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Sleeve Gastrectomy with Duodenal Transit Bipartition (S-DTB): Preliminary Results and Technical Aspects of Its Metabolic Structure

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Abstract

Obesity is a significant and escalating health issue both in Brazil and globally, with over 650 million overweight adults worldwide. The treatment of obesity can be performed clinically, endoscopically or surgically; surgical treatment proves to be safe and more effective in terms of weight loss and long-term maintenance. **Objective:** This study aimed to monitor the progress of weight loss and comorbidity control in patients undergoing sleeve gastrectomy with duodenal bipartition. **Methods:** This pilot project involved 8 patients divided into 2 arms. In the first arm, patients underwent sleeve gastrectomy with Roux-en-Y duodenoileal transit bipartition (S-RYDITB), while in the second arm, patients underwent sleeve gastrectomy with Roux-en-Y duodenojejunal transit bipartition (S-RYDJTB). Both procedures involved Roux-en-Y reconstruction without duodenal exclusion. In S-RYDITB, the duodenal-ileal anastomosis was performed 300 cm from the ileocecal valve (ICV), creating a 250 cm common channel and a 50 cm alimentary channel. In S-RYDJTB, a biliopancreatic loop was created 200 cm from the angle of Treitz, with a 1 m alimentary channel. **Results:** Five patients underwent the procedures, with one undergoing S-RYDITB and four undergoing S-RYDJTB. No adverse events such as hospitalizations, readmissions, reoperations, fistulas, bleeding, pulmonary embolism, diarrhea, dumping syndrome, or hypoglycemia occurred during the study period. The mean length of hospital stay was 2 days. The average BMI decreased from 37.27 kg/m^2 preoperatively to 29.48 kg/m^2 after 6 months. The significant percentage of weight loss was 21.22%, with excess weight loss of 63.6%. Ninety-five percent remission of comorbidities, including hypercholesterolemia, hypertriglyceridemia, diabetes, hypertension, steatosis, and pre-diabetes. Two patients underwent sleeve gastrectomy with duodenal bipartition using a single anastomosis. **Conclusion:** Duodenal switch surgery has gained worldwide recognition for its safety and efficacy in treating obesity and its associated comorbidities. In efforts to maintain the positive outcomes of the classic technique while minimizing adverse effects such as malnutrition and diarrhea, modifications to the original procedure have been proposed. Among these adaptations, Sleeve gastrectomy with duodenal transit bipartition (S-DTB) emerges as a promising variant, offering alternative strategies to optimize patients' nutritional safety while preserving endoscopic access to the duodenum. Initial results of S-DTB, whether performed in Roux-en-Y or single anastomosis (loop) configuration without intestinal exclusions, demonstrate the procedure's safety and effectiveness in managing obesity and its comorbidities.

Keywords

Obesity, Bariatric Surgery, Metabolic Surgery, Duodenal Switch

1. Introduction

Obesity has had a significant increase in Brazil and in the world; today there are more than 650 million overweight adults in the world. Obesity brings with it comorbidities, including type 2 diabetes, hepatic steatosis, hypertension, cancer and others.

The treatment of obesity can be clinical, endoscopic and surgical. Surgical treatment, represented by bariatric and metabolic surgery, is safe and more effective in terms of weight loss and long-term maintenance.

Duodenal switch [1] [2] is one of the surgical procedures used in the surgical treatment of obesity and its comorbidities. This procedure associates a sleeve gastrectomy, with preservation of the pylorus, to a roux y ileal duodenum bypass with a common channel of approximately 100 cm, characterizing the malabsorption part of this procedure, also including the duodenal exclusion from the first duodenal portion.

This procedure has proven to be effective in the treatment of obesity and its comorbidities, especially in the control of type 2 diabetes [3] [4] [5].

However, due to the intestinal malabsorption component of the duodenal switch, some patients may present complications related to increased intestinal frequency, anemia, malnutrition, among others that, when aggravated, are difficult to control [1] [2].

In view of the complications described above, some authors proposed adaptations to the classic duodenal switch in order to minimize the adverse effects caused by malabsorption, however, maintaining the satisfactory results in weight loss and comorbidities. Among these proposals, we have the intestinal transit bipartition [6] SADIS (Single anastomosis duodenal ileal bypass with sleeve gastrectomy) [7] [8] ileal interposition [9] [10] and SADJB-SG (Single anastomosis duodenal jejunal bypass with sleeve gastrectomy) which is a modification of the duodenal switch with jejunal duodenal anastomosis [11] [12].

In the present study we propose the adaptations in the classic Duodenal Switch applying metabolic concepts and adding other concepts that we consider inherent to the duodenal transit bipartition.

Unlike classical bariatric procedures that were devised before this knowledge was available and therefore were based on mechanical restriction, intestinal malabsorption, or a mixture of both, mechanical restriction and malabsorption are obviously non-physiological, and a physiological metabolic procedure should not include these features, nor use prostheses, nor create excluded segments. An ideal surgical procedure should maintain gastric, duodenal, jejunal, and ileal functions. In addition, it would be interesting to create a functional smaller stomach that would signal earlier with distension, since modern diets are more caloric. In addition, in case of obesity, decreasing fasting ghrelin levels and increasing GLP-1 and PYY, 2, 3 secretion would be it is interesting [13] [14] [15] [16] [17].

The first duodenal bipartition performed in our service was performed approximately 15 years ago [18]. The author follows a line of study in classic bariatric surgery techniques proposing adaptations aimed at maintaining the physiological anatomy of the digestive tract, defending mainly the non-exclusion of gastrointestinal portions [19] [20].

2. Material and Methods

This study was approved by the ethics committee of UNIFAN-Alfredo Nasser University, CAAEE 64578222.9.0000.8011, with Professor Paulo Reis Esselin de Melo as main researcher.

