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Original research

Comparative nutritional, metabolic and body composition effect in patients of Roux-en-Y Gastric Bypass with Long or Short Pancreato-Biliary Limb

Leticia del Carmen Guajardo-Montemayor[a1], Rosendo Andrés Rojas-Alvarado[b2], Israel Augusto González-González[c3], Raúl Marín-Domínguez[c4], Francisco José Campos-Pérez[c], Andrea Ibarra-García[a5], Antonio Ibarra[a6*]

[a] Universidad Anáhuac México Campus Norte, Centro de Investigación en Ciencias de la Salud (CICSA), Estado de México, México
[b] Universidad Autónoma de Baja California, Departamento de Epidemiología, Baja California, México
[c] Hospital General "Dr. Rubén Leñero", Clínica Integral de Cirugía para la Obesidad y Enfermedades Metabólicas, Ciudad de México, México

ID ORCID:

[1]https://orcid.org/0000-0003-3308-1460, [2]https://orcid.org/0000-0001-5055-8342, [3]https://orcid.org/0000-0001-6155-6027, [4]https://orcid.org/0000-0001-8906-8965, [5]https://orcid.org/0000-0003-0068-2614, [6]https://orcid.org/0000-0003-2489-4689

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ABSTRACT

Introduction: Laparoscopic Roux-en-Y Gastric Bypass (LRYGB) is one of the most common techniques for the treatment of morbid obesity. However, evidence for the metabolic effects caused by the measures of intestinal limbs that are used in LRYGB is limited. The present study was conducted to assess the metabolic impact of using a long biliopancreatic limb (LBP-limb) versus a short biliopancreatic limb (SBP-limb) in patients with obesity undergoing LRYGB at six, nine and twelve months after the surgery to compare changes from baseline between the two procedures. **Methods:** Sixty-four patients with obesity participated in this study and underwent gastric bypass with either a 100-cm biliopancreatic limb (SBP-limb) and 150-cm alimentary limb (n = 31) or a 200-cm biliopancreatic limb (LBP-limb) and 50-cm alimentary limb (n = 33). Body weight, body fat (%), lean mass (%), total weight loss (%) and biochemical parameters glucose, glycosylated hemoglobin (HbA1c), total cholesterol, low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), triglycerides, albumin and glycated hemoglobin were compared at the time of surgery and at six, nine and twelve months after surgery. **Results:** After surgery, the LBP-limb group had a greater total weight loss (P = 0.004) at twelve months after surgery, and a significant increase in HDL-C levels at six months (P = 0.001) compared with the SBP-limb group. However, no differences in the remission of comorbidities were found between the two groups. **Conclusions:** At the end of the first year after surgery the LBP-limb technique generated greater weight loss.

Key words: bariatric surgery; morbid obesity; long biliopancreatic limb; short biliopancreatic limb.

* *Corresponding Author*: Antonio Ibarra. Universidad Anáhuac México, Centro de Investigación en Ciencias de la Salud (CICSA). Address: Av. Universidad Anáhuac núm. 46, Lomas Anáhuac, 52786. Huixquilucan, Estado de México, México. Tel.: +52 55 5627 0210 ext. 8524. Email: jose.ibarra@anahuac.mx

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RESUMEN

Introducción: El bypass gástrico laparoscópico en Y de Roux (BPGYR) es una de las técnicas empleadas en el tratamiento de la obesidad mórbida. Este estudio comparó el impacto metabólico del la técnica quirúrgica con asa biliopancreática larga (LBP-limb) versus un asa biliopancreática corta (SBP-limb) en pacientes sometidos a BPGYR a los seis, nueve y doce meses después de la cirugía comparando los cambios entre los dos procedimientos. **Métodos:** Sesenta y cuatro pacientes con obesidad sometidos a BPGYR en dos grupos, uno con asa biliopancreática de 100 cm (SBP-limb) y asa alimentaria de 150 cm (n = 31) y otro con una asa biliopancreática de 200 cm (LBP-limb) y asa alimentaria de 50 cm (n = 33). El peso corporal, grasa corporal (Fat Mass), masa libre de grasa (Lean Mass), peso total perdido y parámetros bioquímicos de glucosa, hemoglobina glucosilada (HbA1c), colesterol total, colesterol de baja densidad (c-LDL), colesterol de alta densidad (c-HDL), y albúmina fueron comparados a los seis, nueve y doce meses después de la cirugía. **Resultados:** Después de la cirugía se observó que en el grupo de LBP-limb existió una mayor pérdida de peso total (P = 0,004) a los doce meses después de la cirugía y un aumento significativo en los niveles de c-HDL a los seis meses (P = 0,001) en comparación con el grupo SBP-limb. Sin embargo, no se encontraron diferencias en la remisión de comorbilidades entre los dos grupos. **Conclusiones:** Al finalizar el primer año posoperatorio la técnica LBP-limb generó mayor pérdida de peso.

