COMPLICATIONS AND LATE FOLLOW-UP OF SCOPINARO’S SURGERY WITH GASTRIC PRESERVATION: 1570 PATIENTS OPERATED IN 20 YEARS

COMPLICAÇÕES E ACOMPANHAMENTO TARDIOS DA CIRURGIA DE SCOPINARO COM PRESERVAÇÃO GÁSTRICA: 1.570 PACIENTES OPERADOS EM 20 ANOS

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ABSTRACT – BACKGROUND: Scopinaro-type bilipancreatic diversion (BPD-S) and its variations are the surgeries that offer the best immediate results in weight loss and regain in the late follow-up. It has a high rate of immediate complications and demands control with frequent laboratory tests.

AIMS: The aim of this study was to analyze the late postoperative complications of 1570 patients operated by bilipancreatic diversion with gastric preservation laparoscopic video with up to 20 years of postoperative follow-up. METHODS: In a follow-up period of up to 20 years, the clinical and surgical complications of 1570 patients with grade II or III obesity were evaluated who were operated on from 2001 to 2014 with the same team of surgeons. Clavien Dindo 11 classification was used for analysis and comparison. Laboratory tests and body mass index (BMI) were used in the analysis of late metabolic outcomes. RESULTS: On the one hand, complications in 204 patients were recorded (13%), and 143 patients (9.1%) were reoperated. On the other hand, 61 patients (29.9%), who had postoperative complications were clinically treated with good evolution in 9.2 years (95%CI 8.2-10.3), with a median of 9.5 years (95%CI 6.1-12.9). Gastroileal anastomosis ulcers occurred in 44 patients (2.8%). Patients with malnutrition, severe anemia, or chronic diarrhea were operated on with common loop elongation (n=64 – 4%), conversion to gastric diversion (n=29 – 5%), or reversal of surgery (n=10 – 0.6%). One death was registered throughout the study (0.06%). CONCLUSIONS: Metabolic result of BPD-S was considered excellent in most patients, even referring to changes in the frequency of bowel movements, loose stools, and unpleasant odor. Complications are usually serious and most of the patients require surgical treatment. Therefore, the bilipancreatic diversion of Scopinaro should be reserved for exceptional cases, as there are safer surgical alternatives with less serious side effects.

HEADINGS: Postoperative Complications. Bariatric surgery. Malnutrition. Morbid obesity

RESUMO – RACIONAL – A derivação bilipancreática tipo Scopinaro (DBP-S) e suas variações são as cirurgias que oferecem os melhores resultados iniciais no perda de peso e de reganho de peso no acompanhamento tardio. Apresenta índice elevado de complicações imediatas e demanda controle laboratorial frequente. OBJETIVOS: Analisar as complicações pós-operatórias tardias de 1.570 pacientes operados por derivação bilipancreática com preservação gástrica videolaparoscópica com até 20 anos de acompanhamento pós-operatório. MÉODOS: Foram avaliadas as complicações clínicas e cirúrgicas, no acompanhamento tardio de até 20 anos, de 1.570 pacientes com obesidade grau II ou III, operados no período de 2001 a 2014, por uma mesma equipe de cirurgiões. A classificação de Clavien Dindo 11 foi empregada para análise e comparação. Exames laboratoriais e índice de massa corpórea (IMC) foram utilizados na análise dos resultados metabólicos tardios.

RESULTADOS – Foram registradas complicações em 204 pacientes (13%), e 143 (9.1%) foram reoperados. Por outro lado, 61 pacientes (29.9%), no período de 9,2 anos (IC 95% 8.2-10.3), com médiana de 9.5 anos (IC 95% 6.1-12.3), que tiveram complicações pós-operatórias foram tratados clinicamente, com boa evolução. A úlcera de anastomose gastroileal ocorreu em 44 pacientes (2.8%). Os pacientes com desnutrição, anemia grave ou diarreia crônica foram operados com alongamento da alça comum (n=64 – 4%), conversão para bypass gástrico (n=29 – 5%) ou reversão da cirurgia (n=10 – 0.6%). Foi registrado um óbito ao longo de toda a casuística (0.06%). CONCLUSÕES: O resultado metabólico da DBP-S foi considerado excelente na maioria dos pacientes, mesmo referindo-se a alteração da frequência de evacuações, fezes amolecidas e com odor desagradável. As complicações são geralmente graves e a maioria demanda tratamento cirúrgico. Portanto, a derivação bilipancreática de Scopinaro deve ser reservada a casos excepcionais, pois existem alternativas cirúrgicas mais seguras e com efeitos colaterais menos graves.

DESCRITORES: Complicações Pós-Operatórias. Cirurgia Bariátrica. Desnutrição. Obesidade Mórbida

Central Message Considering the late clinical, surgical, and metabolic complications, Scopinaro’s surgery should be reserved for exceptional cases, as there are safer surgical procedures with fewer serious side effects.

