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Functional Roux-En-Y Gastric Bypass With Diverted Sleeve Gastrectomy (FRYGB-DSG) As A Proposal For Obesity And Gerd After Fundoplication: New Concept

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ABSTRACT

Gastroesophageal reflux disease (GERD) is a widespread health issue, often managed surgically by fundoplication in non-obese patients unresponsive to medical treatment. With obesity rates rising globally—closely associated with increased GERD—morbidly obese patients with prior fundoplication have become more prevalent. While Roux-en-Y gastric bypass (RYGB) addresses both obesity and GERD, its main drawback is the exclusion of the stomach and duodenum from future endoscopic access, posing risks in patients predisposed to gastric cancer. This case series evaluates a novel surgical approach— Functional Roux-en-Y Gastric Bypass with Diverted Sleeve Gastrectomy (FRYGB-DSG)—which anatomically mimics transit bipartition and functionally resembles RYGB, while maintaining access to the entire gastrointestinal tract. Three patients with prior Nissen fundoplication developed morbid obesity: one had GERD relapse and hiatal hernia, the others were asymptomatic (one with a small hiatal hernia). All had strong family histories of gastrointestinal cancer and declined procedures that would exclude GI segments. GERD was assessed through validated questionnaires and endoscopy. The FRYGB-DSG technique involved dismantling the fundoplication, repairing hiatal hernia (if present), crura adjustment and performing a sleeve gastrectomy, initiated 3 cm from the pylorus, followed by a wide antral wedge resection and a Roux-en-Y gastroileostomy, favoring alimentary flow via the anastomosis. The biliopancreatic limb was 40% of total intestinal length and the alimentary limb was 80 cm long. All surgeries were performed by a single surgeon, with 12 months of follow-up. Postoperatively, all patients achieved complete GERD symptom resolution, no endoscopic signs of esophagitis, with comparable weight loss to standard RYGB. FRYGB-DSG may thus provide an effective alternative for morbidly obese patients with prior fundoplication, without gastrointestinal exclusions. Further studies are necessary to validate these findings.

Keywords

Bariatric Surgery, Jejunum Gastric Bypass, Revisional Bariatric Surgery, Roux-en-Y Gastric Bypass, Sleeve Gastrectomy.

Introduction

Obesity is rapidly increasing worldwide and represents a significant threat to individual health. Visceral obesity is particularly common in certain ethnicities and increases the odds of developing hiatal hernia (HH) and GERD [1]. Laparoscopic HH repair with fundoplication is a safe and effective procedure, in non-obese patients [2]. Although some authors have reported its effectiveness in patients with excess weight [3], there is a tendency toward increased failure rates of all types of valves in obese individuals [4]. RYGB has been shown to improve GERD symptoms in the obese population and is commonly performed as a stand-alone procedure, being considered the most effective bariatric approach in this scenario [5]. RYGB has also been recommended as a reasonable revisional surgery for patients who have previously undergone fundoplication and subsequently developed obesity, with or without HH/GERD recurrence [6,7]. However, in populations with a higher risk of gastric cancer, this operation can present a problem, as transoral endoscopic evaluation of the remnant stomach is hindered. In such cases, removal of the gastric remnant has been recommended by some authors [8,9].

In this case report, we address three individuals who had previously undergone Nissen fundoplication while lean and subsequently developed morbid obesity, one of whom had GERD recurrence. All three individuals had a strong family history of gastrointestinal cancer and declined gastrointestinal exclusions, due to concerns about cancer risk. The patients were evaluated clinically through a validated GERD questionnaire [10] and endoscopically, for HH and erosive esophagitis (Los Angeles classification) [11]. Given this scenario, a novel revisional surgical approach was proposed to treat GERD and obesity without excluding gastrointestinal segments [12,13]. The surgical technique consisted of fundoplication takedown and HH repair (if present), with appropriate crural adjustment. SG was performed, starting 3 cm proximally to the pylorus and extending to the His angle, resecting the previous wrap tissue, 1 to 2 cm lateral to the esophagus. To decrease intragastric pressure, a 3 cm wedge resection was made on the anterior gastric wall, near the pylorus. A wide gastroenterostomy in a Roux-en-Y configuration was created at this site. This anastomosis was intended to divert the alimentary flow away from the pylorus, allowing food to pass directly to the intestine and creating a functional duodenal exclusion, as well as a decompressed gastric pouch. This configuration is termed FRYGB-DSG and aims to preserve endoscopic accessibility to the duodenum, without excluded segments. The BPL was set at 40% of TLL, to obtain the metabolic advantages of long BPLs [14] and to achieve outcomes like those reported for long-pouch RYGB, with extended biliopancreatic limb, regarding weight loss, GERD control and comorbidity resolution [15]. One-year postoperative assessment included a validated reflux symptom questionnaire and endoscopic evaluation. Weight loss (based on the percentage of total weight loss - %TWL) and comorbidity control were also evaluated.

