Laparoscopic Insertion of a Percutaneous Gastrostomy Prevented Malnutrition in a Patient with Previous Roux-en-Y Gastric Bypass

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\section*{Abstract}
Bariatric surgery is a highly effective treatment option for morbid obesity. Short- and long-term effects of bariatric surgery are not limited to weight loss but include resolution of type 2 diabetes, arterial hypertension, improvement of cardiovascular health, and overall mortality. The long life expectancy of patients undergoing bariatric procedures means many of these patients will succumb to other diseases. Altered GI anatomy after bariatric procedures could prove an obstacle in treatment. We present our management of one such occurrence. The patient, who had 5 years previously undergone a Roux-en-Y gastric bypass, presented after a massive subarachnoid hemorrhage which resulted in spastic tetraplegia. He was unable to consume food and was at risk of malnutrition. A decision was made to laparoscopically create a percutaneous gastrostomy (PEG) into the excluded stomach, allowing for the use of standard feeding formula and avoiding the need for parenteral nutrition and prolonged hospitalization due to metabolic complications. The growing number of patients following bariatric procedures directs the need for novelty treatment options suited to the altered anatomy and physiology of the patient post-bariatric surgery. Prompt evaluation of long-term complications after cardiovascular events in patients operated with bariatric surgical technics reduced nutritional complications, rated hospital stay, and improved quality of life. In those patients who, due to the localization of the brain defect, are expected to be unable to feed independently due to the consequences of the latter and have either long-term or lifelong feeding through feeding tubes, it is necessary to establish an enteral feeding pathway through which the patient can receive a standard nutritional formula. This prevents the patient from developing metabolic complications and related complications. At the same time, we enable inpatient accommodation without the risk of dietary complications associated with bariatric surgery.

\section*{Introduction}
The purpose of the case report is to draw attention to the need for prompt identification and appropriate action in patients who have previously undergone bariatric surgery and who develop conditions requiring special treatment and care. Bariatric surgery is an effective method for treating morbid obesity and obesity-
related diseases. Rising trends and various surgical procedures are a reflection of the global increase in the incidence of morbid obesity. Roux-en-Y gastric bypass (RYGB) and sleeve gastrectomy became popular methods, achieving significant reduction of weight and improvement of glycemic control [1–4]. During RYGB, a large portion of the stomach is surgically excluded from the passage of food together with the duodenum and a length jejunum (usually 150 cm). This creates volume restriction of food consumption due to the small gastric pouch and proximal jejunal malabsorption due to jejunal exclusion: nutritional treatment and supplementation are mandatory to prevent general surgical and metabolic complications short and long term after surgery.

Methods/Design

Complications following such procedures range from internal hernias developing due to altered anatomy or metabolic leading to metabolic bone disease and associated increased fracture risk [1, 5]. According to data in the literature, the incidence of marginal ulcer in RYGB group is 6.28%, and 9.28% need surgical repair [6]. Outside these directly related conditions, consideration must be made to the impact of physiologic and anatomic alterations on a number of potential subsequent diseases, with both technical and metabolically related consequences. Access to the excluded stomach poses a difficulty in percutaneous gastrostomy (PEG) creation in RYGB patients (shown in Fig. 1 and Fig. 2).

Traditionally, PEG is utilized to improve quality of life and survival in patients where prolonged inability of oral food intake is expected. Among the indications of such conditions is the inability of food ingestion due to neurological disorders or malignancies.