Palabras clave: cirugía bariátrica; obesidad mórbida; asa biliopancreática larga; asa biliopancreática corta.

INTRODUCTION

Obesity is a chronic disease that has tripled in prevalence since the 1970s and has been classified as a pandemic in recent years.[1] According to the World Health Organization (WHO), 650 million adults were estimated to have this disease in 2018, representing a prevalence of 13% worldwide. Obesity, especially morbid obesity with a body mass index (BMI) ≥ 40 kg/m^2, is one of the main pathologies that has been related to the incidence and prevalence of type 2 diabetes (DT2), with morbid obesity leading to a 23% greater risk of developing T2D.[2] Obesity has also been associated with an increased incidence of cardiovascular morbidity, arterial hypertension (AHT), insulin resistance and dyslipidemia.[2-5] A systematic review showed that morbid obesity is related to the development of heart disease, heart failure and cardiovascular mortality.[2-5] One of the strategies used to reduce this pathology and some of its complications is bariatric surgery. The use of this type of procedure has increased exponentially, and the International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO) reported that 685,874 bariatric surgeries were performed worldwide in 2018.[6] Although laparoscopic Roux-en-Y Gastric Bypass (LRYGB) is the second most frequently performed surgery worldwide, and also in Mexico, LRYGB has become one of the most common surgeries and is the reference standard for the long-term treatment of obesity.[7] This surgical technique has yielded good results since its introduction in the 1960s, but due to the substantial variability of the technique as a result of the complexity of obesity, the long-term results remain controversial.[8-10] Bariatric surgery is performed as a treatment for morbid obesity with the primary objective to improve patients' health, achieve a healthy weight, and decrease or remit medical comorbidities causing weight and metabolic control. This procedure contributes to reducing the long-term comorbidities induced by the hormonal effects of weight loss.[9,11-14]

In recent years, weight regain has been observed in some patients who underwent LRYGB, and variations of the technique have been developed to prevent this situation. One of these variations involves lengthening of the alimentary limb (A-limb) and/or biliopancreatic limb (BP-limb).[15] Several studies have shown that short-length limbs, mainly BP-limbs, generate weight loss after bariatric surgery and facilitate the resolution of comorbidities.[11-15] However, such elongation has also been demonstrated to result in a high incidence of nutritional complications.[8,9,16] Currently, there are studies with inconclusive results regarding BP-limb lengths, thus the aim of this study was to assess the 12- month metabolic impact generated by the long BP-limb compared to the SBP-limb.

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MATERIALS AND METHODS

Participants

This study was carried out at the Surgery Clinic for Obesity and Metabolic Diseases of the Rubén Leñero Hospital in Mexico City, Mexico, from June 2018 to August 2019. Mexican patients aged 18 years to 65 years with a BMI of 40-49.[9] kg/m^2 were included. The exclusion criteria included a diagnosis of T2D for more than five years, secondary arterial hypertension (AHT) (renal malformation, unilateral renal agenesis), smoking and history of cancer and alcohol abuse. Additionally, participants were excluded if they left the city and/or abandoned the study or failed to attend their medical consultations/laboratory visits.

Design of the study

This study was a randomized and controlled clinical trial with the objective of comparing the nutritional, metabolic and body composition effect in patients of Roux-en-Y Gastric Bypass with Long or Short Pancreato-Biliary Limb.

The participants who met the inclusion criteria for bariatric surgery were instructed to follow a restrictive balanced dietary plan with a 55% carbohydrate, 20% protein and 25% fat distribution (1,500 kcal/day). After one month on the dietary plan and normalization of biochemical parameters and blood pressure, the patients were randomly selected using random allocation software (Microsoft Visual Basic 6) to assign their type of surgery by research. The evaluated techniques included LRYGB with a long BP-limb (LBP-limb) (50-cm A-limb + 200-cm LBP) and LRYGB with short BP-limb (SBP-limb) (150-cm A-limb + 100-cm SBP). One week before the date of surgery, the dietary plan was modified to a Mediterranean- type/anti-inflammatory hypocaloric (1,000 kcal/day) plan. The study consisted of five visits in total, including two pre-surgical (one month before surgery and the day before surgery) and post-surgical consultations at six, nine and twelve months. During the first consultation, the patients' medical and nutritional history was recorded, and during the postsurgical consultations, a twenty-four-hour dietary recall was carried out, and the type and duration of physical activity (aerobic or anaerobic) performed were recorded. Body composition evaluated via bioelectrical bioimpedance was also recorded. Biochemical parameters were measured prior to surgery at six, nine and twelve months after surgery.

