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SADI-S with Extended Duodeno-Bulb Preservation: Case Report

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Abstract

Obesity has been growing in Brazil and in the world. It is reaching epidemic proportions, and bariatric surgery is the most effective treatment for patients with this disease. Among the procedures described in the literature, ileal surgeries such as biliopancreatic diversion with duodenal switch (BPD-DS) and single-anastomosis duodeno-ileal bypass with sleeve gastrectomy (SADI-S) present better long-term results in terms of weight loss and comorbidities control. However, there are concerns regarding long term nutritional problems with these procedures. In this case report the aim is to demonstrate the technical feasibility of preserving an extended duodenal bulb segment, in the SADIS-S procedure, when there are difficulties in dissecting the retrobulbar region, as occurred here, due to fibrosis in this area. This assures the maintenance of the proposed surgical technique, in such a situation. The dissection and transection of the duodenum was done 7 cm distally to the pylorus, under endoscopic view, proximally to the papillae, where the tissue was normal. Additionally, due the importance of the duodenal mucosa on minerals and trace elements absorption and the release of important hormones in this region, this case report elicits the evaluation of the impact of this technical modification, which occurred casually, in the nutritional, hormonal and metabolic results, long term. In this case report, the extended duodenal length has demonstrated reasonable weight loss, adequate comorbidities control and good nutritional status, so far. These aspects must be evaluated in the long term, by clinical trials.

Keywords

Single-Anastomosis Duodeno-Ileal Bypass with Sleeve Gastrectomy, Obesity, Bulb Preservation, Bariatric Surgery, Metabolic Surgery

1. Introduction

Bariatric surgery is the most effective treatment for morbid obesity. The mechnisms of action vary according to the surgical technique employed. The objectives of bariatric surgeries are to decrease hunger, increase satiety signals, and stabilize metabolism, keeping a good patient's nutritional status [1].

Nutritional deficiencies after bariatric surgery have been reported in the scientific literature. The frequency, severity and type of nutritional deficiency may vary depending on the type of surgical procedure performed and its consequent change in gastrointestinal anatomy and function. Nutritional deficiencies after bariatric surgery basically occur due to restriction in food intake and/or reduction of nutrient absorption. In addition, the expedited gastrointestinal transit can also result in malabsorption of several micronutrients, related not only to the exclusion of the duodenum and jejunum, but also to the limited contact of the food with the brush border of the small intestine. The inconsistent or non-use of multivitamins/minerals after surgery also contributes to this process [2].

The SADI-S (single-anastomosis duodeno-ileal bypass with sleeve gastrectomy) is a relatively new surgical technique in the field of bariatric surgery, described in 2007 by the group of Sánchez-Pernaute *et al.* [3], at the San Carlos Clinical Hospital, in Madrid, Spain. It is a modification of the biliopancreatic diversion with duodenal switch (BPD-DS), which has two anastomoses, and emerged with the intention of diminishing the procedure complexity by reducing it to just one anastomosis, the ileoduodenal one. As in the original BPD-DS, it sought to preserve the pylorus, performing a more physiological procedure, preserving the anatomical barrier against bile reflux to the stomach. In addition, an important aspect of SADI-S is the elongation of common channel, which has been demonstrated, more recently, to improve the nutritional safety of this technique. In this aspect, the length of the common channel in SADI-S has been elongated, moving from the initial 200 cm from the ileal cecal valve (ICV) to the current 250 to 300 cm [3]. Different hormones profiles have been documented comparing BPD-DS with SADI-S [4]. Although not adopted consistently, its indication is increasing worldwide and recent publications have shown that SADI-S is a safe and effective procedure, representing a growing bariatric procedure [5].

In this case report we describe a SADI-S with the preservation of a long extension (7 cm) of the duodenum, keeping intact the bulb and the initial part of second duodenal portion in gastrointestinal transit, differently from the original technique that keeps 2 to 3 cm of bulb, to be anastomosed with the ileum [6] [7].

This technical modification occurred by chance, due to a retrobulbar fibrosis found during the surgery, hindering the dissection at this level, which would require extensive devascularization. The intraoperative decision was to dissect a normal area of the duodenum, above de major and minor papillae, guided by intraoperative endoscopy. This was found to be viable and safe 7 cm distally to the pylorus. The duodenum is an important segment of the digestive tract in terms of nutrients absorption [8] [9] [10] and hormone release [11] [12] [13] [14]. With this modification, we intend to improve the nutritional and metabolic aspects of SADI-S, preserving the already demonstrated good results of this surgery concerning weight loss and comorbidities control. The improvement of neuroendocrine mechanisms of this ileal surgery, with this technical modification, is a possibility.

