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How to address post-Roux-en-Y gastric bypass late dumping in a patient with a history of Nissen fundoplication converted to bypass for obesity

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ABSTRACT

Introduction: Reversal of Roux-en-Y gastric bypass (RYGB) may be indicated for possible side effects such as malnutrition, intolerance, dumping syndrome, or late dumping. Reversal can however induce significant gastro-esophageal reflux disease (GERD).

Method: We report the case of a 55years old Caucasian woman, who had undergone conversion of Nissen fundoplication performed for GERD (Grade B) into RYGB because of recurrent reflux, though Grade A esophagitis and increasing obesity (37.5 kg/m² BMI). She developed invalidating symptoms of late dumping syndrome and severe diarrhea. Pre- and postoperative evaluation an eso-gastroscope with esophagitis grade evaluation. Treatment consisted of physiologic reversal of the RYGB, by reimplantation of the alimentary limb into the remnant stomach.

Result: Pre-reversal endoscopy showed Grade A esophagitis. Oral glucose test demonstrated severe hypoglycemia persisting till 120 min post-ingestion and clinical symptoms of hypoglycemia (Whipple triad) (40 to 53 mg/dl). Three months after reversal the diagnostic tests had significantly improved, both in terms of glucose metabolism and GERD symptoms. At 22 months after surgery, the patient still did not suffer from diarrhea anymore, her glycemic profile was stable under antidiabetic medications and her BMI raised to 29 kg/m².

Discussion and conclusion: Reversal of Roux-en-Y gastric bypass by incorporation of the alimentary limb between the gastric pouch and the gastric remnant seems to successfully address the dual issue of post-RYGB late dumping and preventing GERD, the different mechanisms involved will be explained latter in this paper.

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Introduction

The obesity epidemic quite logically involves a great number of patients who benefited from metabolic-bariatric (MBS) procedures. Overall, sleeve gastrectomy and Roux-en-Y gastric bypass (RYGB) are the most commonly performed MBS operations. A substantial number of patients underwent RYGB for complex issues such as severe obesity in combination with Gastroesophageal reflux disease (GERD). Moreover, several patients who had been treated in the past by an anti-reflux procedure -most frequently Nissen fundoplication- required a revisional RYGB to address both the GERD and the weight issue.

One of the common complications of RYGB is dumping. Dumping may be early or late. The former is due to an osmotic challenge of nutrients inducing hypovolemia at the level of the alimentary limb while the latter is linked to the inappropriate/exaggerated secretion of insulin and consequently

significant symptomatic hypoglycemia. Treatment of the dumping syndrome may be attempted by medications, but the most effective treatment undoubtedly consists of reversal of the bypass construction. While effective in terms of dumping, reversal of RYGB into normal anatomy often is fraught with the development of GERD, either de novo or recurrent, described by our team some years ago [1–3]. The aim of this paper is to describe a strategy to address the issue of post-RYGB dumping syndrome while avoiding GERD.

Method

A 55years-old woman with Body Mass Index (BMI) 36 kg/m² (weight 99 Kg, h 168 cm) and suffering from treatment-refractory gastro-esophageal reflux (GERD), had benefited from a laparoscopic Nissen fundoplication in 2015. Six years later she consulted for recurrence of significant GERD symptoms