Figure 1 (A, B C) provides a schematic overview of the final anatomical configuration, following the Functional Roux-en-Y Gastric Bypass with Diverted Sleeve Gastrectomy (FRYGB-DSG). This illustration highlights the previous Nissen Fundoplication (A), the formation of the gastric pouch through sleeve gastrectomy (B), the position and dimension of the gastroileostomy relative to the pylorus and the preservation of anatomical and endoscopic access to the pylorus and duodenum (C). The figure aims to facilitate the understanding of the technical steps and the unique features of this surgical approach.

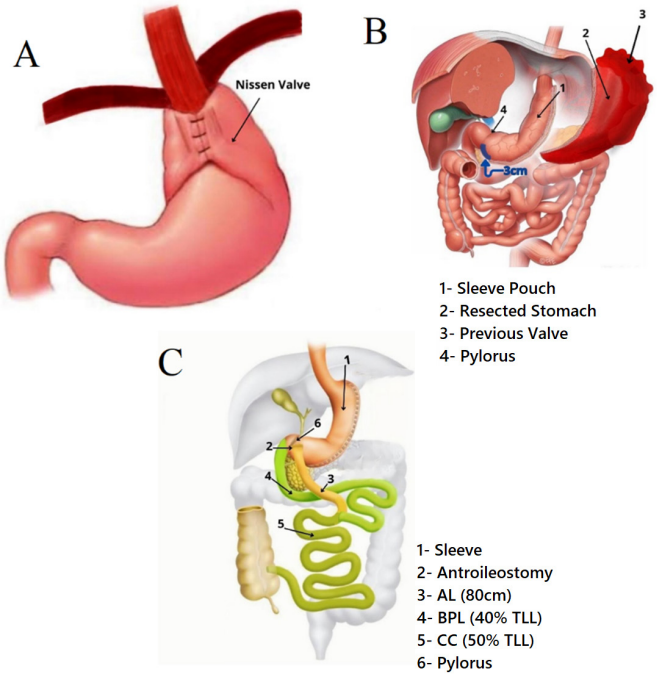

Figure 1: Schematic Representation of Anatomical Reconstruction After Functional Roux-en-Y Gastric Bypass with Diverted Sleeve Gastrectomy (FRYGB-DSG).
Legend: Schematic representation of the postoperative anatomy following FRYGB-DSG. A: Previous Nissen fundoplication; B: Creation of the gastric pouch by sleeve gastrectomy; C: Final configuration showing the gastroileostomy's position in relation to the pylorus, with preserved access to the pylorus and duodenum; AL: Alimentary Limb; BPL: Biliopancreatic Limb; CC: Common Channel; TLL: Total Limb Length.

Cases Report

Table 1 summarizes the baseline characteristics, surgical details and postoperative outcomes of the three patients included in this case series. All patients were female and had previously undergone Nissen fundoplication, while with normal BMI. Subsequently they developed morbid obesity, with or without GERD recurrence. Comorbidities included pre-diabetes, hypertension and hepatic steatosis. Pre- and 1-year postoperative GERD symptoms, endoscopic findings, radiological assessments, key anthropometric measurements and %TWL are detailed for each case. This enables a clear comparison of clinical evolution and outcomes associated with the Functional RYGB with DSG (FRYGB-DSG).

The three individuals underwent surgery between March and November 2023. All were evaluated pre- and postoperatively with validated GERD questionnaires [10]. Preoperative endoscopy assessed hiatal hernia—measuring the distance between the esophagogastric mucosal transition and crura constriction during endoscope retrieval—esophagitis, according to the LA classification [11], and valve anatomy (Figure 2).

Table 1: Patients Characteristics and Outcomes.