2. Case Presentation

Table 1 presents the overall characteristics of the clinical case.

The patient signed a Free and Informed Consent Form (FICF) and was informed about the procedure he would undergo, having all his doubts answered in the presence of a companion. It was explained to the patient that the Single Anastomosis Duodenal Switch with Sleeve Gastrectomy would be performed due to the severity of his metabolic disorder and obesity, being informed of the possibility of a second operative time, according to weight loss and control of comorbidities, when he would be converted to BPD-DS. An informed consent signed by the patient was obtained to the use of case details and images of surgery by the surgeon. All the human data was performed in accordance with the Declaration of Helsinki.

SADI-S Technique with Bulb Preservation

In Table 2 we describe the surgical team, patient, and trocars positions (Figures 1-3). In Table 3 we describe the surgery steps (Figures 4-7).

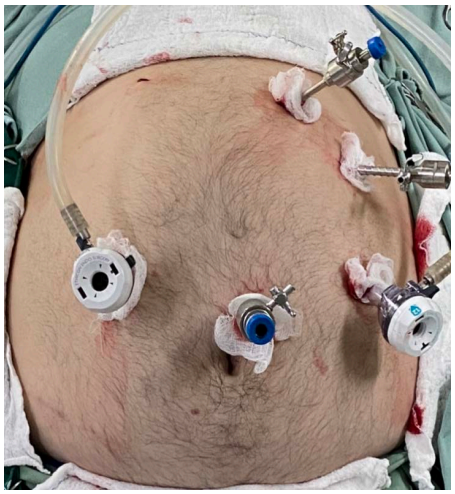

Figure 1. Trocars position.

Table 1. Patient characteristics.

Demographics:

- Patient RMSR
- Male
- 29 years old
- Weight - 172.4 Kg
- Height - 1.75 m
- BMI - 56.29 Kg/m^2
- Android obesity
- History of progressive obesity for 12 years
- Preference for pasta and meat. Binge eater
- No alcoholism or smoking
- No physical activity
- Several previous attempts to lose weight, with nutritional guidelines, Endocrinological follow-up, and use of medications (Sibutramine, Liraglutide, Semaglutide), without sustainable results

Comorbidities:

- Hypertension for 5 years—Losartan 100 mg daily
- Recent diabetes (2 years)—Sitagliptin/Metformin 50/1000 - HbA1C (6.7%)
- Sleep apnea
- Steatohepatitis
- Knees arthropathy
- No previous surgeries

Family History:

- Morbidly obese: father, paternal uncle and brother
- Hypertension—father
- Diabetes—mother
- No family history of cancer

Preoperative Upper Digestive Endoscopy:

- Mild pangastritis
- Histopathology—chronic inactive gastritis/H. pylori-negative

Other information:

- Pre op workup ok, with due care
- Multidisciplinary team counseling
- Proposed surgery—SADI-S
- Surgery performed on 09/02/2022, without intercurrences.
- Surgical time-85 min
- Length of hospital stay-24 hours
- Uneventful post operative

Fourth Postoperative Month:

- 42 kg loss
- %TWL-24.41%
- No medications for diabetes since hospital discharge
- No antihypertensive since the second month of PO

Figure 2. Patient and trocars.

Figure 3. Team position.

Table 2. Surgical team, patient, and trocars positions.

- Patient in horizontal dorsal decubitus, in lithotomy position;
- Surgical table in 30˚ anti-Trendelenburg during all the surgery, except at the moment of counting the ileum from the ileo-cecal valve (ICV), when the table is moved to 20˚ Trendelenburg and lateralized 30˚ to the left;
- Surgeon between the patient's legs, first assistant on the patient's left, camera holder on the patient's right, scrub nurse on the patient's left, anesthesiologist at the head of the patient and video set at the level of the patient's right shoulder;
- Pneumoperitoneum is performed with a Veress needle, at Palmer's point;
- First 12 mm trocar is inserted 25 cm below the xiphoid process, 2 cm to the left of the midline, under laparoscopic view;
- Second 12 mm trocar is inserted 20 cm below the left costal margin, at the anterior axilar line;
- Third 12 mm trocar is inserted 25 cm below the right costal margin, at the anterior axilar line;
- Fourth 5 mm trocar is inserted 5 cm below the left costal margin, at the midclavicular line;
- Fifth 5 mm trocar is inserted 5 cm below and 2 cm lateral to the left of the xiphoid process.