and dysphagia, though Grade A esophagitis was found in the endoscopy. Her BMI raised from 26 kg/m² at the time of the fundoplication to Grade II obesity, (current BMI of 37.05 kg/m²) and sleep apnea syndrome. After extensive preoperative work-up and after informed consent had been obtained, she underwent a conversion to RYGB, as described in the literature [4]. Six months after the RYGB, the patient started suffering from recurrent (at least 5 five times a week) and symptomatic post prandial documented hypoglycemia (glucose serum level as low as 33 mg/dl and e.g. 47 mg/dl occurring at 2 pm after a meal taken at 1 pm The day before, we note a blood sugar at 8 pm at 234 mg/dl, a meal taken at 7 pm, hypoglycemia at 9:39 pm at 57, symptomatic. Feeding also resulted in severe diarrhea. Thus, the patient developed protein malnutrition as well and her BMI fell to 18 kg/m². Other metabolic and endocrinologic causes of the patient's poor condition were excluded. None of the medications used were able to relieve the patient (Acarbose, Verapamil, Metformin, Nifedipine, and Octreotide). Because of the patient's poor quality of life, surgical management was considered. A reversal to normal anatomy was considered not to be the best option as demonstrated by the literature due to possible symptomatic and endoscopic GERD [1,2,4]. The management was initiated by placing a gastrostomy in the remnant stomach with two major goals. First, to allow the patient to regain weight. She indeed stabilized her weight and regained 0.5 BMI point. Secondly, we intended to check if rerouting the nutrients' pathway *via* the duodenal route would correct the hypoglycemia. This goal was also achieved. The parenteral feeding consisted in Peptamen (Nestlé) 500 ml/night to achieve a total intake of 1800 kcal including 89 g of proteins.

The steps of the procedure are depicted in Figure 1. They consist of and include the identification of the surgical landmarks, including the gastric pouch, the Alimentary limb (AL), the Biliopancreatic limb (BPL), and Common limb (CL) as well as the jejuno-jejunosomy (JJ), and finally the gastric remnant. The closed mesenteric defects were located and reopened. The gastrostomy was dismantled and the gastrostomy defect in the stomach was closed with a linear stapler, using a blue load (Echelon, Ethicon Endosurgery, Cincinnati OH). Next, the AL was dissected free and disconnected in its distal part. In this case, the AL was deemed of "normal" length (some 80 cm) and needed neither trimming nor lengthening before implantation in the remnant antrum (see Figure 1, drawing C). The anastomosis was performed semi-mechanically using again the linear stapler, again with the use of a blue load. The introduction opening for inserting the stapler was closed by a running suture of resorbable barbed wire (Stratafix 3/0, Ethicon, Neuilly, France). The mesenteric defects were then closed again, using non-resorbable suture material (EHMS, Novisurge, PG Achterveld, the Netherlands). No drains were placed. Trocars were removed, aponeurosis and skin were closed (Figure 2).

Results

The patient recovered quite swiftly. An upper G-I series was performed to check the permeability and the functionality of the circuit (Figure 3). Refeeding was started with water and clear liquids, followed by more solid food intake, and care being taken to restrict fast carbohydrates. Hypoglycemia and diarrhea were no longer recorded after the procedure. At 10-month follow-up, the patient was still free of all adverse symptoms.

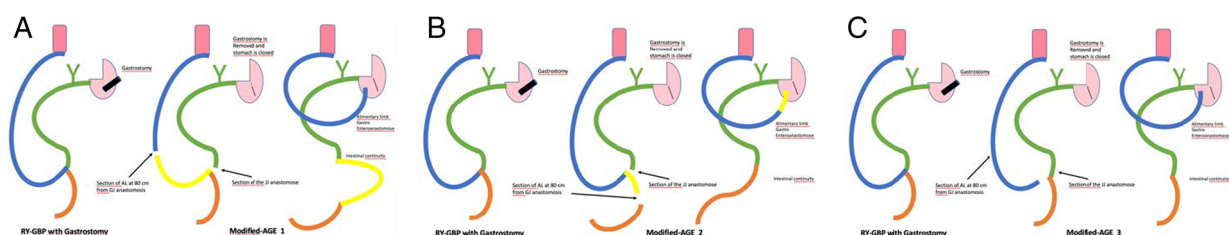


Figure 1. The 3 possible situations when performing the GERD preventing reconversion of RYGB. The aim is to keep a sufficiently long alimentary limb (in blue on the sketches), so as to avoid GERD while preventing microbial overgrowth. Picture 1A represents the artist's impression of "too long" an AL. The AL is transected proximal to the jejuno-jejunal anastomosis (JJ). Continuity is restored by separating the BPL from the JJ and re-anastomosing it to the proximal section plane of the distal end of the AL. Picture 2 B represents "too short" an AL (i.e. in terms of possible GERD). Lengthening is obtained by separation of the BPL from the JJ followed by transection of the CL well distal to the JJ. The thus lengthened AL is reimplanted in the remnant antrum. Picture 3 C depicts the situation as experienced in our case.