This is a pilot project with 8 patients and 2 arms. The arms were stratified based on BMI and underwent one of the specific types of anastomoses, duodenojejunal or duodenoileal, with the aim of safeguarding patients. Patients with grade 1 and grade 2 obesity (BMI between 30 and 39.9 kg/m^2) underwent duodenaljejunal anastomosis and patients with grade 3 obesity (BMI greater than or equal to 40 kg/m^2) underwent greater intestinal diversion through duodenoileal anastomosis. In the first arm there are patients undergoing sleeve gastrectomy with Roux-en-Y duodenoileal transit bipartition (patients with BMI greater than or equal to 40 kg/m^2), which we will henceforth call S-RYDITB, and in the second arm, sleeve gastrectomy with Roux-en-Y duodenojejunal transit bipartition (patients with BMI between 30 and 39.9 kg/m^2 who have indication for bariatric and/or metabolic surgery) which we will henceforth call S-RYDJTB. To refer to the general the procedure, we will use S-DTB (sleeve gastrectomy with duodenal transit bipartition).

The reconstruction of intestinal transit in the two proposals is in Roux-en-Y and without duodenal exclusion. In S-RYDITB, the ileal duodenal anastomosis will be done at 300 cm from the ileocecal valve (ICV), creating a 250 cm common channel and a 50 cm alimentary channel (**Figure 1**). In S-RYDJTB there will be a biliopancreatic loop 200 cm from the angle of Treitz and a 1 m alimentary channel (**Figure 2**). The surgical procedures were performed by videolaparoscopy with stapled anastomosis. We also use advanced energy forceps, 60 mm staple loads and laparoscopic staplers from the company Scitech®. The anastomosis is approximately 4 to 4.5 cm in size and was made side to side in the first portion of the duodenum.

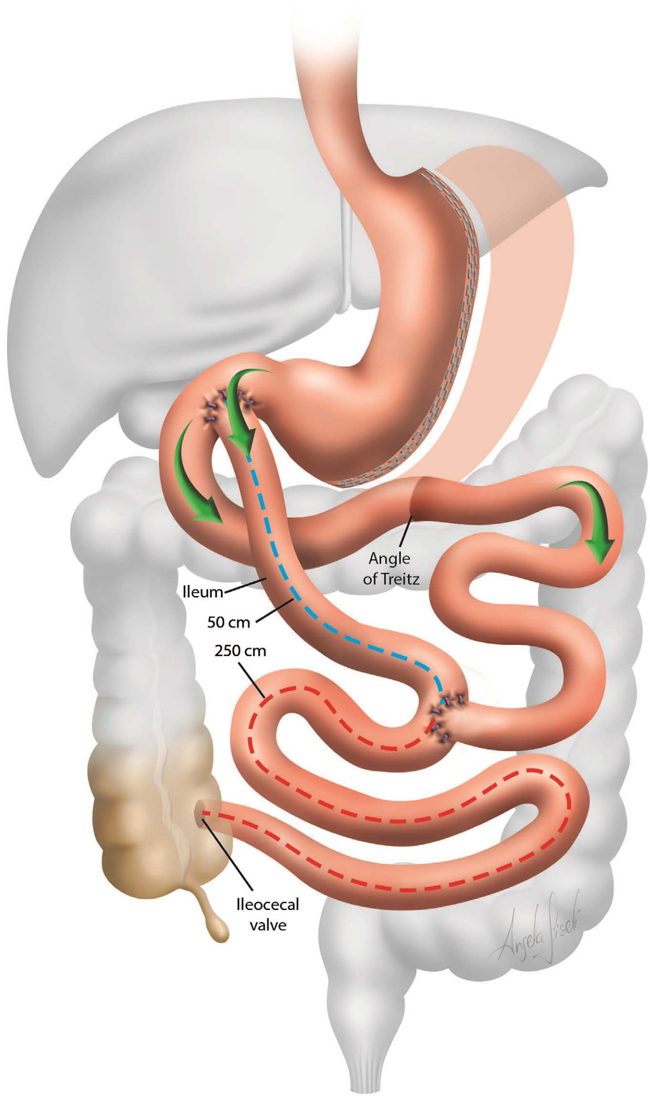


Figure 1. S-RYDITB-Sleeve gastrectomy with Roux-en-Y duodenoileal transit bipartition.

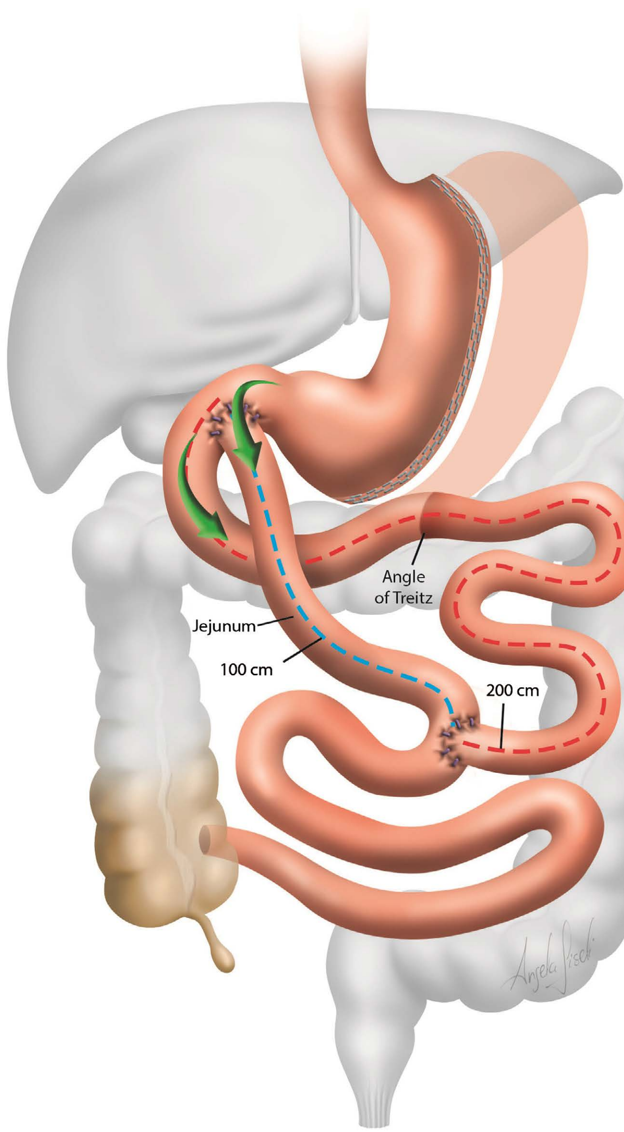


Figure 2. S-RYDJTB: Sleeve gastrectomy with Roux-Y duodenojejunal transit bipartition.