Perspectives On the one hand, Scopinaro’s surgery (DBP-S), and its variations, offer the best immediate results in weight loss and a lower rate of weight regain in late follow-up; in addition, they also determine the best rates for remission and prolonged control of type 2 diabetes mellitus (DMII) and dyslipidemia. On the other hand, they are more complex and more difficult to be carried out, they have a greater immediate complication rate, and demand frequent laboratory control due to a significant decrease in vitamins and minerals, in addition to the increased risk of protein malnutrition.
INTRODUCTION

Currently, bariatric surgeries are performed to determine different outcomes in terms of weight loss and maintenance. Scopinaro-type biliopancreatic diversion (BPD-S), the biliopancreatic diversion with duodenal deviation (DBP-DD), and its variations are the surgeries that achieve the best immediate results in weight loss and the lowest rate of weight regain in the late follow-up; in addition, they also determine the best remission rates and prolonged control of type 2 diabetes mellitus (DMII) and dyslipidemia. On the contrary, they are more complex surgeries and more difficult to be performed, have a greater rate of immediate complications, and also require frequent pathological testing due to a significant decrease in vitamins and minerals, in addition to the increased risk of protein malnutrition. Quality of life is compromised by flatulence, diarrhea, and foul odor in feces mainly due to steatorrhea caused by lower fat absorption. Such complications continue to occur even after more than 20 years of follow-up in different moments of the postoperative period, which apparently are not predictable; these patients are reoperated for clinical complications or reviews for malnutrition or poor quality of life due to diarrhea and flatulence.

The above-mentioned factors, technical complexity, and a high rate of complications partially help in explaining the low adherence of surgeons to biliopancreatic leads, which never previously published standardization (Figure 1).

Objectives

The present work analyzes postoperative complications and delayed results from 1570 patients operated by biliopancreatic diversion with gastric preservation laparoscopic video (Domene et al., 2001) with up to 20 years of postoperative follow-up.

METHODS

Casuistic

A total of 1570 patients with grade II or III obesity were retrospectively evaluated. These patients were operated in the period from 2001 to 2014, whose data were collected from medical records. All patients have undergone biliopancreatic diversion with gastric preservation laparoscopic video, with gastric reservoir of 200-400 ml, food loop of length 150-200 cm, and common loop of length 100-120 cm, according to previously published standardization (Figure 1).

This surgery is a modification of the biliopancreatic diversion proposed by Scopinaro et al. (1979) 30, who performed distal gastrectomy having a common loop of 50 cm in length; this surgery was based on the proposal by Mason and Ito (1967) who performed gastroenterostomy having a loop of 25 cm (Figure 2).

Of all the patients, 1366 (87.0%) had no complications, while 204 (13.0%) developed postoperative complications; 61 patients (29.9%) were clinically treated and 143 (70.1%) had undergone surgical treatment. These complications will be assessed with the time of onset of treatment. There was a second complication in 36 of these patients (17.6%).

To test the hypothesis of non-modification of quantitative attributes related to control of diabetes mellitus between groups with a significant diagnosis of DM, a repeated-measure ANOVA model was used 21.

Kaplan-Meier curves were used to estimate the probability of occurrence of complications after treatment. All tests considered one to bidirectional 0.05 and a 95% confidence interval (CI) and were performed using the computational software R (https://www.r-project.org/), package nparLD, IBM SPSS 25 (Statistical Package for the Social Sciences), and Excel 2016 (Microsoft Office) 27.

The study in question received approval from the Ethics Committee under the number 31002620.9.0000.0068 at the Hospital de Clínicas of the Faculty of Medicine of the University of Sao Paulo.

RESULTS

There were complications in 204 patients (13%), and some patients had more than one complication (Table 1).

Tables 2 and 3 summarize the characteristics of patients who evolved with complications. These individuals were mostly female (145 – 71.1%) (95%CI 64.6-77.0), with a mean age of 40.0 years (±13.0 years). According to Table 2, 57 or (27.9%) (95%CI 22.1-34.4) of the individuals were diabetic at T0 interval; 143 cases were affected by surgical complications (70.1%) (95%CI 63.6-76.1), also characterized as Clavien Dindo IIIb. After the treatment of the first complication, 36 individuals (17.6%) developed a second complication, classified as Clavien Dindo IIIB in 19 cases (52.8%; 95%CI 36.8-68.3).

BMI measurements in the group with complications (CC) ranged from 41.2 kg/m² (±13.0 kg/m²) at T0 to 27.9 kg/m² (±4.8 kg/m²) at T3, while hemoglobin measurements, ferritin, and albumin were 10.8 g/dL (±1.8 g/dL), 110.3 μg /L (±449.7), and 3.2 g/dL (±0.8 g/dL), respectively (Table 3).

Figure 1 - Biliopancreatic diversion with gastric preservation.
Gastroileal anastomosis ulcer occurred in 44 patients (21.5%), 34 of them without complications and 23 of them with complications such as perforation, stenosis, or upper gastrointestinal bleeding (Table 4).

Notably, 143 (70.1%) patients had undergone surgical treatment. There was death in 0.49% of patients. The surgeries performed in 143 patients who had complications in surgical procedures are listed in Table 5. Clinical treatment was indicated for 61 (29.9%) of the patients who had postoperative complications, all with good evolution after the treatment was performed (Table 6).