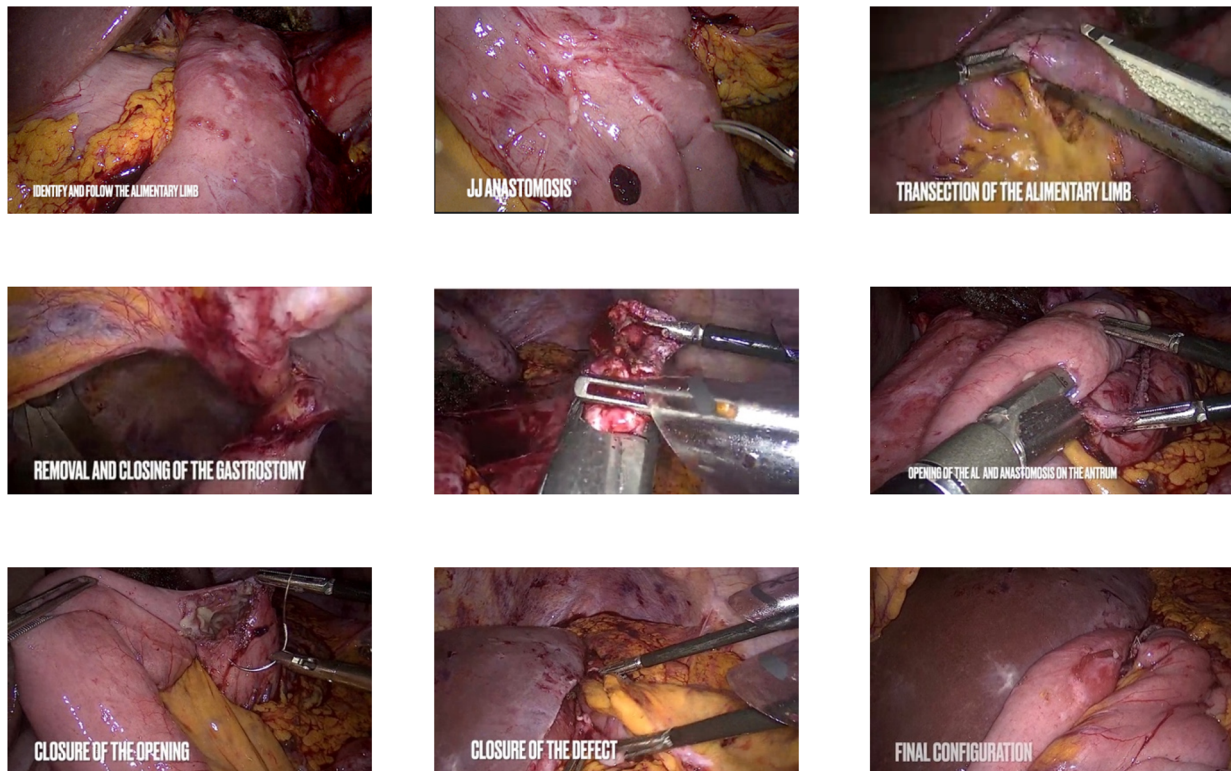


Figure 2. Intra-operative captures.