3. Results

The procedures have been performed in 5 patients so far, 01 from the S-RYDITB group and 04 from the S-RYDJTB group. There were no deaths, readmissions, reoperations, fistulas, bleeding, pulmonary embolism, diarrhea, dumping, hypoglycemia, or ulcers to date. The length of stay was 2 days. Due to intraoperative clinical conditions, the medical team decided to shorten the surgical time in 2 patients, performing the procedure in a single anastomosis (S-OADTB-Sleeve gastrectomy with one anastomosis and duodenal transit bipatition), similar to SADI-S (**Figure 3** and **Figure 4**). As it was an intraoperative decision and not part of the initial plan, we do not have a comparative analysis between the single anastomosis and the Roux-en-Y anastomosis. What we have observed is that to date, patients who have undergone sleeve gastrectomy with duodenal transit bipartition in a single anastomosis are also progressing favorably.

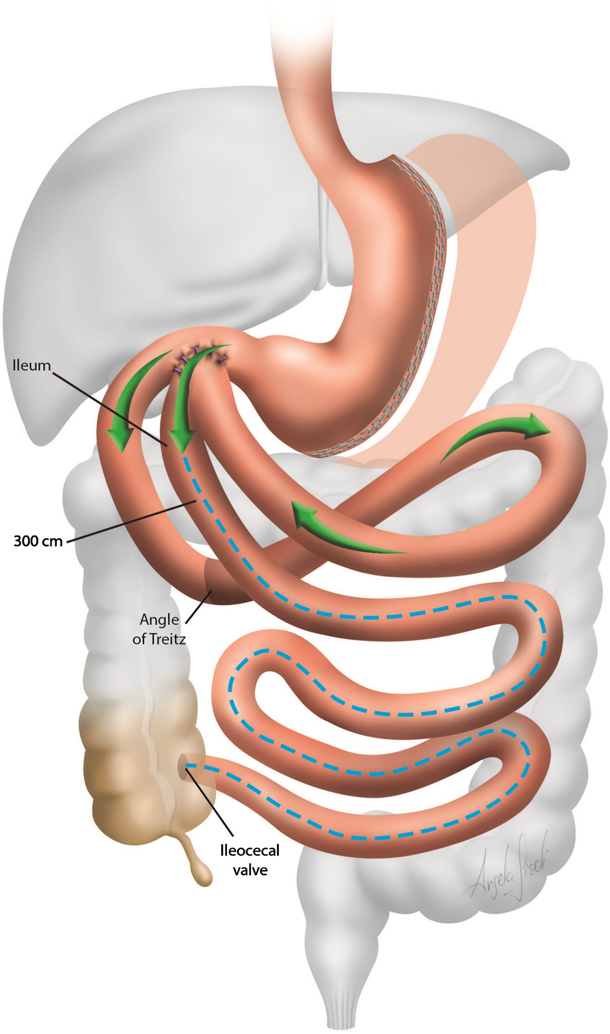


Figure 3. SADIS-DTB-Single anastomosis duodenoileal bypass with sleeve gastrectomy and duodenal transit bipartition.

The mean preoperative BMI of these patients was 37.27 kg/m^2, and after 5.4 months, 29.48 kg/m^2 on average. The mean percentage of weight loss was 21.22% and excess weight loss was 63.6%. The comorbidities presented by the patients included hypercholesterolemia, hypertriglyceridemia, diabetes, hypertension, steatosis and prediabetes [21] [22] [23]; 95% of the comorbidities remitted. This overall percentage of improvement represents the arithmetic average of the percentages obtained from all subjects. Among the five subjects included in the research, four demonstrated improvements in all comorbidities, achieving a 100% improvement rate. Conversely, one subject did not exhibit improvement in one of the four comorbidities analyzed in this paper, resulting in a 75% improvement rate.

The tables (**Tables 1-5**) and figures (**Figures 5-9**) depict the progression of patient outcomes concerning weight loss and comorbidities over the specified period, including the achievement of more than 50% excess weight loss within the 6-month post-operative timeframe.

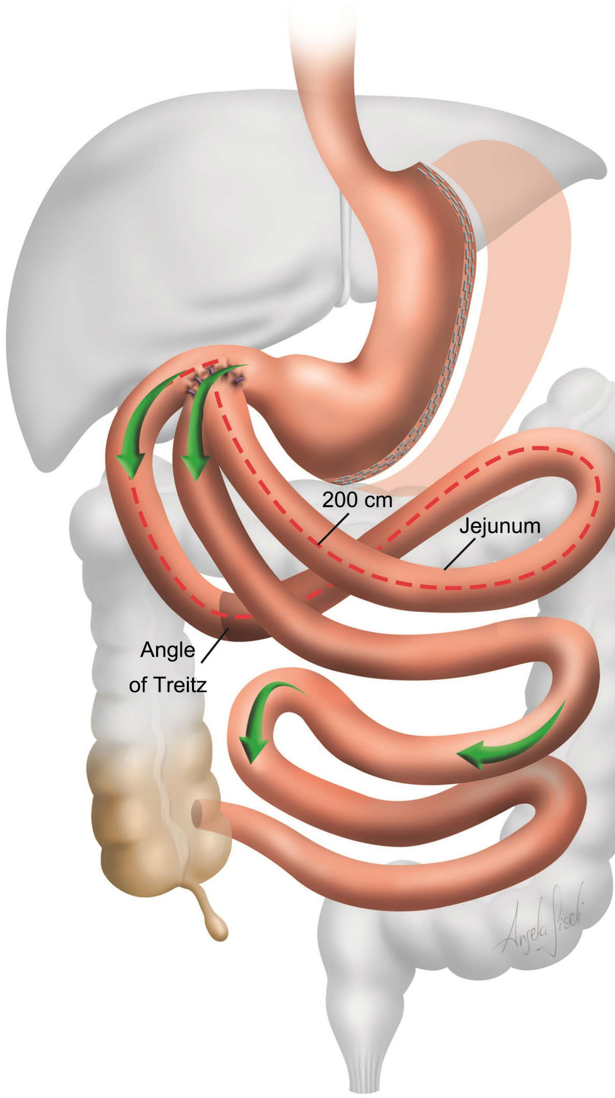


Figure 4. SADJB-DTB-Single anastomosis duodenojejunal bypass with sleeve gastrectomy and duodenal transit bipartition.