Among 204 individuals who suffered a complication, with 61 cases accounting for 29.9% of the total complications, the average time of occurrence of clinical complications was 9.2 years (95%CI 8.2-10.3), with a median of 9.5 years (95%CI 6.1-12.9); the incidence of these complications was proportional to time, that is, at 3 years of follow-up, the probability of occurrence of this event was 20%, and at 8 years of follow-up, the probability was 40% (Table 7 and Figure 4).

Complications that required reoperation after surgery, that is, those classified as Clavien-Dindo IIIB, with 143 cases, accounted for 70.1% of cases of post-treatment complications. The average time of occurrence of complications until the presence of this event was 5.9 years (95%CI 5.2-6.6), with a median of 5.1 years (95%CI 3.7-6.5). Approximately 35% of cases with complications occurred up to the second year after surgery, with proportionality observed in the time after the second year, which extended to the tenth year. Even after this period, some cases of reoperation occurred (Figure 5).

Figures 6-8 show the probability of occurrence of ulcer, malnutrition, and internal hernia after surgery, respectively. It can be noted that these events occurred consecutively in 44 (21.5%), 89 (43.6%), and 21 (10.3%) of the patients, respectively.

Thirty-six patients had a second complication (17.6%). The diagnosis of the first complication in these patients is summarized in Table 8.

Among 36 patients who had a second complication, three had severe chronic diarrhea and three had internal hernias as the first complication. The behavior at first complication, and diagnosis, management, and evolution of the second complication are summarized in Table 9.

Of the 19 patients who had malnutrition as their first complication, five were treated clinically and 14 underwent surgery on the first occasion. Diagnosis, treatment, and evolution of the second complication in patients with malnutrition and clinical treatment are summarized in Table 10.

Exceptionally, 14 malnourished patients who underwent surgery were treated with stretching of the common loop

![Figure 2 - Biliopancreatic diversion surgery (BPD-S) described by Scopinaro et al. (1979) 33 on the left and BPD-S described by Mason and Ito (1967) 25 on the right.](image)

![Figure 3 - Occurrence of complications among operated patients.](image)

![Table 1 - Postoperative complications of 204 patients (there were patients with more than one complication).](table)
through the section of the anastomosis of the alimentary loop at the level of the anastomosis with the ileum, and anastomosis of the alimentary loop at 1.5 m from the biliopancreatic loop, counted from the broken anastomosis (Figure 8).

The second complication, management, and evolution of these patients are summarized in Table 11.

Eleven patients had gastroileal anastomosis ulceration as the first complication, six of them with perforation and five of them without perforation. The evolution and conduct of second complication of these patients are summarized in Tables 12 and 13.

**DISCUSSION**

In an effort to reduce the serious side effects of pure intestinal diversions for the treatment of morbid obesity, Scopinaro et al. (1979) 33 modified the procedure of gastric diversion proposed by Mason et al.; Ito (1967) 25 performed a horizontal subtotal gastrectomy, one gastroileal and one ileoileal anastomosis (Figure 2).

Compared to the study by Mason et al., the surgery performed in the study by Ito uses a larger gastric reservoir, long biliopancreatic loop, and small common loop, associating less restriction to food intake, the relative decrease in absorption of carbohydrates, and a large malabsorption of proteins and fats. After the experimental studies were carried out in animals, the authors standardized a technique in humans with a gastric reservoir of 200-500 ml, loop feeding from 200 to 300 cm, and a common handle of 50 cm 33.

The biliopancreatic diversions are the operations that promote more and more sustained weight loss in the late follow-up, as well as effective and prolonged control of the DMII 14.32. In the present study, the result in terms of weight loss was very satisfactory, starting from an average of 42.0 kg/m^2 in the preoperative period to 30.7 kg/m^2 in the last consultation after surgery.

The mean glycated hemoglobin was 7.9 g/dl preoperatively and 5.0 g/dl in the late follow-up (Table 3). However, the rate of late complications was 13%, with malnutrition being the most common, followed by diarrhea, gastroileal anastomosis ulcer, and anemia; the inpatient care for hernia also occurred in 21 patients during late follow-up (Table 1). The majority of these

