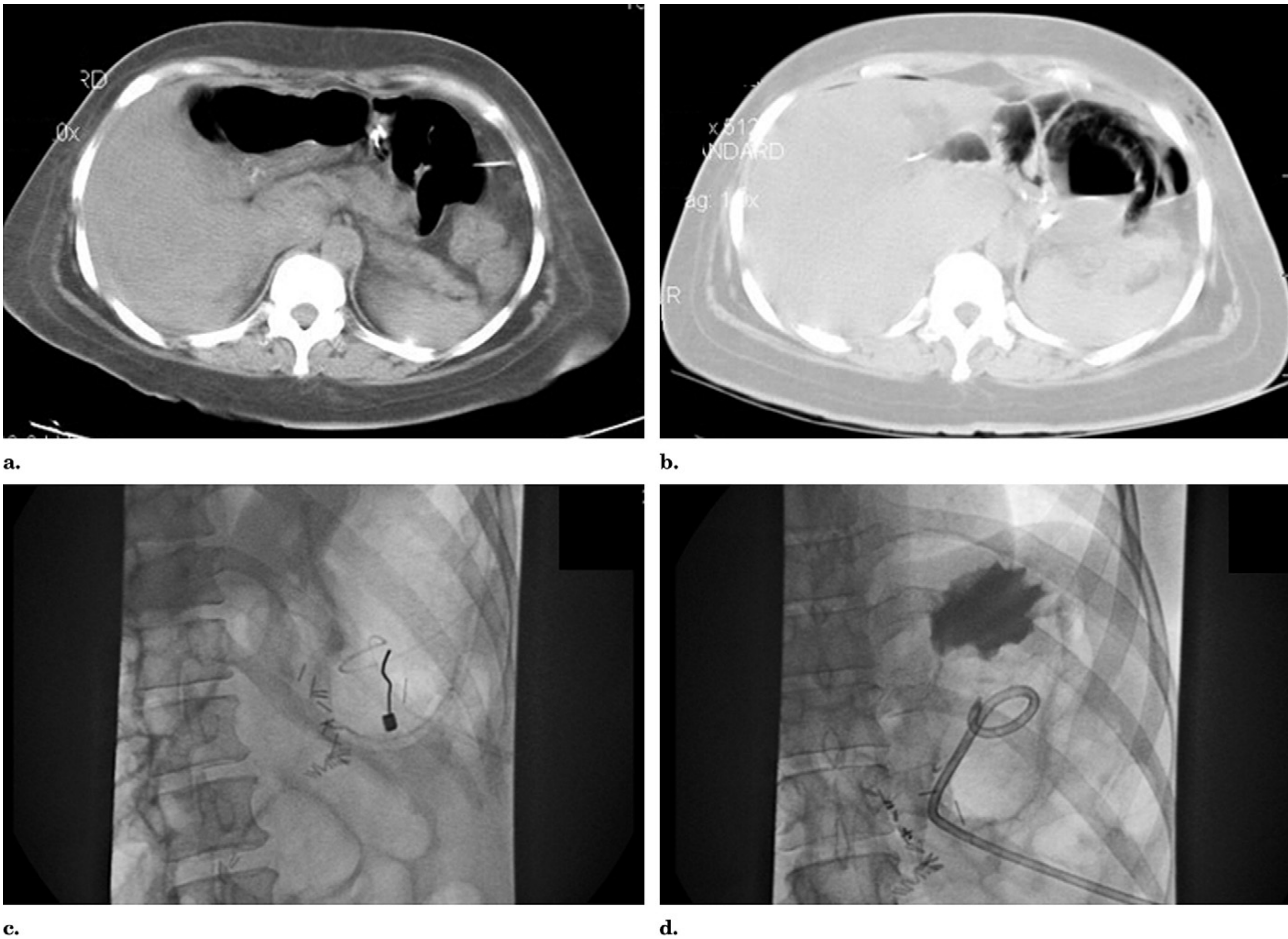

Figure 3. Select images from the percutaneous gastrostomy of patient 9. In this 37-year-old woman who presented with malnutrition resulting from an ulcer at the proximal anastomosis, a direct path to the excluded gastric segment via the lateral abdominal wall was identified. After the 21-gauge needle was initially placed **(a)**, air was injected but no air/fluid level was seen and the procedure was aborted. On a later review with lung windows, it became apparent that the needle was within the gastric wall and the injected air was dissecting the gastric wall planes. The patient returned 3 days later, after the air had partially resorbed, and a needle was successfully placed in the lumen of the excluded segment and an air/fluid level was generated **(b)**. A wire was then placed in the stomach and the patient was transferred to the fluoroscopy unit, where anchors were placed **(c)**, securing the stomach to the wall so the gastrostomy could be dilated and the feeding tube could be deployed **(d)**.

the night before the procedure to mark the colon.

The results of our experience indicate that the technique presented here can be used successfully in a majority of patients who have undergone RYGBP and present with an urgent need for percutaneous placement of a gastrostomy tube in the collapsed excluded stomach. A technique similar to ours was described recently by Goitein et al (19). In their study, they describe an additional four successful CT and fluoroscopically guided gastrostomy placements in decompressed gastric remnants. However, it must be noted that both of these studies are retrospective and are therefore subject to flaws in experimental design, including selection bias and an inability to prospectively proscribe the precise protocol for the procedure. In addition, our study was limited by the small number of cases studied and the fact that long-term follow-up was not available. Nonetheless, the patients we treated, who were debilitated, were served well by our percutaneous procedures and required only moderate sedation. The cases we studied were all consecutive and no patients were excluded. A more definitive investigation into the safety and efficacy of our techniques would require a larger multicenter study. However, we have demonstrated that a percutaneous approach can be undertaken as a first-line therapy in gastrostomy into the excluded gastric segment of patients who have previously undergone RYGBP.

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