Case Presentation

The patient presented in bariatric unit outpatient 5 years before massive cerebrovascular, with next anthropometric characteristics: BW 136 kg, BH 169 cm, BMI 47.6 kg/m², and concomitant diseases: T2DM, arterial hypertension, dyslipidemia, and muscular and bone pain. With preoperative nutritional counseling and physical activity (PA) the patient effectively lost 32 kg (BW 102 kg, BMI 36.14 kg/m², %EWL 51.51, and %BMI reduction 24.1). Optimal postoperative course with regular outpatient follow-up was efficient; at 1-year post-BS with RYGB with standard limb length, he lost 22.8 kg (BMI 28 kg/m², BW 79.2 kg, %EWL 86.06%, %BMI reduction 40.96) with complete weight loss 54.8 kg, representing and exhibiting a total remission of diabetes and arterial hypertension. Bioimpedance reviled normal lean body mass, normal bone mass, normal compartment distribution, PA 7.3° (ranged for men 6.2°–10°).

5y after Roux-en-Y patient suffered massive brain bleeding with poor long-term prognosis and definitive dependency to tube feeding. A decision was made to create a PEG to facilitate enteral feeding and prevent aspiration and malnutrition. After the decision was made to create PEG, scheduled upper GI endoscopy showed a normal esophagus and remaining small stomach pouch and was performed to exclude distal esophageal, esophago-gastric junction, gastro-jejunal anastomosis, and pouch pathology.
To prevent malnutrition due to lack of feeding formula and mandatory supplementation after RYGB and other types of BS interventions, a gastrostomy feeding tube positioned in the natural gastric remnants was indicated. After being cleared for the procedure by the anesthesiologist, the patient was operated on the same day. The procedure was carried out by the senior bariatric surgeon.

The procedure occurred under general anesthesia. Patient was placed in the French position. Previous entry points were used for trocar placement, and three trocars were inserted. Adhesions between the Roux limb and the excluded stomach were dissected, and a position in the remnant stomach with enough mobility to reach the abdominal wall was chosen for PEG creation. An opening was made in the gastric wall using electrocautery, and two rows of absorbable purse-string sutures (Vicryl 3-0, Ethicon, Raritan, NJ, USA) were placed around the opening (shown in Fig. 3 and Fig. 4). A site was chosen for PEG positioning, and a channel was made using a 5 mm trocar; a gastrostomy feeding tube (KangarooTM Gastrostomy Feeding Tube, Cardinal Health, Dublin, OH, USA) was inserted through the abdominal wall and into the stomach. The balloon was inflated using 18cc saline solution and the purse-string sutures tightened. Three absorbable sutures (Ethicon) were placed in the stomach around the feeding tube and fixed to the abdominal wall using IPOM needle. The pneumoperitoneum was released, and the sutures tightened as the abdominal cavity collapsed. The stomach was thus fixated to the abdominal wall. Care was taken to mark the depth of the gastrostomy feeding tube.

The patient was transferred back to the neurological clinic postoperatively. Tube feeding started on the day of surgery, and standard pre-pyloric feeding formula was used. No complications due to feeding formula and PEG insertion were observed during hospitalization and were discharged on postoperative day 9 to a nursing home.

Seven months after PEG implantation, another nutritional screening was performed with normal laboratory and bioimpedance results. Standard pre-prepared tube feeding formula, enriched with protein and vitamin formula in addition to standard enriched oral nutritional supplements, prevented metabolic and other complications related to poor general condition. In the initial post-ictal period, the patient ability of one- and two-syllable words gradually reduced with no meaningful contact.

**Discussion**

Alternatives to surgical insertion of PEG exist and include image-guided PEG placement and utilization of single-/double-balloon enteroscopy, but this technical option is excluded due to gastric remnant exclusion. Image-guided PEG placement utilizes either ultrasound, endoscopic ultrasound, fluoroscopy, or CT [7–9]. The procedure requires gaseous distension of the excluded stomach, which is achieved with needle puncture and may require puncture through the bowel or liver [9, 10]. The upper positioned gastrojejunal anastomosis, small gastric pouch, and proximal jejunal exclusion due to the malabsorptive part of RYGB disable percutaneous technics for...
PEG placement [11]. Moreover, pre-pyloric feeding and supplementation are highly recommended in the cohort of patients; short-time nasogastric tube feeding is a transient therapeutic option, and nutritional screening is mandatory to prevent metabolically related complications, leading to the increase of all overall complications, i.e., pneumonia, luminal perforation, pressure ulcers, stress ulcer bleeding, repetitive aspiration, and epistaxis [7, 11]. In the literature review by Jaafar et al. [9], a clear conclusion was that gastrostomy feeding is associated with a greater 4-month complication-free survival and, second, lower tube-related complications compared with long-term nasogastric feeding [8, 12].