| **Table 2** - Characteristics of individuals with complications, including absolute and relative frequency and 95% confidence interval (95%CI) |
| --- |
| **N** | % | 95%CI |
| **Sex** |  |  |  |
| Male | 59 | 28.9% | 23.0% | 35.4% |
| Female | 145 | 71.1% | 64.6% | 77.0% |
| **Diabetes T0** |  |  |  |
| No | 147 | 72.1% | 65.6% | 77.9% |
| Yes | 57 | 27.9% | 22.1% | 34.4% |
| **Complication Type T1** |  |  |  |
| Clinical | 61 | 29.9% | 23.9% | 36.4% |
| Surgical | 143 | 70.1% | 63.6% | 76.1% |
| **Clavien Dindo T1** |  |  |  |
| II | 61 | 29.9% | 23.9% | 36.4% |
| IIIB | 143 | 70.1% | 63.6% | 76.1% |
| **Treatment T1** |  |  |  |
| Clinical | 61 | 29.9% | 23.9% | 36.4% |
| Surgical | 143 | 70.1% | 63.6% | 76.1% |
| **Evolution T1** |  |  |  |
| Good | 188 | 92.2% | 87.9% | 95.3% |
| Regular | 14 | 6.9% | 4.0% | 10.9% |
| Death | 2 | 1.0% | 0.2% | 3.1% |
| **Complications T2** |  |  |  |
| I | 1 | 2.8% | 0.3% | 12.3% |
| II | 14 | 38.9% | 24.3% | 55.2% |
| IIIB | 19 | 52.8% | 36.8% | 68.3% |
| IV | 2 | 5.6% | 1.2% | 16.6% |
| **Treatment T2** |  |  |  |
| Clinical | 12 | 42.9% | 27.6% | 59.3% |
| Surgical | 24 | 57.1% | 40.7% | 72.4% |
| **Evolution T2** |  |  |  |
| Good | 34 | 94.3% | 82.9% | 98.8% |
| Death | 2 | 5.7% | 1.2% | 17.1% |

**Table 3** - Descriptive statistics of individuals with complications (CC) considered in the study, such as mean, standard deviation (SD), median, 25th (P25) and 75th (P75) percentiles, minimum (Min.), and maximum (Max.).

| **Variable** | **Average** | **SD** | **Median** | **P25** | **P75** | **Min.** | **Max.** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Age (years) | 48.0 | 10.0 | 48.0 | 42.0 | 54.0 | 17.0 | 72.0 |
| Time of disease (years) | 4.7 | 3.3 | 4.0 | 2.0 | 6.0 | 0.4 | 20.0 |
| BMI (kg/m^2) T0 | 42.0 | 5.8 | 40.8 | 37.7 | 44.7 | 30.1 | 65.2 |
| A1C (%) T0 | 7.9 | 1.5 | 7.3 | 6.8 | 8.4 | 6.5 | 14.8 |
| Glycemia (mg/dL) T0 | 161.0 | 58.0 | 140.0 | 124.0 | 183.0 | 102.0 | 576.0 |
| Other medications (number) T0 | 1.0 | 1.0 | 1.0 | 1.0 | 2.0 | 1.0 | 4.0 |
| Comorbidities (number) T0 | 2.0 | 1.0 | 1.0 | 1.0 | 2.0 | 1.0 | 4.0 |
| A1C (%) T1 | 5.6 | 0.9 | 5.5 | 5.2 | 6.0 | 4.0 | 10.3 |
| Glycemia (mg/dL) T1 | 96.8 | 22.9 | 93.0 | 87.0 | 101.5 | 4.9 | 189.0 |
| A1C (%) T2 | 5.0 | 0.6 | 5.0 | 4.6 | 5.4 | 3.6 | 7.2 |
| Glycemia (mg/dL) T2 | 92.2 | 16.2 | 88.0 | 84.0 | 96.0 | 70.0 | 193.0 |
| BMI (kg/m^2) ST | 30.7 | 5.2 | 29.7 | 27.5 | 33.2 | 19.7 | 57.1 |
| A1C (%) ST | 5.3 | 0.9 | 5.2 | 4.6 | 5.7 | 3.5 | 10.0 |
| Glycemia (mg/dL) ST | 95.0 | 25.7 | 89.5 | 85.0 | 99.0 | 48.0 | 317.0 |
| Other medications (number) ST | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.0 |
| Comorbidities ST | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 2.0 |

The percentages refer to the total number of patients with complications (n=204).
complications were very severe, classified as Clavien-Dindo IIIb in 70.1% of cases (Table 2). Often, the increase in the size of the common loop did not determine the resolution of the complication – whether malnutrition, diarrhea, or anemia – which requires a new reintervention.

Gastrojejunal anastomosis ulcers occur between 3.2% and 12.5% of patients after BPD-S; the production of hydrochloric acid in the large gastric stump is a characteristic of this surgery, which is observed in the pathogenesis of ulcer. A decrease in the number of duodenal ulcers in BPD-S can be explained by the absence of acid exposure to the duodenum; a possible explanation would be the obstruction of the afferent loop and consequent ischemia. The complications resulting from BPD-S, such as malnutrition (16%), anastomotic ulcers (16%), and reversal of surgery (8%), have no different incidence when patients are classified according to the difference in age.

Gastrojejunostomy ulcers were observed in 2.8% of cases in our study (Table 4). Active follow-up of these patients was carried out, with the performance of endoscopies noticed at 6 months, 12 months, and annually thereafter. It should be noted that the high incidence of anastomotic ulcer in BPD-S was the main reason for the description of biliopancreatic diversion with duodenal deviation (DBP-DD) which represents a smaller common handle and the short common handle represent a smaller risk of protein, vitamin, and mineral deficiencies; as glucose is well absorbed in all the intestinal segments, there is no risk of lack of glucose. Vitamin and mineral deficiencies after BPD-S and DBP-DD are a big problem: up to 90% of these patients will develop some type of vitamin or mineral deficiency within 3 years after surgery. This relates to the characteristic of large desorption of these surgeries due to the varying modalities of the common channel of 50-100 cm. It is essential to consider the long length of the small intestine outside the food transit represented by the biliopancreatic loop. In this handle, there can be bacterial overgrowth, leading to several consequences.