Characteristics	Case 1	Case 2	Case 3
Sex / Age	Female / 44y	Female / 64y	Female / 59y
Initial Nissen Fundoplication	4 years before	15 years before	15 years before
Weight (at Fundoplication, kg)	72	63	75
Height (m)	1.67	1.58	1.68
BMI (at Fundoplication, kg/m²)	25.89	25.30	26.59
Validated GERD Questionnaire	Total score = 0	Total score = 0	Total score = 39
Pre-Op Symptoms (before conversion)	No GERD symptoms	No GERD symptoms	GERD symptoms recidivism (heartburn, dysphagia)
Pre-Op Endoscopy	No HH, no esophagitis, proper valve	Grade I HH, no esophagitis, Nissen migration, mild pangastritis	Grade I HH, grade C esophagitis, proper valve
Pre-Op Comorbidities	OSA, Pre-diabetes (Metformin 1g/daily), hypertriglyceridemia (Ciprofibrate 100mg/daily), moderate steatosis	Pre-diabetes (Metformin 1g/daily), hypertension (Candesartan 16mg/daily), moderate steatosis	Pre-diabetes (Metformin 500mg/daily), hypertension (Olmesartan 20mg/daily), severe steatosis (no fibrosis)
Weight (Pre-Conversion, kg)	102	93	111
BMI (Pre-Conversion, kg/m²)	36.69	38.15	42.36
Surgery Performed	FRYGB-DSG	FRYGB-DSG	FRYGB-DSG
12-Month Follow-Up			
Weight (kg)	59.5	53	69.5
BMI (kg/m²)	21.40	21.28	24.64
%TWL (Total Weight Loss)	41.66%	43.01%	37.83%
Comorbidities Outcome	Resolution, ↓ hypertriglyceridemia (½ dose of medication)	Resolution	Resolution, except mild steatosis
Validated GERD Questionnaire	Total score = 0 No GERD symptoms	Total score = 0 No GERD symptoms	Total score = 0 No GERD symptoms
Post-Op Endoscopy	No esophagitis/HH, sleeve pouch, 3 cm GEA, spastic pylorus, pervious	No esophagitis/HH, sleeve pouch, 3.5 cm GEA, spastic pylorus, pervious	No esophagitis/HH, sleeve pouch, 3 cm GEA, spastic pylorus, pervious
Location of Gastroenterostomy	1 cm proximal to pylorus	1.5 cm proximal to pylorus	1.5 cm proximal to pylorus
Post-Op Radiology	No HH, no pouch dilation, no contrast to duodenum (Grade 0)	No HH, no pouch dilation, contrast to GEA only, no to duodenum (Grade 0)	No HH, no pouch dilation, contrast to GEA only, no to duodenum (Grade 0)

y= years old; HH = hiatal hernia; OSA = obstructive sleep apnea; GEA = gastroenterostomy; %TWL = percent total weight loss.