The study was conducted in accordance with the Declaration of Helsinki. The ethics committees of the Dr. Rubén Leñero General Hospital (No. 2050101717) and Universidad Anáhuac México, North Campus (No. 201815) approved the study. A written informed consent was obtained from all participants in the first visit. The full protocol is available in Universidad Anáhuac México, North Campus.

Diet

The diet of the participants was modified before and after surgery. They consumed a restrictive balanced diet with a macronutrient distribution of 45-55% carbohydrates, 15-25% protein and 25-30% fat. After surgery, only the amount of protein was adjusted according to the intensity and type of exercise performed.

Compliance with the diet was evaluated by a twenty- four-hour dietary recall repeated three times to account for the time elapsed between visits, and the amount of protein ingested throughout the day was the main element quantified, where > 1.5 g of protein per kg of the ideal weight/day was indicative of compliance with the protein goal, and whereas a lower protein intake was indicative of noncompliance with the protein goal.[31]

INTERVENTION: SURGICAL TECHNIQUES OF LAPAROSCOPIC ROUX-EN-Y GASTRIC BYPASS USING A SHORT BILIOPANCREATIC LIMB OR A LONG BILIOPANCREATIC LIMB

Long alimentary limb Gastric Bypass

The pouch was created using the standard technique, omentum was divided and small bowel was counted 100 cm from the ligament of Treitz; we created gastro-jejunostomy with a linear stapler using a 32 Fr Bougie as a guide. A 150 cm alimentary limb was measured and jejuno-jejunostomy was created, we used a linear stapler to transect the bowel transforming the omega into a roux-en-y gastric bypass. The mesenteric and Petersen's defect were closed using non-absorbable suture.

Long biliopancreatic limb Gastric Bypass

After creating a pouch using standard technique and omentum was divided, small bowel was measured to 200cm from the ligament of Treitz, we created a gastro- jejunostomy using a 32 Fr Bougie as a guide. A 50 cm alimentary limb was counted and jejuno-jejunostomy was created. A linear stapled was used to transect bowel transforming to roux-en-y gastric bypass. The mesenteric and Petersen's defect were closed using non-absorbable suture.

Body composition measures

Height was recorded in duplicate according to the Lohman method.[17] Fat mass and lean mass percentages were obtained through a direct segmental multifrequency bioelectrical impedance analysis method using a total body position analyzer (InBody model 370, CO., LTD) one night before surgery following an eight-hour fast. The patient was barefoot, wore only light clothing and no metallic accessories and assumed an upright standing position (with each foot and hand on the corresponding electrodes) for the measurements.

Sampling and biochemical analysis

Blood samples were collected following a twelve-hour fast after each visit. The serum was obtained, and the blood was centrifuged at 1,500 x g for 10 minutes and stored at -70 °C until analysis. The biochemical parameters were determined using DxC600 equipment (Beckman Coulter).

Statistical Analysis

The sample size was calculated using the analytical formula for quantitative comparative studies, and a change of 40 mg in triglycerides at twelve months of follow-up as established in a previous study was used as a reference. A power of 80% was used, with a P value of 0.05. A total of thirty-one patients were required per group, and a loss to follow-up rate of 20% was considered; thus, thirty-six participants were included in each group. Baseline parameters were compared using Student's t-test for independent samples. One-way ANOVA adjusted for age, gender and baseline weight was performed to compare changes in body composition and the concentrations of biochemical parameters between the groups. $P < 0.05$ (one-tailed) indicated a significant difference. The data were analyzed by SPSS (version 20.00 SPSS Inc. Chicago, IL).

RESULTS

Baseline characteristics of the population

Sixty-four patients with morbid obesity scheduled for SBP-limb (n = 31) and LBP-limb (n = 33) gastric bypass surgery participated in the present study and they were followed for twelve months (Figure 1).