### Table 5 - Management of 143 patients with surgical complications (diversion is an abbreviation for Roux-en-Y gastric bypass).

| Diagnosis                        | N   | %   | Treatment                  | N   | %   | Evolution |
|----------------------------------|-----|-----|----------------------------|-----|-----|-----------|
| Malnutrition/Anemia              | 68  | 33.3| Common Limb Elongation     | 55  | 26.9| Good      |
|                                  |     |     | Conversion To Bypass       | 10  | 04.9| Good      |
|                                  |     |     | Reversal                   | 03  | 01.5| Good      |
| Chronic Diarrhea                 | 32  | 15.6| Conversion To Bypass       | 16  | 07.8| Good      |
|                                  |     |     | Common Limb Elongation     | 09  | 04.4| Good      |
|                                  |     |     | Reversal                   | 07  | 03.4| Good      |
| Internal Hernia                  | 21  | 10.3| Mesenteric Closure         | 21  | 10.3| Good      |
| GI Anastomosis Ulcer             | 17  | 08.3| Suture Of Ulceration       | 07  | 03.4| Good      |
|                                  |     |     | Degastrectomy              | 07  | 03.4| Good      |
|                                  |     |     | Conversion To Bypass       | 03  | 01.5| Good      |
| Intestinal Obstruction           | 01  | 0.49| Enterectomy                | 01  | 0.49| Good      |
| Acute Pancreatitis               | 01  | 0.49| Distal Pancreatectomy      | 01  | 0.49| Death     |
| Spontaneous Fracture             | 01  | 0.49| Reversal                   | 01  | 0.49| Good      |
| Acute Hepatopathy                | 01  | 0.49| Reversal                   | 01  | 0.49| Good      |
| Hipoalcemry                      | 01  | 0.49| Reversal                   | 01  | 0.49| Good      |
| Total                            |     | 143 | 70.1                       |     |     |           |

### Table 6 - Complications that were treated clinically (the percentage refers to the total number of patients with complications, n=204)

| Diagnosis                                | N   | %   | Evolution |
|------------------------------------------|-----|-----|-----------|
| Severe malnutrition                      | 28  | 13.7| Good      |
| Gastrojeunal anastomosis ulceration      | 27  | 13.2| Good      |
| Severe chronic diarrhea                  | 02  | 0.98| Good      |
| Septiency                                | 01  | 0.49| Good      |
| Spontaneous bone fracture, malnutrition, anemia | 01  | 0.49| Good      |
| Pulmonary tuberculosis, malnutrition, ulcer | 01  | 0.49| Good      |
| Acute hepatic failure                    | 01  | 0.49| Good      |
| Total                                    | 61  | 29.9|           |

### Table 7 - Time before the occurrence of post-surgery complications, including absolute frequency, relative mean, and median estimates with 95% confidence interval (95%CI)

|                          | N   | %   | Average | 95%CI        | Median | 95%CI   |
|--------------------------|-----|-----|---------|--------------|--------|---------|
| Clinical complication    | 59  | 29.9| 9.2     | 8.2-10.3     | 9.5    | 6.1-12.9|
| Surgical complication    | 140 | 70.1| 5.9     | 5.2-6.6      | 5.1    | 3.7-6.5 |
| Ulcer                    | 51  | 21.5| 10.1    | 9.1-11.2     | 11.7   | 8.9-14.5|
| Malnutrition             | 89  | 43.6| 7.6     | 6.8-8.5      | 7.5    | 6.3-8.8 |
| Internal hernia          | 22  | 10.3| 12.4    | 11.5-13.3    | 14.3   | 9.8-18.8|

Malnutrition was observed just after the treatment (T0), as it occurred in an average of 7.6 years (95%CI 6.8-8.5). Ulcers were observed in an average of 10.1 years (95%CI 9.1-11.2) and internal hernia occurred in an average of 12.4 years after surgery (95%CI 11.5-13.3).
Symptoms include diarrhea and weight loss, which can be erroneously attributed to the change in anatomical effect of the gastrointestinal tract caused by the surgery, and such complication may be underdiagnosed. Garzon et al. (2007) demonstrated that intestinal loop lengths determine important differences in terms of weight loss and complications. The authors compared two groups of patients operated on for BPD-S with loop intestinal measurements: a group with a length of 50 cm of common loop and a length 200 cm of food loop and another group with a length of 75 cm of common loop and a length of 225 cm of food loop were followed up for 12 years. The first group had better and more sustained weight loss; however, this same group presented much more malnutrition (16%) and anemia (60%) than the second group (2% and 40%, respectively).

Several modifications of Scopinaro’s surgery have been published, to decrease the rate of morbidity and late complications. In one of these modifications, bowel loops were having similar length, along with the preservation of the distal stomach, to perform a less aggressive intervention and reduce morbidity. The modification by Domene et al. (2001) was used in the present study. This procedure includes a gastric reservoir.