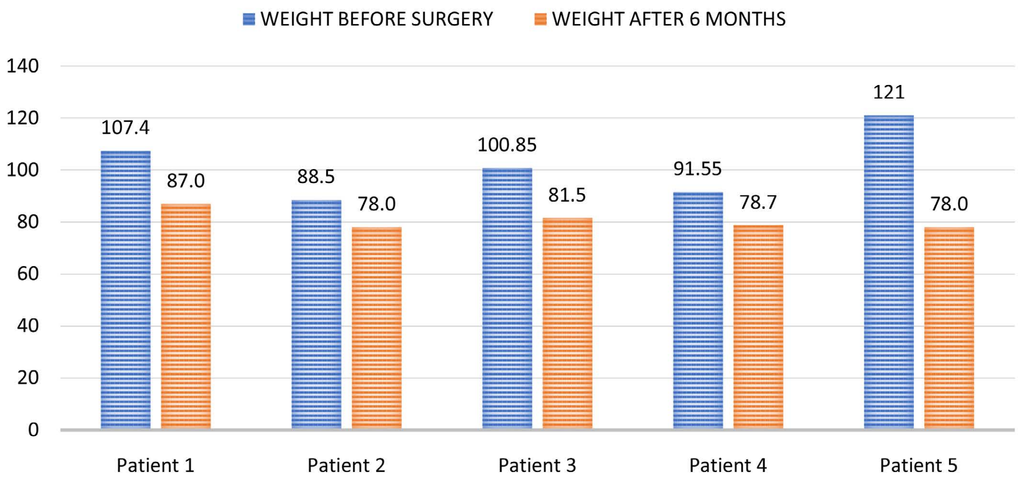


Figure 5. Evolution of weight loss.

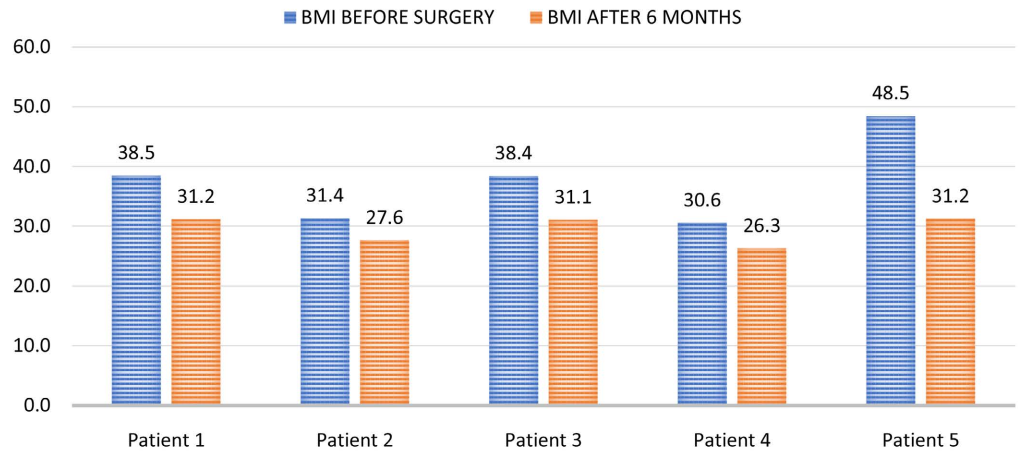


Figure 6. Body mass index.

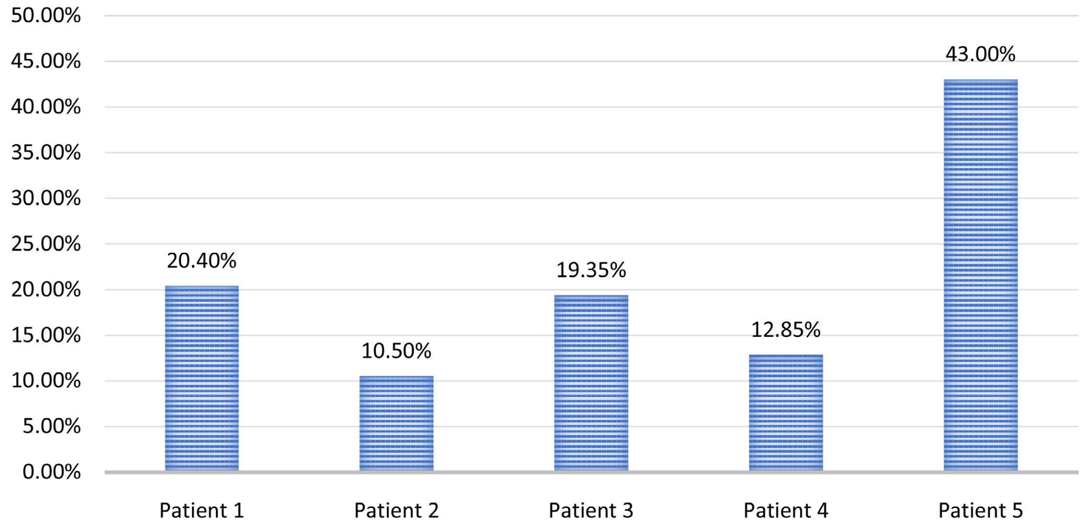


Figure 7. Percentage of weight loss—% WL.