Table 3. Surgical steps.

- The surgery starts with a pneumoperitoneum confection, using a Veress needle introduced bellow the left costal margin (Palmer point);
- The patient is positioned in a 30˚ reverse Trendelemburg position without lateralization;
- The abdominal cavity checked, with the surgeon positioning between the patient's legs , the first assistant, on the patient's left and the camera assistant, on the patient's right;
- The left hepatic lobe is withdrawal using a straight cylindric retractor, inserted through the 5 mm trocar, close to the xiphoid process;
- Intraoperative endoscopy is performed, with prior clamping of the jejunal limb, 10 cm distally to the angle of Treitz;
- Through intra-op endoscopy, the major and minor duodenal papillae are identified and are laparoscopically marked with a 3-0 PDS seromuscular stitches, on a contralateral wall; the endoscope is removed, with previous gastric aspiration, followed by jejunal clamp release;
- A 32Fr Fouchet tube is introduced down to the stomach;
- The dissection of the vessels of the greater curvature of the antrum starts 6 cm proximal to the pylorus, opening a small retrogastric window;
- Longitudinal gastric stapling begins at this level, shaped loosely by a 32Fr Fouchet tube, stapling with 60 mm J & J Echelon GST (6 to 7 shots), up to the His angle, septating the stomach longitudinally; for this, 1 green, 1 gold and 4 to 5 blue cartridges are used, from distal to proximal stomach;
- The gastric vessels from the right and left gastro-epiploic arcade are sealed, near the stomach wall, with ultrasonic scalpel, from the level of the distal gastric septation until the angle of His, releasing the entire septated stomach, which is positioned over the right hepatic lobe;
- Oversuture of the staple line is performed with 3-0 PDS;
- The posterior wall of the gastric tube is fixed to the base of the transverse mesocolon, at the level of the incisura angularis, up to the distal edge of the gastric staple line, with 3-0 Polipropilene thread;
- The bulb dissection started, but a huge umpredictable fibrosis was found in this region, making it difficult to continue the dissection;
- A distal dissection is chosen, to avoid fibrous tissue;
- An intraoperative endoscopy is done to locate both papillae, which are marked with seromuscular stay sutures;
- The duodenal dissection starts on both margins, above the papillae, 3 to 4 cm distal to the cross line between the choledochus and the superior edge of duodenum, approximately 7 to 8 cm distally to the pylorus;
- A retroduodenal tunnel is created, just enough for the passage of the stapler;
- The right gastric artery and the entire antrum-duodenal vascular and neural arcade are preserved, from the distal level of the gastric septation until the duodenal transection level;
- After dissecting the posterior duodenal wall, a tape is passed behind and pulled up, to expose this region (**Figure 4**);
- The duodenum is stapled and sectioned, under direct vision, using a 60 mm J & J Echelon GST blue cartridge, entering through the 12 mm trocar of the left abdomen (**Figure 5** and **Figure 6**);
- A pre-tied 3-0 PDS thread is used to transfix the proximal duodenal stump staple line, at the contralateral pancreatic side, to help bringing up the ileum;
- The table is positioned in 20˚ Trendelenburg with 30˚ left lateralization;
- The surgeon moves to the left side of the patient, the camera holder positions himself between the patient legs and the first assistant moves to the patient's right;
- The cecum is identified and 300 cm of the ileal limb is counted, proximally, from the cecum; The ileal limb is marked at this point in its mesentery, with 1 clip in its proximal portion and 2 clips in its distal portion; the rest of the intestine is counted;
- The previous 3-0 PDS thread attached to the proximal duodenum stump is used to transfix the seromuscular layer of the ileum (at 300 cm from the ICV), in the mesenteric border. By pulling up this thread, the ileum is brought up and rests over the proximal duodenum stump, thus being ready to be anastomosed with it;
- At this point, all surgical team return to the previous position, as well as the patient;
- The correct positioning of the proximal and distal segments of the ileum is confirmed by observing the endoclips attached to ileal meso;
- The first posterior anastomotic layer is constructed with the 3-0 PDS thread previously passed, in an uninterrupted way, addressing the staple line of duodenum and mesenteric seromuscular layer of ileum;
- The anterior duodenal wall and the lateral ileum wall are opened by an extension of 2 cm, using ultrasonic scalpel (J & J);