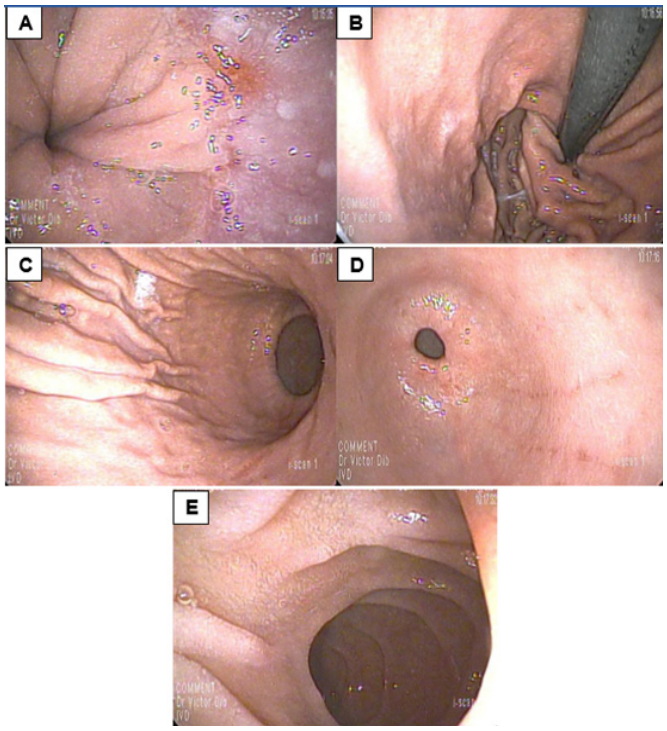

Figure 2: Preoperative Endoscopic Assessment of Hiatal Hernia, Esophagitis, and Valve Anatomy.
Legend: Endoscopic images demonstrating preoperative evaluation of hiatal hernia (measured by the distance between the esophagogastric mucosal transition and crural constriction during endoscope withdrawal), esophagitis graded by the Los Angeles classification, and the anatomy of the esophagogastric valve. A: Small HH / Grade C esophagitis; B: A loose Nissen wrap; C: Gastric Corpus; D: Antrum and Pylorus; E: Duodenum.

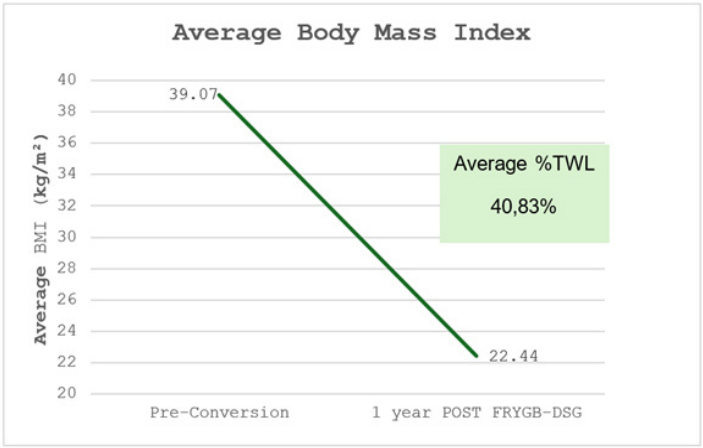

Figure 3: Average in Body Mass Index (BMI) Before and After Conversion to FRYGB-DSG and Average Percentage of Total Weight Loss (%TWL).
Legend: Average of the pre-conversion and post FRYGB-DSG BMIs of the 3 cases and average of the total percentage of weight loss (%TWL).

One patient presented moderate GERD symptoms, requiring frequent PPI use, along with a small hiatal hernia and grade C erosive esophagitis. The other two were asymptomatic and free from esophagitis, though one had a small hiatal hernia.

The surgical procedure consisted of valve takedown, hiatal hernia and crura repair if required (no mesh used), followed by sleeve gastrectomy along the greater curvature, preserving 3 cm of the antrum and removing the previous fundoplication. A 32 Fr bougie was used to guide stapling. A single-layer, wide, manual gastroileostomy in the antrum was added, using absorbable continuous running suture, after excising a 3 cm round wedge of the anterior gastric wall, 1 cm distant from the pylorus. The reconstruction was performed by a Roux-en-Y configuration. Total intestinal length was measured, a 40% biliopancreatic limb length (BPL) was created, and an 80 cm alimentary limb (AL) was adopted. Mesenteric defects were closed with non-absorbable running sutures.

Postoperative follow-up was 12 months and comprised both, clinical (validated questionnaire) and endoscopic assessment (hiatal hernia presence, erosive esophagitis per LA classification).

After one year, the patient with preoperative reflux and grade C esophagitis showed complete remission of GERD symptoms and esophagitis. The other two individuals remained asymptomatic. All hiatal hernias were successfully repaired. Average %TWL was 40.83%, with complete control of comorbidities, except for one case with improved, but persistent, hypertriglyceridemia and hepatic steatosis (Figure 3). These outcomes are consistent with those reported for long-pouch RYGB, in the literature.

Figure 4 displays the changes in body mass index (BMI) observed in the three patients, before and after conversion to FRYGB-DSG. The chart illustrates the significant reduction in BMI, 12 months after the revisional surgery, in this patients cohort.