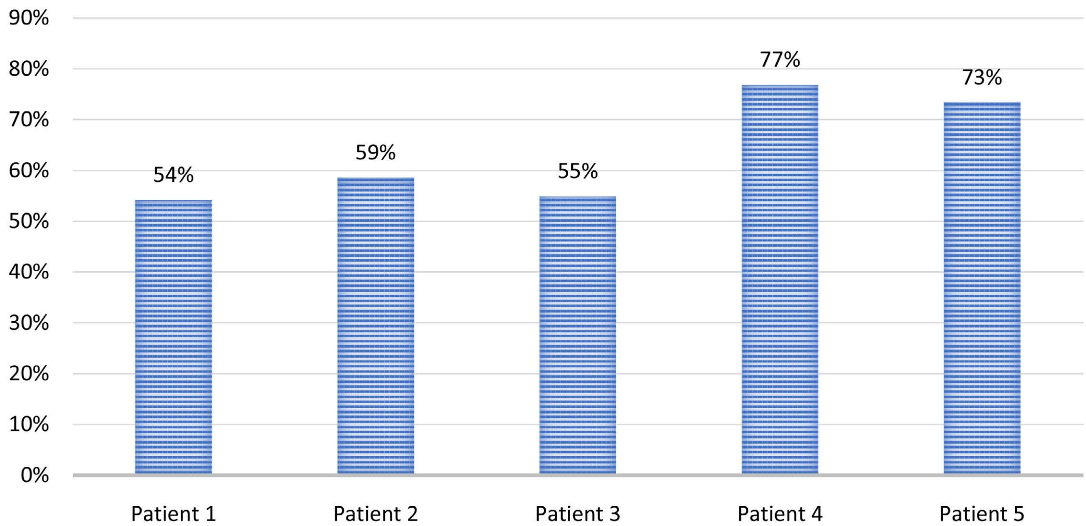


Figure 8. Percentage of excess weight loss—% EWL.

Table 1. Outcome of individuals undergoing surgery.

Variables	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5
Time post-operation	6 months	6 months	6 months	6 months	6 months
Weight in operation	107.4 kg	88.5 kg	100.85 kg	91.55 kg	121 kg
BMI in Operation	38.5 kg/m^2	31.4 kg/m^2	38.4 kg/m^2	30.6 kg/m^2	48.5 kg/m^2
Current BMI	31.2 kg/m^2	27.6 kg/m^2	31.1 kg/m^2	26.3 kg/m^2	31.2 kg/m^2
% EWL	54%	59%	55%	77%	73%

Table 2. Arithmetic mean of the evolution of individuals at six months.

Variables	Mean	Minimum and Maximum
BMI in operation	37.27 kg/m^2	30.6 kg/m^2 - 48.5 kg/m^2
Current BMI	29.48 kg/m^2	26.3 kg/m^2 - 31.2 kg/m^2
% EWL	64%	54% - 77%

Table 3. Research data.

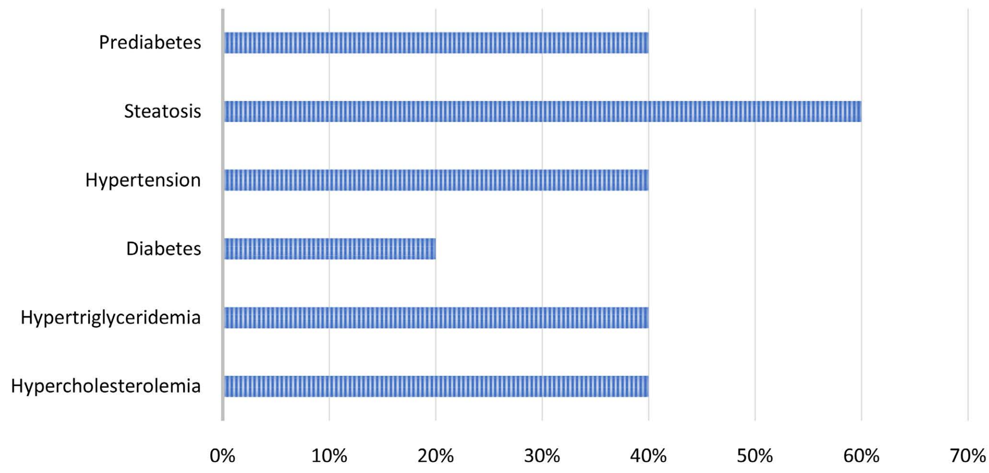
Patients	Age (years)	Weight before surgery (kg)	Height (m)	BMI before surgery (kg/m^2)	Weight after 6 months (kg)	BMI after 6 months (kg/m^2)	Percentage of weight loss—% WL	Percentage of excess weight loss—% EWL
Patient 1	39	107.4	1.67	38.5	87.0	31.2	20.40%	54%
Patient 2	48	88.5	1.68	31.4	78.0	27.6	10.50%	59%
Patient 3	46	100.85	1.62	38.4	81.5	31.1	19.35%	55%
Patient 4	55	91.55	1.73	30.6	78.7	26.3	12.85%	77%
Patient 5	25	121	1.58	48.5	78.0	31.2	43.00%	73%

Table 4. Research data regarding comorbidities—before surgery.

Patient	Hypercholesterolemia	Hypertriglyceridemia	Diabetes	Hypertension	Steatosis
Patient 1	No	No	No	No	No
Patient 2	Yes	Yes	Yes	Yes	Yes
Patient 3	No	No	Pre-Diabetic	No	Yes
Patient 4	No	No	Yes	No	No
Patient 5	Yes	Yes	Pre-Diabetic	Yes	Yes

Table 5. Research data regarding comorbidities—after surgery.

Patient	Hypercholesterolemia	Hypertriglyceridemia	Diabetes	Hypertension
Patient 1	No	No	No	No
Patient 2	No	No	No	Yes
Patient 3	No	No	No	No
Patient 4	No	No	No	No
Patient 5	No	No	No	No



Note: Considering that the majority of patients have more than one comorbidity at this point in the research, thus the sum of the percentages exceeds 100% due to intersections between comorbidities.

Figure 9. Percentage of patients with comorbidities before surgery.

4. Discussion

In metabolic diseases, incretin effects are impaired. For this reason, surgical procedures that have a metabolic structure capable of restoring the incretin stimuli in patients are needed.