In a series of 41 procedures reported covering 13 years’ period by Shaikh et al. [13], clear windows of puncture were achieved in 85%, the success rate for the procedure was 95%, and 4 patients reported major complications (9.8%); major complications including early tube dislodgement with peritonitis, intractable pain, and upper gastrointestinal bleeding [9, 10] showed a 100% success rate, but 7 out of 10 reported cases required needle insufflation through either small bowel, colon, or liver [11].

Endoscopic PEG placements were achieved using single- or double-balloon enteroscopy. The technique comprises a series of enteroscope, overtube, and balloon maneuvers to achieve further range than standard enteroscopy [12]. The procedure is technically demanding and requires specialized equipment and personnel. A report of 23 cases showed only a 70% success in reaching the excluded stomach and a 69% success rate in placing the PEG [13]. Based on our experience, laparoscopically assisted PEG (LAPEG) is technically less invasive, requires shorter operative time, reduces the possibility of damage to adjacent organs due to direct visibility, and enables interoperative testing for possible leakage. Besides, laparoscopy allows simultaneous resolution of possible adhesions, correction of internal hernia, and examination of the small intestine in terms of resolution of adhesions.

LAPEG is a minimally invasive and safe procedure. Several studies showed a 100% surgical technic success rate and no postoperative complications, although one study reported an intraoperative small bowel lesion [11–13].

The main difference in LAPEG creation in the excluded stomach is the lack of intraoperative enteroscopy. According to the study of Pih et al. [14], PEG is a relatively safe and feasible procedure; early mortality rate is associated with platelet count <100,000/μL, level of CPR ≥5 mg/dL, and malignancy. The same study reviled a lower early mortality rate in the neurologic disease groups, including dementia, Parkinson’s disease, neuromuscular disease, and hypoxic brain damage [14].

Minimally invasive 3-trocar procedure safely overcomes this limitation, and that LAPEG into the excluded stomach will show similar results regarding complications. The decision to choose LAPEG versus other methods is even clearer in RYGB patients due to the technical difficulties of enteroscopic or image-guided procedures. Limited availability of required facilities for these procedures will further tip the scale toward LAPEG and implementation of LAPEG technics with standard procedures. This minimal surgical technique is also important in the care of anastomotic leaks at the level of gastrojejunal anastomosis and addresses early enteral feeding that is superior to parenteral nutrition and allows home facilities. Additionally, importantly, in a study conducted by Elke et al. published in 2016, it was shown that enteral feeding decreases infectious complications and ICU LOS, due to the benefit of reduced macronutrient intake rather than the enteral route itself. However, importantly, early enteral feeding, pre-pyloric with an adapted formula due to BS medical history, allows early transfer to inpatient facilities or home care [15, 16].

The technical aspects of the procedure should further be addressed as more results are available. Points of specific interest are the need for purse-string sutures and gastropexy, which has been the subject of some debate in LAPEG patients [12]. Further studies are needed to compare these methods in terms of morbidity, mortality, and cost-effectiveness.

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Statement of Ethics

Written informed consent was obtained from next of kin, the daughter of a deceased patient. Before that, we explained in detail the purpose of the presentation and the pictures for the publication. This study protocol was reviewed and approved by KME, approval No. 0120-398/2021/16.

Conflict of Interest Statement

The authors have no conflict of interests to declare.
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Author Contributions

T.P. and J.S. equally contributed to case report design and preparation.

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