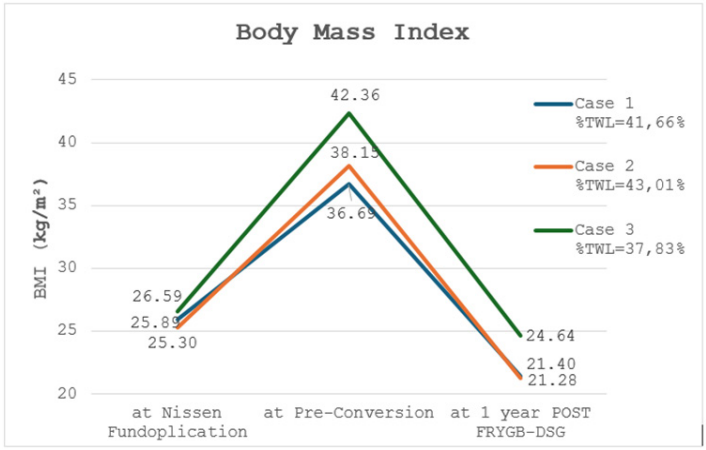

Figure 4: Changes in Body Mass Index (BMI) Before and After Conversion to FRYGB-DSG and Percent of Total Weight Loss (%TWL).
Legend: Body mass index (BMI) values of the three patients are depicted at Nissen Fundoplication, before (preoperative) and 12 months after conversion to Functional Roux-en-Y Gastric Bypass with Diverted Sleeve Gastrectomy (FRYGB-DSG), demonstrating a substantial reduction following the revisional procedure.

Endoscopically, the gastroileal anastomoses remained widely patent, 1 to 1.5 cm proximal to the pylorus, with no marginal

ulcers; the pylorus was completely spastic in all cases, but still allowed endoscopic passage and duodenal access (Figure 5).

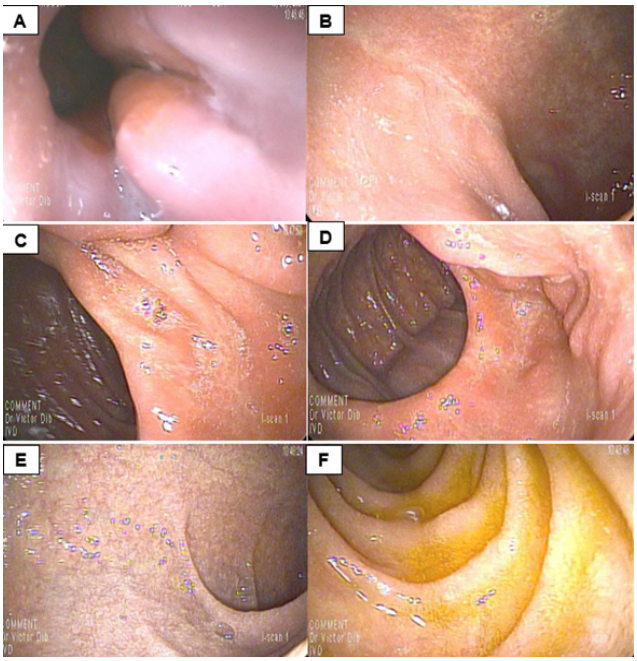

Figure 5: Endoscopic Findings after FRYGB-DSG: Patent Gastroileal Anastomosis and Preserved Duodenal Access.

Legend: Representative endoscopic image showing a widely patent gastroileal anastomosis, located 1 to 1.5 cm proximal to the pylorus. The pylorus remains spastic but allows endoscopic passage and visualization of the duodenum. A: Esophagogastric transition; B: Sleeve pouch; C: Gastroentero anastomosis + spastic pylorus; D: Gastroentero anastomosis + spastic pylorus; E: Duodenum; F: Ileum.

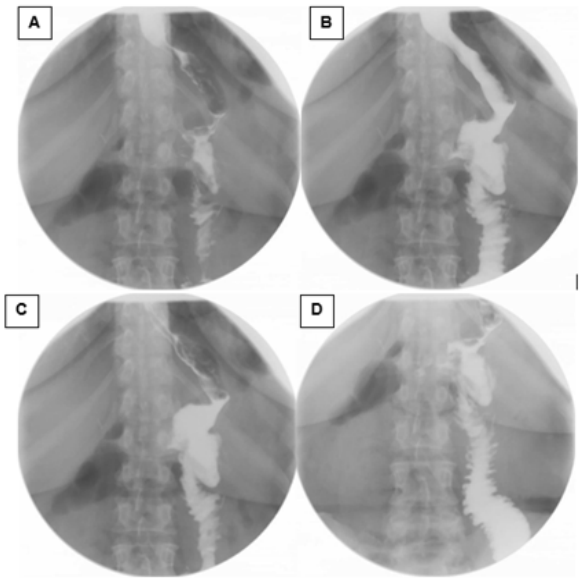

Figure 6: Radiological Contrast Study Showing Duodenal Exclusion and Gastroileostomy Patency.