Duodenal transit bipartition (S-DTB) presents this metabolic structure (**Figure 10**) represented in the following pillars:

4.1. Metabolically Functional Stomach-Sleeve

Represented by the gastric sleeve (**Figure 11**): tubular stomach, with low compliance, rapid emptying with subsequent blockage of this emptying due to the action of incretin intestinal hormones, including GLP1, decreased ghrelin, increased satiety, glucagon blockade, decreased gluconeogenesis due to improved incretin function of glucose-dependent insulinotropic polypeptide (GIP) and improved insulin sensitivity [13] [14] [24] [25].

For these reasons described above, the sleeve itself is considered a metabolic surgery.

4.2. Pylorus Preservation

The pylorus controls the flow between a reservoir dedicated to mechanical and chemical digestion (the stomach) and a channel dedicated to nutrient absorption (the intestines) [26].

The pylorus is a structure that works through neuroendocrine stimuli and contributes to the satiety mechanism, taking into account that incretin stimuli decrease gastric emptying and promote contraction of the pylorus [25] [27]. Pylorus controls the passage of food from the stomach to the duodenum and its activity is controlled by the ANS and enterohormones, which will modulate the relaxation or contraction of the pylorus, causing it to function as a "metabolic switch" [28].

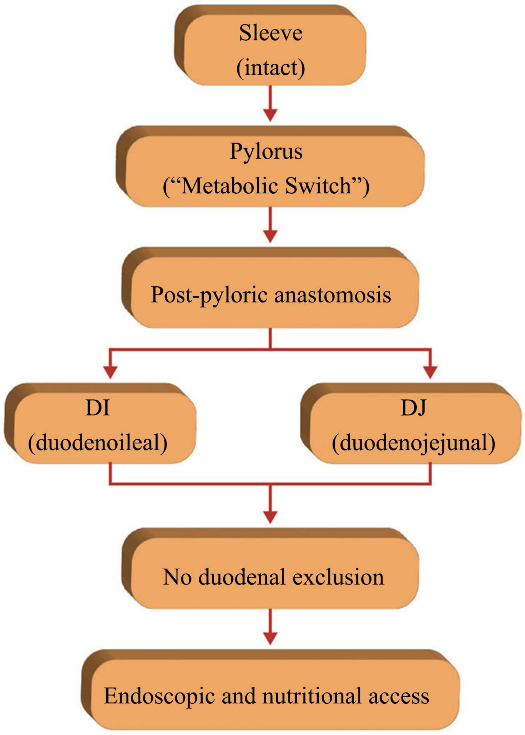


Figure 10. Organizational chart of sleeve gastrectomy with duodenal transit bipartition (S-DTB).

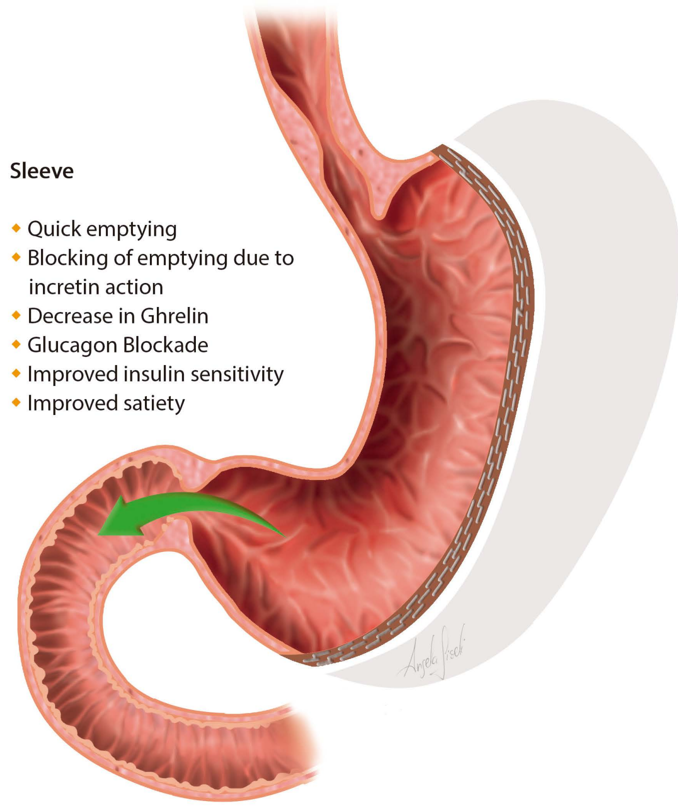


Figure 11. Sleeve—Metabolically functional stomach.

The relaxation of the pylorus during the digestive period causes the escape of only a small volume of chyme to the duodenum, the peristaltic wave causes contraction of the pylorus, the permanence of the pylorus closure causes retropropulsion of chyme to the antrum in order to break the chyme into smaller particles and then be sent back to the duodenum [27].

Hypothetically, the retropropulsion of chyme could cause some repercussions depending on the position of the anastomosis. For this reason and others, in the duodenal transit bipartition, a post-pyloric anastomosis is made, preserving the physiology of the gastrointestinal anatomy as we will see below.

Finally, in S-DTB, the preservation of the pylorus contributes to reducing the occurrence of dumping, diarrhea and bile reflux, in addition to contributing to the stimulation of satiety as mentioned above [26] [29] [30].

4.3. Post-Pyloric Anastomosis

Duodenal bipartition adopts modern metabolic concepts, avoiding exclusions of gastrointestinal segments, intestinal malabsorption, and reduced stomachs, with the objective of promoting mechanical restriction [13] [31] [32] [33], but also maintains classic concepts such as the making of post-pyloric anastomosis practiced in the duodenal switch, SADI-S, isolated duodenal transit bipartition and ileal interposition [1] [2] [18] [34] [35] [36] [37] [38].