Figure 4 - Probability of occurrence of clinical complications after the surgical procedure.

Figure 5 - Probability of occurrence of surgical complications after the surgical procedure.
of 200-400 ml, length of food loop of 200 cm, and length of common loop from 50 to 100 cm, without resection of the distal stomach, aiming to reduce surgical trauma and avoiding the risk of fistula of the duodenal stump. Consecrated surgeries, such as the Roux-en-Y gastric diversion, or gastric diversion, preserving the distal stomach, showed the safety of these types of surgeries. The type of gastric preservation performed in our patients does not pose a risk of retained antrum syndrome, as it preserves the acid inside the stomach, due to the small size of the gastric stump. The DBP-S determines a high incidence of gastroileal anastomosis ulcer, and this occurred in 44 patients in our sample (2.8%), many of them difficult to treat and even needing surgical treatment (Table 1).

Crea et al. (2011) compared 287 patients operated on with BPD-S with distal gastrectomy and 253 with gastric preservation and length of 50 cm of common loop, for more than 7 years. The two groups had similar results in terms of weight loss and resolution of diabetes; according to the authors, there were no vitamin and protein deficiencies in this follow-up period. There were 13 cases (2.4%) of anastomotic ulcers in this group, six with gastrectomy and seven without resection, with no statistically significant difference.

Figure 6 - Probability of occurrence of ulcer after the surgical procedure.

Figure 7 - Probability of occurrence of malnutrition after the surgical procedure.
Table 8 - Diagnosis of the first complication in patients with the second complication.

| First complication       | N | %   | N   | %   |
|-------------------------|---|-----|-----|-----|
| Malnutrition            | 19| 09.3| 11  | 05.3|
| Associated              |   |     |     |     |
| Isolated                | 08| 03.9|
| GI anastomosis ulcer    | 11| 05.3| 06  | 02.9|
| Perforation             |   |     | 05  | 02.4|
| No perforation          |   |     |     |     |
| Diarrea                 | 03| 01.4|
| Internal hernia         | 03| 01.4|
| Total                   | 36| 17.6|

In the study by Ballesteros-Pomar et al. (2016), 1,299 patients underwent surgery, 71 (24%) with distal gastrectomy and 228 (76%) with gastric preservation, with length of food loop around 200 cm and length of common loop ranging from 50 to 100 cm, followed for 10 years. The length of common loop was initially 50 cm and was later increased to 100 cm to reduce nutritional complications. No significant differences were found between clinical and nutritional complications among patients with or without gastrectomy, as well as length of common loops of 50 or 100 cm in extension. After 10 years, the loss of excess weight was 63.7%; blood glucose levels and cholesterol were normal in all the patients. Protein malnutrition affected 4% of patients and anemia occurred in 16% of patients during the follow-up period; 61.5% of patients had vitamin deficiency during the follow-up. Vitamin A, D, and E deficiencies were increased in the late follow-up. There was no study on the occurrence of ulcers of anastomosis.

Follow-up of 75 patients operated without distal gastrectomy showed that the results obtained in 11 patients were quite similar to those of Scopinaro – anemia in 78.6% of cases, hypoproteinemia in 25.4% of cases, and hypovitaminosis in less than 10% of patients. Clinical occurrences such as diarrhea, flatulence, and anal diseases were also frequent.2,3,10

Another serious consequence of biliopancreatic diversion is liver cirrhosis, which has the absorption of hepatotoxic substances in the excluded small intestine as one of its mechanisms, and excessive mobilization of free fatty acids, causing steatosis and oxidative damage of the hepatocytes,2,11 which may even lead to liver transplantation.10

Of the complications that occurred in 13% of our patients, 61 of the patients (29.9%) had undergone clinical treatment, and 143 (70.1%) were treated surgically (Tables 4-6). Our patients were instructed preoperatively and postoperatively as per the need for the use of intense and continuous supplementation of vitamins and minerals. Even so, the iron deficiency and fat-soluble vitamins were very common, often requiring the use of injectable replacement, mainly iron. Except for patients with anastomatic ulcers or septicemia, who had hospitalization of up to 2 weeks, all other clinically treated patients had a prolonged period of hospitalization, from 4 weeks to 4 months, for nutritional and clinical recovery. Enteral nutrition does not show good results in these patients, as it leads to severe diarrhea even with elemental nutrition; all of these patients needed prolonged parenteral nutrition for their recovery. There was good evolution in all of them, but some developed a second complication during late follow-up (Table 8).

Among the patients who had undergone surgical treatment (Table 5), all those who had a hernia were treated with the closure of the mesenteric gap and had a good evolution. Seventeen patients with perforated ulcers were treated, with seven of them treated with only ulcer raffia, seven treated with degastrectomy, and three with conversion to gastric diversion. Patients with malnutrition, severe anemia, or chronic diarrhea were operated on with elongation of the common loop (n=64), conversion to gastric diversion (n=29), or reversal of surgery (n=10). The reversal was always carried out at the request of the patients. Initially, it was the elongation of the common loop which was performed in all patients; some of them did not have satisfactory evolution and required reintervention, leading to the indication of conversion to gastric diversion, all with good results. The only operated patient who died was one with severe acute pancreatitis which progressed to hemorrhagic necrosis.