Legend: Postoperative radiological examination using 300 ml of barium contrast demonstrates complete exclusion of the duodenum, with all contrast medium passing exclusively through the gastroileostomy, confirming the patency of the anastomosis. A: Esophagogastric Transition; B: Sleeve Pouch full of contrast; C: No contrast through pylorus; D: Free passage of contrast to the ileum.

Radiological contrast studies (300 ml of barium solution) demonstrated complete duodenal exclusion in all patients, where no contrast passed through the gastroileostomy (Figure 6). To describe contrast passage through the pylorus, the following grading was used:

- Grade 0: No contrast passing into the duodenum;
- Grade 1: Contrast restricted to the duodenal arch;
- Grade 2: Contrast beyond the Treitz ligament, not reaching the entero-enterostomy (JJ);
- Grade 3: Contrast passing through the entero-enterostomy.

Discussion

GERD is a highly prevalent disease and is even more frequent among obese individuals, particularly those with visceral obesity, due to elevated intra-abdominal pressure [16]. Most patients with GERD are effectively managed with acid-suppressive medications such as PPIs and P-CABs [17]. However, some cases require continuous medical therapy and lifestyle modifications, which not all patients adhere to, resulting in impaired quality of life and progressive esophageal mucosal damage, potentially evolving into Barrett's esophagus or esophageal adenocarcinoma (18). Poor responders to medical therapy can be identified clinically, endoscopically, or through physiological esophageal evaluation [19,20]. For such patients, surgery—typically laparoscopic fundoplication with various wrap techniques—is the best option [21]. Outcomes are most favorable in lean patients, though some studies have demonstrated sustainable results after weight gain [3,22]. Nevertheless, obesity negatively impacts fundoplication results, increasing the risk of hiatal hernia and GERD recurrence [23]. In this case series, we evaluated three individuals who developed morbid obesity, after fundoplication. Two patients developed hiatal hernias, but only one experienced clinical and endoscopic recurrence of GERD, after initial improvement.

Patients with prior fundoplication who become obese—regardless of reflux recurrence—are generally best treated with conversion to RYGB, which addresses both, obesity and GERD [7,24]. RYGB aids in reflux control through significant weight loss, lowering intra-abdominal pressure, and by creating a small gastric pouch, that reduces acid production and the pressure over the lower esophageal sphincter, while also diverting bile content [25]. However, persistent or de novo GERD after RYGB has been reported in 15–25% of cases [26,27]. The present report proposes and evaluates an alternative revisional procedure for individuals with prior fundoplication and subsequent obesity, with or without GERD recurrence. This approach aims to control GERD, by reducing gastric acid production, through approximately 80% of stomach resection (including the majority of parietal cells), accomplished by longitudinal gastrectomy, from the pylorus to the angle of His, after dismantling the previous fundoplication. Hiatal hernia repair is mandatory, if present. Preservation of the pylorus, in combination with a long, narrow, low-compliance gastric pouch, creates a high-pressure gastric chamber. To mitigate

this pressure and reduce the risk of GERD, a large gastroileostomy is made on the anterior gastric wall, close to the pylorus, after a previous wedge resection of the antrum wall. This redirects most gastric content through the anastomosis, instead of the pylorus, functionally excluding the duodenum, although minimal passage through the pylorus may still occur—a technique termed FRYGB-DSG. In the current study, the one-year postoperative radiological contrast assessment confirmed this deviation. Notably, no contrast passage through the pylorus was identified in any case (Grade 0). Due to the anatomy of antrum vagal innervation, the wedge antral resection may have influenced in pyloric motility, resulting in its spasm (28). Nevertheless, a gentle pressure over the endoscope allowed its passage through the pylorus in all cases, assuring duodenal papillae accessibility. Endoscopically, during a one-year FU, a wide, non ulcerated gastroileal anastomosis was observed, near a spastic pylorus, in all cases.

Some studies have highlighted potential carcinogenic risk in the excluded stomach following RYGB [29,30]. For populations with a high incidence of gastric cancer or a strong family history of gastrointestinal tumors, this risk could justify gastric remnant resection [8,9]. The FRYGB-DSG technique circumvents this issue by avoiding excluded gastric segments, thereby preserving endoscopic access for ongoing gastric surveillance. All three patients in this study had strong family histories of gastrointestinal tumors, further justifying this approach.