The post-pyloric anastomosis in the duodenal bipartition (**Figure 12**) allows the pylorus to maintain its function of controlling the passage of food from the

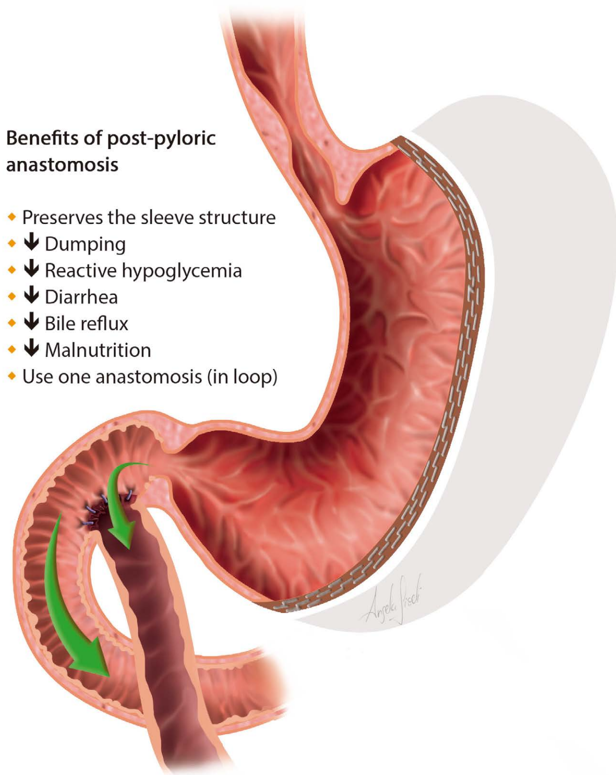


Figure 12. Benefits of post pyloric anastomosis.

stomach to the duodenum, after the reduction of food by the physiological process of chyme retropropulsion carried out between the antrum and the pylorus, reducing the chances of complications such as: dumping, reactive hypoglycemia, ulcers, diarrhea, malnutrition, bile reflux [27] [30] [39] [40] [41] [42] [43]. In addition, post-pyloric anastomosis allows the preservation of the sleeve structure in the duodenal bipartition, maintaining as much as possible its metabolic characteristics, as mentioned above, and allows it to be made in Roux-en-Y or loop (single anastomosis, as done in SADI-S) because the pylorus is a protection against bile reflux [35]. In fact, in this study, we had 2 cases in which we performed S-DTB in a single anastomosis, as previously mentioned.

4.4. Ileus and Distal Jejunum

The end products of carbohydrate digestion are the monosaccharides glucose, fructose, and galactose. Their absorption in the small intestine occurs through different mechanisms involving distinct carrier molecules. Glucose and galactose are transported into intestinal mucosal cells by an active process (which requires energy expenditure, ATP), by the transporter protein SGLT-1 (sodium-dependent glucose co-transporter 1). Fructose is transported into intestinal cells by the carrier protein GLUT-5, a process known as facilitated diffusion. After absorption, almost all fructose and galactose are converted to glucose in the liver. This glucose is then used as an energy source by the different tissues of the body and a good part is stored in the form of glycogen, mainly in the liver and muscles [44] [45].

After being absorbed in the intestine, glucose molecules enter the bloodstream. Glucose is then taken up by tissues (which need to use it as an energy source) through carrier proteins called GLUTs. There are different types of GLUTs, depending on the tissue. Most tissues uptake glucose without the action of insulin, but skeletal muscle and adipose tissue depend on the action of insulin to capture most of the glucose from the bloodstream. In these tissues glucose is taken up by the protein GLUT-4, which is stimulated by insulin. After entering the tissues, glucose can be used as energy source (producing ATP) or be stored as glycogen, mainly in the liver and skeletal muscle.

When glucose is absorbed by the intestine and falls into the bloodstream of an individual without metabolic changes, the pancreas automatically produces and releases insulin that couples to the cell membrane, undergoes phosphorylation by activating GLUT 4 that allows glucose to enter the cell. In individuals with metabolic disorders/insulin resistance, this process is impaired [44] [45].

Insulin resistance is a condition in which tissues stop responding to the hormone, suppressing its main effects, namely, the stimulation of glucose entry into tissues, especially muscle and fat, and inhibition of glucose production by the liver. The resulting hyperglycemia stimulates the pancreas to secrete more insulin, in order to normalize the concentration of blood glucose; however, even in the presence of high concentrations of the circulating hormone, blood glucose remains elevated. In many cases, chronic stimulation of pancreatic β cells leads to their failure and deficient secretion of the hormone [46].

Incretins are hormones produced by cells in the small intestine in response to nutrient intake. The main representatives of the group are glucagon-like peptide-1 (GLP-1) and glucose-dependent insulinotropic polypeptide (GIP). They are responsible for more than 50% of insulin secretion after a meal; the incretin effect is decreased in patients with metabolic disorders. In fact, GLP-1 has lower insulinotropic activity than that observed in healthy individuals, but it is still substantial. On the other hand, the stimulatory effect of GIP is almost completely lost, indicating that most of the enteroinsular effect on insulin secretion is determined by GIP [4] [5] [47].

Bariatric and metabolic surgery will act precisely in restoring incretin activity, basically increasing satiety and improving insulin sensitivity [14] [17] [48] [49]. This mechanism can be didactically divided into 2 types: direct incretinic activation and indirect incretinic activation.

Duodenoileal transit bipartition (S-RYDITB) represents the mechanism of direct incretin activation, since in this procedure the incretin stimulus is mediated mainly by the ileal component, that is, food arrives early/preferably in the ileum (L/GLP1 cells), through the post-pyloric ileal duodenum anastomosis and elongated common channel (250 cm), following the metabolic concepts of "ileal surgeries" [6] [13] [31] [38] [49].

The early arrival of the bolus in the ileum, containing an elongated common channel with pancreatic and bile secretions (holoileum hypothesis), allows the ileum to function better as an endocrine organ and decreases the risks of malabsorption [31]. Furthermore, it stimulates L cells to secrete GLP1, activating incretin effects, improving insulin sensitivity by blocking gastric emptying. This recovery of GLP1-mediated incretinic activity stimulates the K cells of the proximal intestine (duodenum and jejunum), reestablishing the incretinic function of GIP by inhibiting glucagon and gluconeogenesis, improving insulin sensitivity, and also improving satiety [4] [14] [27] [50].

Within the context of bariatric and metabolic surgeries, a little-spoken but extremely important enterohormone, especially in procedures with a greater ileal component, is GLP2.

GLP-2 can contribute to the metabolic balance of individuals submitted to different procedures in a more adaptive and compensatory way, in order to minimize potential losses that may be caused by the procedures [50].