Continued

- The second duodeno-ileal total posterior layer suture is done in uninterrupted way, with a 3-0 PDS thread;
- The anterior layer of duodenum-ileum anastomoses is closed in one plane, by a continuing full-layer stitchs, using 3-0 PDS (Figure 7);
- The mesenteric space between the colon and the ileal limbs is not closed;
- The integrity of the anastomosis is tested with methylene blue, infused through the Fouchet tube, removing it afterwards;
- The resected stomach segment is placed in an endobag and extracted through the 12 mm trocar incision, in the left abdomen;
- The hepatic retractor and the trocars are removed, with closure of the aponeurosis at the sites of the 12 mm trocars with 2-0 Vicryl transparietal sutures;
- Cavity drainage is not performed;
- The wounds are closed with intradermic sutures, using 3-0 Monocryl thread.

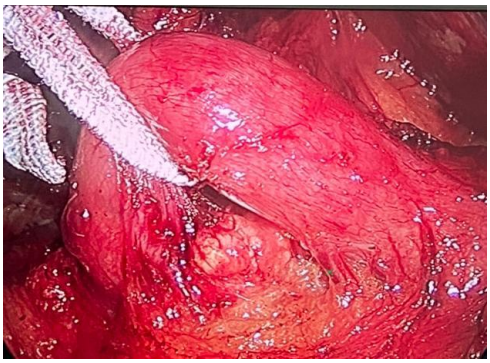

Figure 4. Duodenum dissection.

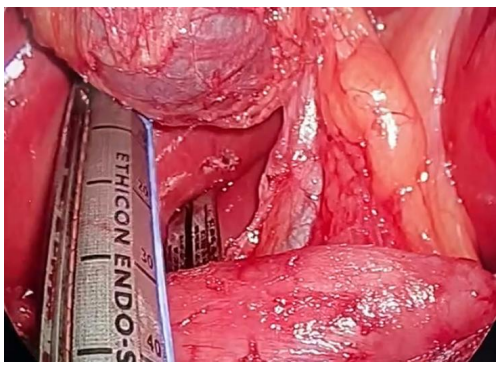

Figure 5. Duodenum staple positioning.

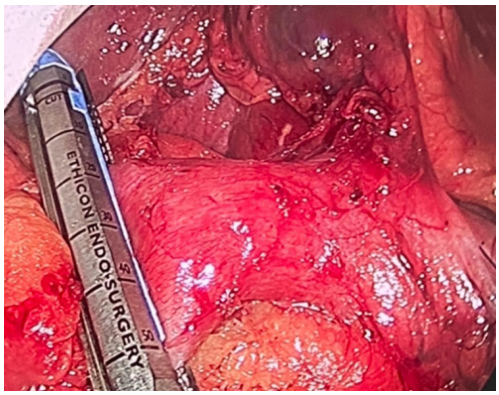

Figure 6. Duodenum transection.

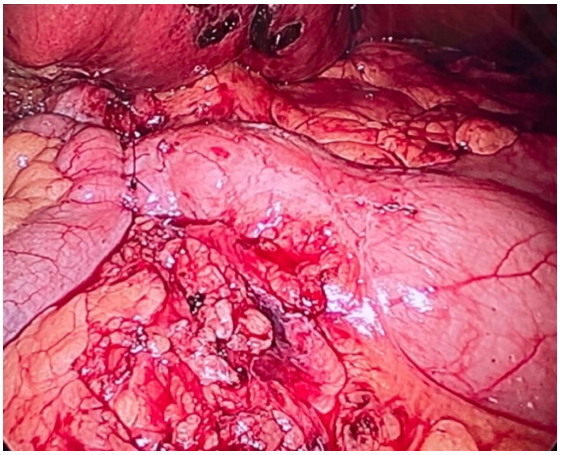

Figure 7. Ileoduodenal anastomosis.

3. Discussion

In recent decades, a significant increase in the severity of obesity has been observed globally [15]. Super obesity has become more frequent [16]. It is demonstrated that in this group, ileal surgeries, such as BPD-DS and SADI-S, achieve better long-term results, in terms of weight loss and comorbidities control [17]. Despite of this, the BPD-DS has been performed scarcely. Technical demands in its execution and difficulties in long-term nutritional control may, in part, explain this fact. The introduction of its one anastomosis version, 15 years ago, being technically simpler, points out to a trend in its more frequent indication [18] [19].