The elongation of the common loop was performed by sectioning the loop anastomosis feeding at the level of the anastomosis with the ileum, and anastomosis of the alimentary loop at 1.5 m of the biliopancreatic loop, counted from the

Figure 8 - Probability of occurrence of internal hernia after the surgical procedure.
broken anastomosis (Figure 9). Thereby, the absorption surface is increased by incorporating a 1.5 m biliopancreatic loop in the common loop, through which the digested food passes.

Complications, both clinical and surgical, occur in about one-third of the cases (35%) in the first 2 years, but they continue to happen even after 15 years of surgery. The mean time of surgical complications was 5.9 years, and of clinical complications was 9.2 years (Table 7, Figures 4 and 5). Malnutrition, anastomotic ulcers, and internal hernias can happen even after 15 years of surgery (Figures 6-8). These observations demonstrate the need for permanent monitoring of these patients, as they can present serious complications even after a long time after surgery. A second complication occurred in 36 patients who had malnutrition, anemia, diarrhea, or internal hernia as their first complication (Table 9); 12 of them were treated clinically and 24 were treated surgically (Tables 9-13).

The second complication was mostly different from the first one. Three patients with the closure of the breach due to internal hernia evolved with anastomotic ulcer or malnutrition. Three of them with diarrhea and elongation of the common loop during the first complication continued having diarrhea and were converted to diversion (Table 9). Among 19 patients with malnutrition as the first occurrence, 5 had undergone clinical treatment initially and 14 were treated with common loop elongation (Tables 10 and 11). Of those who had clinical treatment initially, two of them again had malnutrition and were clinically managed; other two patients had ulcers of anastomosis and one with an internal hernia was treated surgically (Table 10).

Of the 14 patients operated with loop stretching, 5 had nutritional complications – malnutrition or diarrhea; three were treated with reversal or conversion to diversion, and two with parenteral nutrition. It is important to highlight the occurrence of two cases of severe liver changes that resulted in the death of these patients (Table 11). Even with the significant increase in the area of nutrient absorption that occurred again with severe nutritional complications or liver alterations resulting from the modification of the enterohepatic bile salts, these occurrences motivated the conversion to diversion as an option of choice in patients with severe nutritional complications or diarrhea.

Among 11 patients diagnosed with an anastomotic ulcer in the first complication and had a second complication, 5 of them had no perforation, and 6 had a perforation in the first complication. Of the five patients without drilling, there was a new ulcer in two of them, malnutrition in the other two, and an internal hernia in one of them (Table 12). The other six patients had perforation, which initially evolved with a new ulcer in two of them, malnutrition in another two, and an internal hernia in one (Table 13). The ulcer of anastomosis continues to occur in the late postoperative period and is possibly due to performing the Roux-en-Y gastroileal anastomosis, with a relatively long-term gastric stump.

The results with the various length modifications of the intestinal loops of the Scopinaro surgery demonstrated the difficulty of striking a balance between the effects of surgery, such as sufficient and sustained weight loss, and serious side effects such as malnutrition, anemia, and multiple vitamin deficiencies; the greater the weight loss, the higher the risk of serious complications. The evaluation of the various publications with modifications of the lengths of the intestinal loops of the DBP-S, to maintain adequate slimming power with minimal side effects, did not bring very different results. These types of surgeries determine an important improvement in the metabolic syndrome – control of blood glucose, cholesterol, and triglyceride levels – and a consistent reduction in excess weight, maintained in the late postoperative period. One should follow general, unrestricted diet, which is an important factor in assessing the quality of life by the operated patients. However, they have very worst results regarding the symptoms of side effects, nutritional effects, and micronutrient levels. The patients often present with diarrhea, foul odor of feces and skin, in addition to pathologies of orifices and anastomotic ulcers. Albumin levels and fat-soluble vitamins (A, D, E, K), in addition to calcium, iron, and zinc, are greatly altered and need continuous replacement. They need constant monitoring of changes to avoid clinical and nutritional complications. These changes can even present themselves 20 years after surgery, and these patients need reoperations to control clinical and nutritional complications.

### Table 10 - Diagnosis and management of the second complication of patients whose first complication was malnutrition (n=19) and had clinical treatment (n=5).

| Second complication          | N  | Treatment       | Evolution |
|-----------------------------|----|-----------------|-----------|
| Gastroileal anastomosis ulcer | 2  | Clinical        | Good      |
| Desnutrição                 | 2  | Clinical        | Good      |
| Internal hernia             | 1  | Enterectomy and mesenteric closure | Good |
| Total                       | 5  |                 |           |