The trophic effect on the intestinal mucosa fulfilled by GLP-2 is considered its primary property. There is also evidence of the influence of bariatric/metabolic surgery on GLP-2, showing a postoperative increase in the levels of this hormone, and this change is potentially related to the stabilization of weight loss, late reduction of diarrhea and malabsorption, partial compensation of damage to bone mineral metabolism, minimization of the consequences of bacterial overgrowth and regulation of certain aspects of satiety [50].

Although ileal surgeries with metabolic concepts reduce the risks of malabsorption due to the largest common channel, it is important to remember that intestinal adaptation in these procedures is an important step and depends, among other factors, on GLP2. The biggest challenge is to understand the GLP2-mediated intestinal adaptability in each patient. Therefore, so-called "ileal" surgeries, even those that use the abovementioned concepts of metabolic surgery, should be used judiciously.

Bile acids also contribute to the improvement of the metabolic state. The alteration of intestinal flow affects normal bile circulation and, therefore, modifies the reabsorption of bile acids, which explains the increase in circulating bile acids [16] [51] [52].

In addition to their role in the absorption of fat-soluble vitamins and lipids, bile acids (BA) have been increasingly recognized as endocrine molecules, with a possible influence on glycemic control. Plasma BA bind to the G protein-coupled receptor known as TGR5, present in the enteroendocrine cells of the liver, skeletal muscle and brown adipose tissue; its activation leads to increased release of GLP-1, with consequent improvement of insulin secretion and sensitivity. BA are also involved in the regulation of hepatic glucose metabolism through nuclear receptors via Farnesoid X receptor, highly expressed in the liver and intestine, stimulating the post-prandial ileal production of FGF-19, which leads to an indirect improvement of the glucose profile by inhibition of gluconeogenesis [16] [51] [52].

The increase in circulating BA occurs mainly in metabolic procedures that associate modifications of the gastrointestinal anatomy, resulting in an improvement in insulin sensitivity, incretin secretion, and post-prandial glycemia [16] [51] [52] [53] [54].

Duodenojejunal transit bipartition (SG-RYDJTB) represents the indirect incretinic mechanism because in this case the bolus is directed early/preferably to the most distal jejunum, and not to the ileum, through the post-pyloric jejunal duodenal anastomosis at 200 cm from the angle of Treitz. In this mechanism, sleeve gastrectomy plays an important role.

As a metabolic procedure, sleeve leads to an improvement in the incretinic response induced by its rapid emptying [24] [25].

The association of the sleeve with a duodejojejunal anastomosis potentiates the incretinic effects [55] and offers options for patients with specific characteristics in whom a metabolic surgery with ileal component is not ideal, such as: patients with food intolerance, patients with increased intestinal frequency, patients with autoimmune and immunocompromised diseases, some patients with grade 2 obesity, older patients, young patients, etc. The jejunal metabolic component has already been used in bariatric and metabolic surgeries, with Roux-en-Y gastric bypass being the main representative [17] [56]. In addition, other authors describe the association of sleeve with duodenojejunal anastomosis (SADJB-S) as an option to treat obesity and type 2 diabetes [11] [55].

4.5. Non-Duodenal Exclusion

In classical bariatric concepts, the addition of a very small stomach (in theory, restriction) and an excluded segment (in theory, malabsorption) would further potentiate the results. But these concepts of restriction and malabsorption are being questioned by metabolic concepts, in which small gastric pouches and excluded gastrointestinal segments are discarded if early and potent stimulation to the distal intestine occurs.

In fact, any type of mechanical restriction and malabsorption are ruled out if a potent metabolic procedure is performed, and a "potent" metabolic surgery has the following characteristics: low gastric compliance with narrow tubular stomachs, rapid initial gastric emptying, early hormonal blockage of gastric emptying (a functional restriction), reduction in absorptive and endocrine activity of the proximal intestine, and increased absorptive and endocrine activities of the distal intestine. Malabsorption is no longer the goal, but distal absorption. In fact, distal intestinal hormones are secreted during the absorption process, and not when nutrients are lost [32].

The work of Mr. Liu *et al.* showed that early stimulation of the distal ileum is powerful enough, even in the absence of exclusions and small pouches [57].

Thus, the concept of metabolic surgery begins to question the Foregut Hypothesis theory, that is, incretin potency is not to depend on duodenal exclusion, but on the stimulation of distal gut hormones, especially GLP1, which even restores the incretin function of GIP in the proximal intestine, regardless of the exclusion of gastrointestinal segments, as happens in the isolated sleeve, which is a metabolic procedure without any type of exclusion [17] [24].

Furthermore, exclusion of gastric remnants, duodenum and part of the jejunum prevents future endoscopic evaluations of these segments and hinders access to the biliary tree. These exclusions, in some models of bariatric surgery, may be inappropriate for patients with gastroduodenal ulcers, polyps, gastric dysplasia, a strong family history of cancer, and untreatable *H. pylori*, among others. Currently, there are inferences of a cancer environment in the remaining gastric chamber [58]. Another issue related to exclusions concerns micronutrient and vitamin deficiencies, which may appear after surgery, requiring more vigorous nutritional supplementation [59].

5. Conclusion

Duodenal switch is a procedure recognized and consecrated worldwide for its safety and efficacy in the surgical treatment of obesity and its comorbidities, precisely for this reason, adaptations in its original model have been proposed in order to maintain the consecrated results and control some unwanted effects, including malnutrition. Within this context, Sleeve gastrectomy with duodenal transit bipartition (S-DTB) is a variant that presents alternative tactics in classic duodenal switch in order to optimize the nutritional safety of the original technique. The initial results of the Sleeve gastrectomy with duodenal bipartition, in

Roux-en-Y or single anastomosis (loop), without intestinal exclusions, proved to be effective in controlling obesity and its comorbidities, and the procedure is safe and technically reproducible. The 2 patients who underwent duodenal bipartition in single anastomosis are progressing well, as well as the patients who underwent in 2 anastomoses (Roux-en-Y). Also, in these 2 patients, the surgical time, and consequently risks were reduced.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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