More recent physiological understanding of gastrointestinal hormonal function has allowed the development of bariatric procedures that target neuroendocrine changes rather than restriction and malabsorption [20]. The physiological satiety elicited by an adequate meal is the result of a series of interactive signals, arising from many sources, including the gastrointestinal tract [21]. As an adaptation to modern food, rich in carbohydrates and poor in fibers, it is plausible to assume that a smaller stomach and intestine, allowing digested food to reach the distal intestine, as an evolutionary adaptation, would trigger satiety signals better [22] [23].

Promoting a surgical duodeno-jejunal exclusion leads to an expedited digestive transit, thus increasing GLP-1 (Glucagon-like Peptide-1) and peptide YY (PYY) release, after meals. This occurs thanks to L-type endocrine cells stimulus, in the distal ileum [1]. Digested food triggers increased levels in circulating FGF-19, by stimulating the FXR receptors in ileal enterocytes [24]. Both stimuli cause many improvements in metabolic issues related to obesity and metabolic syndrome [25].

It is well known that the bypassed jejunum absorbs bile acids better, which improves glycemic control, through FXR stimulus [21].

A reduction in GIP (Glucose-dependent Insulinotropic Peptide) stimuli in duodeno-jejunal bypasses, by excluding k-cell from food contact, is still a matter

of discussion related to its role in metabolic pattern [26].

In terms of nutritional aspects, shortening the gastrointestinal component in these ileal procedures can result in less absorption of several micronutrients, vitamins, and proteins, due to the exclusion of the duodenum and jejunum from the digestive transit, and by speeding up the transit flow. The adequate multivitamins/minerals and protein supplementation is of paramount importance for good nutritional status in these patients [2] [27] [28].

It has been demonstrated that lengthening the ileal component of common channel, which occurs in SADI-S, compared to BPD-DS, strengths incretins and FGF-19 releasing and results in less bowel movements, causing less diarrhea, better nutritional control and more potent metabolic effects [4] [29]. Some authors have demonstrated comparable weight loss results between BPD-DS and SADI-S in the long term [5].

Preservation of part of the duodenal bulb in the intestinal transit, observed in both techniques (BPD-DS and SADI-S), contributes for a better control in protein, trace elements, minerals and in absorption of some vitamins [30].

The proximal intestine is the main site of absorption for several important vitamins and micronutrients [31]. It is expected that procedures that exclude the proximal intestine induces less iron and calcium absorption, increasing the risks of anemia and osteopenia, postoperatively. Furthermore, the proximal intestine is also indirectly involved in the absorption of fat-soluble vitamins, therefore its exclusion can lead to some hypovitaminosis [32].

In this case report, due to extreme retrobulbar fibrosis by unknown cause, it was necessary to dissect and transect the duodenum distally, 7 cm from the pylorus, under endoscopic guidance, in a position proximal to the papillae. It was demonstrated that transecting the duodenum at this level is technically possible, preserving more duodenal mucosa in the alimentary tract. In SADI-S surgery the usual bulb length left in the alimentary tract is 2 to 3 cm. Understanding the importance of the duodenal mucosa in the absorption of minerals and trace elements [9] [33] and being aware of the important hormones released in this intestinal segment [11] [34] [35] [36], we seek to evaluate the impact of bulbduodenal extended preservation (7 cm) in weight loss, as well as in nutritional, hormonal and metabolic evolution.

A question that arises in a SADI-S with extended bulbduodenal preservation relates to GIP hormone release, since the literature about that is controversial [1] [37]. It seems that neuroendocrine mechanisms work independently. Sleeve Gastrectomy results in good metabolic responses, even without functional or anatomical exclusion of the proximal intestine, being an example of that [31] [38]. This case report opens up a great opportunity to proceed with this evaluation.

This technical modification, could be proposed for difficulty bulbs, that is usual in patients with previous duodenal ulcers. Moreover, there is a reduction in duodenal exclusion, a step that could represent an improvement in this type of ileal procedure, mainly in its nutritional aspects and hormonal profiles. However, long-term follow-up is necessary for a reliable analysis of these hypothesis.

4. Conclusion

The technical modification in a SADIS-S procedure demonstrated in this case report, showed that patients with a difficult bulb dissection are still candidates to this technique. More than that, considering the current physiological concepts of bariatric surgeries, preserving an extended duodenum in digestive tract, in SADI-S surgery, elicits the possibility of evaluating the importance of the extra duodenum in the results of this technique. Long-term metabolic and nutritional impact of this technical modification must be assessed through clinical trials, before this procedure could be adopted in routine practice.

Conflicts of Interest

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

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