Anatomically, the technique described here resembles Transit Bipartition (TB), a bariatric technique which aims to balance gastric content delivery between the ileum (via gastroileal anastomosis) and the duodenum/proximal jejunum (via the pylorus) [31]. TB requires careful anatomical configuration to avoid excessive flow through the gastroileostomy, which could cause diarrhea and malnutrition, due to limited absorptive intestinal length [32]. The present proposed modification, with a wide gastroileostomy placement near a spastic pylorus, promotes substantial preferential flow through the anastomosis, decompressing the gastric chamber. Yet, the risks of malnutrition, due to the proportional 40% BPL length, seems to be low, as seen in long-pouch RYGB and OAGB [14,15,33,34]. A long biliopancreatic limb is a cornerstone of metabolic surgery, which reinforces the use of extended BPL, adopted in the proposed technique of this case report.

According to some authors, Long-Pouch RYGB may offer nutritional advantages over standard Short-Pouch RYGB, by preserving gastric cellularity and decreasing gastric empty rate, which enhances the gastric phase of digestion and may prevent dumping syndrome [14,35]. This advantage is probably kept or even augmented in FRYGB-DSG due to the particularly long pouch. No patients in this study exhibited dumping syndrome during one-year follow-up, under appropriate dietary counseling. Additionally, the possibility of little amount of food passage through the pylorus may increase micronutrient absorption. All patients maintained reasonable nutritional status with protocol-based supplementation.

A known concern with long gastric pouch associated with gastroenterostomy is the risk of marginal ulcer develpment. However, there are no substantiated studies demonstrating this, concerning various pouch sizes, in RYGB [15,35], nor in TB, where marginal ulcers are uncommon [36,37]. No marginal ulcers occurred in this FRYGB-DSG series at one-year FU, after conversion from fundoplication, probably because of substantial removal of parietal cell, during sleeve gastrectomy.

The long-term weight loss achieved with RYGB is well documented [38], contributing to reduced GERD recurrence by lowering intra-abdominal pressure. In this study, the average %TWL at one year was 40.83%, consistent with the results of long-pouch RYGB in the literature. Multiple studies highlight RYGB's efficacy in resolving comorbidities such as hypertension, diabetes, dyslipidemia, OSA and metabolic liver disease [39]. Here, complete resolution was observed in hypertension, hyperglycemia, OSA, and significant improvement in hepatic steatosis and hyperlipidemia was noted. All participants were symptom-free and off acid-suppressive medications, one year after surgery.

Limitations of this report include its retrospective design, small sample size, lack of a control group, and short follow-up period. Longer-term and comparative studies are needed to confirm the effectiveness of this surgical revision for GERD control, comorbidity resolution and weight loss maintenance, while keeping a good nutritional state. We present these preliminary results to encourage further validation through larger, controlled studies. Future research should compare FRYGB-DSG with standard RYGB, as revisional option, for patients with prior fundoplication, who develop obesity, regardless of GERD recurrence.

Conclusions

Conversion of fundoplication to FRYGB-DSG, as a revisional surgery, in individuals who develop obesity—with or without GERD recurrence—may be an effective strategy for addressing both, obesity and pathological gastroesophageal reflux, without causing anatomical exclusions of the gastrointestinal tract. Preserving endoscopic accessibility to all upper gastrointestinal segments, with no blind areas, may significantly reduce the risk of undetectable gastric cancer, especially in high-risk populations. In addition, maintaining transoral endoscopic access to the biliary and pancreatic ducts is likely to be of pivotal importance for the diagnosis and treatment of diseases, affecting these organs. The novel surgical technique, proposed in this case report, demonstrates functional similarities with conventional RYGB, particularly its long-pouch variant and may potentially reproduce its established long-term benefits, regarding weight loss, GERD control, comorbidity resolution and nutritional safety. However, to validate these findings, controlled studies, with larger samples and longer follow-up, are warranted.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this case report.

Ethics Statements

The authors confirm that informed consent was obtained from all patients involved in this study. This consent included permission to use clinical data and images for research and publication purposes, in accordance with ethical standards and patient confidentiality.

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