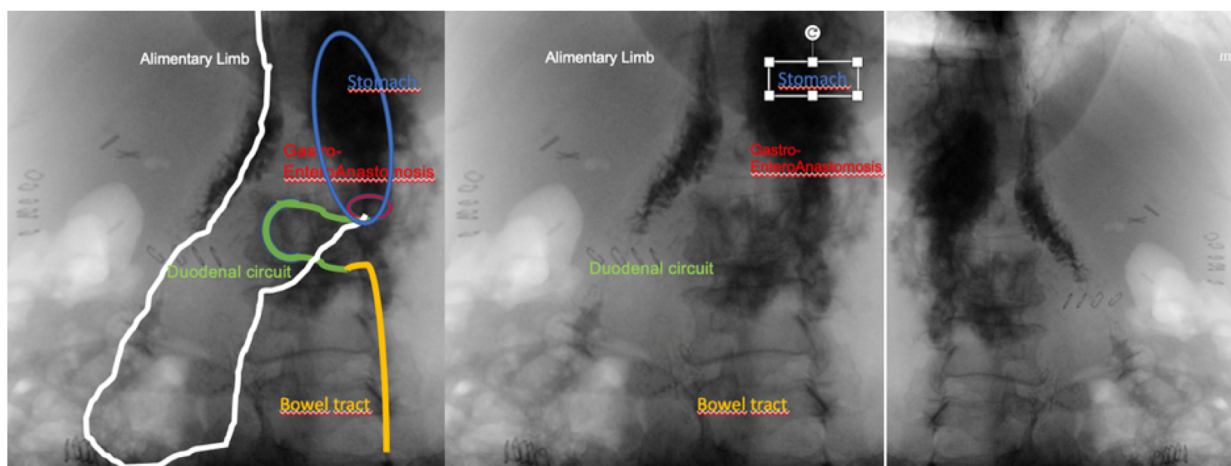


Figure 3. Upper GI series.

Discussion

One of the main advantages of the laparoscopic approach is the fact that reoperations usually are quite feasible because of the absence of adhesions. Roux-en-Y gastric bypass does not constitute an exception to this rule. Hence, whenever the need is present, reversal of the Roux-en-Y can be contemplated. Reversal can be physiological (A) [1] or anatomical (B), described by our team some years ago [2]. The former consists of rebuttal of all the effects of the bypass, the latter consists of reestablishing the anatomy in its original state. In both techniques, the gastric bypass is abolished i.e. gastro-gastrostomy is performed, whereby food

stuffs no longer bypass the duodenum. The main difference however is confined to the alimentary limb. In (A), besides the gastro-gastrostomy the alimentary limb is either resected or left untouched after severance of the gastro-jejunal anastomosis, so that the jejuno-jejunal (JJ) anastomosis only has two active components i.e. the jejunal loop (from Treitz'angle to the former anastomosis) and the former common loop. The resected or isolated part i.e. the former alimentary loop, may be neglected (i.e. removed or left as is) because this part of the bowel plays only a minor physiologic role. When rather than be resected the alimentary limb is left in place and it constitutes a bowel loop that is considered

harmless because it is not harboring nutrients or any significant digestive juices and is isoperistaltic. In (B), the gastro-gastrostomy is complemented by transecting the gastro-jejunosomy at the origin of the alimentary, separating the biliary loop from the J-J and re-anastomosing it subsequently to the origin of the alimentary. Keeping the former alimentary loop not only restores the exact pre-bypass anatomy but may have physiologic consequences that are unknown. The main unwanted side effect of reversing the Roux-en-Y gastric bypass is the prevalence of gastro-esophageal reflux disease (GERD) [3]. The cause of this condition is unknown but may be related to issues of gastric emptying possibly induced by the gastro-gastric anastomosis. Another possible explanation is dysfunction of the jejunum in case of resection of the alimentary loop or, alternatively, leaving the alimentary limb as a blind ending isoperistaltic loop of intestine. (A). The Roux-limb may contain neurologically active fibers with pacemaker-like activity that assure the harmonious contraction of this part of the bowel. Resection may interfere with this mechanism and impair the progression of nutrients distal to the former JJ. Conversely, restoring the exact anatomy may prevent dysfunction at the level of the former JJ. Consequently, it may be preferable to restore the anatomy as closely as possible to the pre-existing status to limit the risks of GERD. In this frame of mind, the alimentary limb should neither be resected nor left as a blind loop.