### Table 11 - Diagnosis and management of the second complication of patients whose first complication was malnutrition (n=19), and they were treated with stretching the loop (n=14)

| Second complication          | N  | Treatment         | N  | Evolution |
|-----------------------------|----|-------------------|----|-----------|
| Perforated ulcer            | 3  | Degastrectomy     | 1  | Good      |
| Ulcer without perforation   | 2  | Clinical          | 2  | Good      |
| Malnutrition                | 3  | Clinical          | 2  | Good      |
| Diarrhea                    | 2  | Conversion to bypass | 2  | Good      |
| Internal hernia             | 1  | Mesenteric closure | 1  | Good      |
| Ulcerative colitis          | 1  | Colectomy and reversal | 1  | Good      |
| Hepatic failure             | 1  | Clinical          | 1  | Death     |
| Hepatic cirrosis            | 1  | Hepatic transplantation | 1  | Death     |
| Total                       | 14 |                   | 14 |           |

### Table 9 - Diagnosis of the first complication and respective management; diagnosis, management, and evolution of second complication in patients whose first complication was diarrhea or internal hernia.

| First complication          | N  | Treatment       | Second complication          | N  | Treatment         | N  | Evolution |
|-----------------------------|----|-----------------|-----------------------------|----|-------------------|----|-----------|
| Diarrhea                    | 3  | Common Limb Elongation | Diarrhea                   | 3  | Conversion to bypass | 3  | Good      |
| Internal Hernia             | 2  | Mesenteric Closure | Gastroileal anastomosis ulcer | 2  | Clinical          | 2  | Good      |
| Internal Hernia             | 1  | Mesenteric Closure | Malnutrition                | 1  | Reversion         | 1  | Good      |
surgery, such as the biliopancreatic diversion with duodenal diversion (DBP-DS), also have difficulties similar to the basic Scopinaro’s surgery to establish the lengths of bowel loops with the right balance between unwanted side effects and adequate leakage and sustained weight.

No other surgery has satisfactory results to control obesity such as the one carried out by biliopancreatic diversions – DBP-S or DPB-DD. However, studies showed that the proportion of DBP-DD has been decreasing from 6.1% to 4.9%, and 2.1% in 2003, 2008, and 2011, respectively, corresponding to less than 1% of all bariatric surgeries. Notably, 1187 (0.6%) of 215666 patients were operated in the USA in 2016.

As the procedure that determines the best and maximum sustained weight loss, significant reversal of comorbidities, is the least performed surgery in the world? The answer is multifactorial and complex. First, it is a highly complex surgery and requires a skilled and experienced team. The morbidity and mortality of this surgery is the highest among all modalities of surgical treatment of obesity, in which mortality may reach 2.7%, against 0.1% of the most commonly performed surgeries.

Our experience with 1570 patients operated on and followed up for up to 20 years shows that the metabolic result of BPD-S is excellent in most patients; however, practically, there are significant changes in the frequency of bowel movements as the feces are passed easily but with an unpleasant odor that often forces the patient to limit their social life, having difficulty going to public restrooms due to the bad smell of feces and, also, to have a bathroom isolated from the house for their personal use. Also, the skin has a change in smell, which can be very strong, and the more intense the odor, the greater the fat intake by the patient.

The replacement of trace elements and vitamins need to be continuous and intense. Vitamin D is permanently low, and even with high-dose replacement, it hardly reaches normal values. Mild anemia happens in most patients, and all need parenteral iron replacement in late follow-up. Malnutrition and severe diarrhea almost always lead to long hospital stays and need prolonged parenteral nutrition; enteral nutrition is either insufficient or cannot be performed because it causes severe diarrhea, possibly due to lesions of the intestinal mucosa by malnutrition. Complications occur in a large number of cases; they are usually serious and most of them require surgical treatment. Due to all these complications, DBP-S should be reserved for exceptional cases, as there are safer surgical alternatives with less serious side effects.

### Table 12 - Evolution of the five patients who had the ulcer of gastroileal anastomosis without perforation as their first complication.

| Treatment of First complication | N | Second complication       | Treatment       | Evolution |
|---------------------------------|---|--------------------------|-----------------|-----------|
| Clinical                        | 1 | Upper GI bleeding        | Hemostasis      | Good      |
| Clinical                        | 1 | Malnutrition             | Clinical        | Good      |
| Clinical                        | 1 | Internal hernia          | Mesenteric Closure | Good     |
| Degastrectomy                   | 1 | Anastomosis ulcer        | Clinical        | Good      |
| Degastrectomy                   | 1 | Malnutrition             | Common limb elongation | Good     |
| Total                           | 5 |                          |                 |           |

### Table 13 - Evolution of the six patients who had the gastroileal anastomosis ulcer with perforation as their first complication.

| Treatment of First complication | N | Second complication       | Treatment       | Evolution |
|---------------------------------|---|--------------------------|-----------------|-----------|
| Clinical                        | 1 | Upper GI bleeding        | Hemostasis      | Good      |
| Clinical                        | 1 | Malnutrition             | Clinical        | Good      |
| Clinical                        | 1 | Internal hernia          | Mesenteric Closure | Good     |
| Degastrectomy                   | 1 | Anastomosis ulcer        | Clinical        | Good      |
| Degastrectomy                   | 1 | Malnutrition             | Common limb elongation | Good     |
| Total                           | 5 |                          |                 |           |
of Scopinaro’s biliopancreatic diversion should be reserved for exceptional cases, as there are safer surgical alternatives with less serious side effects.

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