Patients with a history of GERD are of course at increased risk for recurrent disease. In the current case the quite common issue of suboptimal results of a fundoplication performed in an individual with obesity had been addressed by conversion to Roux-en-Y gastric bypass, which is a well-accepted strategy. Unfortunately, the patient quite swiftly developed the late dumping syndrome, a dreaded complication of the bypass procedure. Late dumping or paradoxical postprandial hyper insulinemic hypoglycemia has been extensively described in the literature. This condition's incidence is estimated between 0.2% and 0.36% according to Marsk et al. [5] and according to the ASMBS allegedly occurs in 0.1% of all post-bypass patients, and in 0.02% of post-bypass patients not taking diabetic medications [6]. In "real life" however, the prevalence of this cumbersome situation is quite higher, and the symptoms are often qualified as invalidating. Medical treatment consisting of Acarbose or Octreotide often fails, which often leaves only few other approaches to relieve the patient's symptoms. A described treatment mode consists of slowing the transit of

nutrients from the gastric pouch into the alimentary limb [7,8]. The inherent possibility of dysphagia was however refuted by the patient.

Hence, another surgical option was proposed. Laparoscopic reversal of the bypass into the pre-existing anatomy. Reversal however often induces GERD, which in this case (the patient had undergone the RYGB primarily for reflux) constituted a significant threat [9]. Hence, because the only acceptable treatment appeared to be reversal, a specific variation of reversal avoiding GERD symptoms had to be thought of. The strategy consisted of first, checking that the reversal maneuver would indeed generate significant improvement of the late dumping syndrome. Gastrostomy is a well-documented approach because it allows to undo the effects of the RYGB by replacing the distal stomach and duodenum in the alimentary cycle. While the gastrostomy is not an innocuous procedure, it allows us to demonstrate beyond doubt that reversal of the RYGB would alleviate the dumping syndrome. In the case under study, the gastrostomy indeed significantly improved the late dumping symptoms which opened the path towards reversal.

In this situation, however, reversal to "normal anatomy" carried a greater than usual risk of inducing GERD, considering the history of Nissen that had preceded the RYGB. Hence, we had to investigate an alternative strategy that would combine reversal and avoidance of reflux induction. This double goal was achieved by keeping the gastro-enteral anastomosis and the alimentary loop as constructed but transecting the distal end of the alimentary loop with the JJ and reimplanting the distal end of the alimentary to the gastric remnant. While this construction reinstalled a normal route for nutrients (i.e. no bypass of the duodenum and proximal jejunum), the interposition of an isoperistaltic loop of bowel (i.e. the alimentary loop) between the gastric pouch and the remnant was intended to constitute in addition an effective barrier against GERD. In this case, the combination of physiologic reversal of RYGB to a normal pathway for nutrients, completed by the interposition of an "anti-reflux" loop succeeded in addressing a double pathology: treating the late dumping syndrome and preventing the GERD occurrence issue.

The correct length of the Roux limb is a critical factor in our technique. Longer Roux limbs may facilitate bacterial overgrowth, which is a cumbersome issue that may require surgical correction [10]. For this very reason, we carefully measured the length of the AL and were ready to adjust as explained in Figure 1.

The measured length of 80 cm was deemed adequate. At 24 months after surgery, the patient was and felt better. She still did not suffer from diarrhea anymore; her glycemic profile was stable under anti-diabetic medications and her BMI raised to 29 kg/m².

Conclusions

This patient suffered from a complex and resistant pathology that demanded tailor-made treatment. So, as to address the current post-RYGB postprandial hypoglycemia in the presence of a history of GERD, we decided to perform a functional reversal of the bypass that would imply a safety measure against the re-development of GERD. We think the incorporation of the Roux limb in the process of reconversion has the advantage of simplicity, whilst minimizing the risks of either occurrence or further worsening of GERD that are inherent with other techniques of (functional or anatomic) reversal. Hence, we called this technique "GERD preventing reconversion of RYGB" in GERD-prone individuals suffering from severe late dumping. Further evaluation on a greater number of patients and with a longer follow-up are of course needed before final conclusions can be drawn. Yet at an appreciable delay from the final procedure, 2 years, we can state that all the initial target goals, resolution of hypoglycemia, food tolerance, correction of diarrhea, weight regain, better quality of life, were obtained.

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