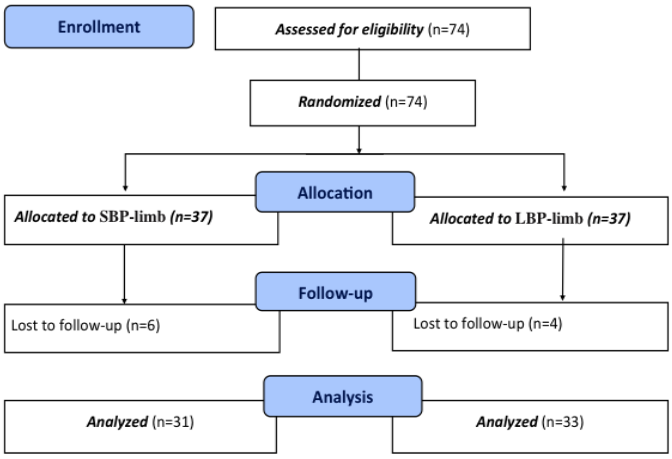

Figure 1. Flow chart of participant selection

The mean ages of the participants were 38 ± 9 years and 36 ± 7 years in the SBP-limb and LBP-limb groups, respectively. The percentage of women was 80% in the SBP-limb group and 75% in the LBP-limb group. The baseline fat mass percentage was 43.9 ± 1.70% in the SBP-limb group and 42.1 ± 2.10% in the LBP-limb group (Table I). No significant differences were found in baseline biochemical parameters or in the rates of comorbidities such as AHT, T2D and dyslipidemia between the participants in both groups (Table I).

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Table I. Baseline characteristics of the study population

	SBP-limb	LBP-limb	P value
Age (years)	38 ± 9	36 ± 7	*0.703*
Sex			
Female, n (%)	25 (81)	25 (76)	
Male, n (%)	6 (18)	8 (24)	
Body			
Weight (kg)	108 ± 18.8	110 ± 18.7	*0.473*
BMI (kg/m^2)	43.9 ± 1.70	42.1 ± 2.10	*0.924*
Fat mass (%)	49.3 ± 5.90	49.1 ± 5.01	*0.152*
Lean mass (%)	28.3 ± 2.50	28.8 ± 2.40	*0.164*
Biochemical			
Glucose	96.2 ± 13.1	97.1 ± 12.0	*0.875*
HbA1c (%)	6.01 ± 1.00	6.02 ± 1.01	*0.590*
Total cholesterol	176 ± 35.0	176 ± 37.1	*0.792*
HDL-C (mg/dL)	35.0 ± 6.01	35.0 ± 8.03	*0.404*
LDL-C (mg/dL)	118 ± 32.2	117 ± 35.1	*0.902*
Triglycerides	175 ± 78.0	139 ± 49.1	*0.107*
Comorbidities			
T2D, n (%)	11 (35)	11 (33)	*0.982*
HT, n (%)	10 (32)	9 (27)	*0.539*
Cholesterolemia	9 (29)	11 (33)	*0.850*
Triglyceridemia	13 (42)	12 (36)	*0.878*

The data are expressed as the means ± SD. The data were analyzed by an unpaired t-test. Body mass index (BMI); Total weight loss (TWL); Glycosylated hemoglobin (HbA1c); High-density cholesterol (HDL-C); Low-density cholesterol (LDL-C); Type 2 diabetes (T2D); Hypertension (HT). All results were considered statistically significant at $P < 0.05$.

Complications occurred in the SBP-limb group, with two patients exhibiting gastrojejunal anastomotic leakage. In the LBP-limb group, one patient had anastomotic leakage, and another patient developed cholelithiasis during the first three months after surgery. Regarding these 2 patients, the nasojejunal probe was placed because the 2 fistulas were presented in the gastrojejunal anastomosis. The probe was left until the fistula was resolved between 14 and 21 days and removed with results control endoscopy performed per month.

Percentage changes in biochemical parameters

Biochemical parameters allow us to evaluate the evolution and effectiveness of treatment. glucose, triglyceride, total cholesterol, low-density lipoprotein cholesterol (LDL-C) and high-density lipoprotein cholesterol (HDL-C) levels were determined at six, nine and twelve months after surgery. At the end of the follow-up, glucose concentrations were similar in both groups (Table II). Triglyceride, total cholesterol and LDL-C levels decreased, but they were not statistically significant (Table II). The HDL-C concentration showed a statistically significant difference between the groups at the end of the follow-up (Table II) ($P < 0.001$).

Table II. General anthropometric and biochemical characteristics of the participants based on surgical procedures

	SBP-limb				LBP-limb				P value
	0	6	9	12	0	6	9	12	
Body composition									
Weight (kg)	108 ± 18.8	80.2 ± 13.9	75 ± 12.6	72.6 ± 11.8	110 ± 18.7	79.6 ± 12.1	74.6 ± 11.3	72.5 ± 11.4	***0.004***
BMI (kg/m^2)	43.9 ± 1.7	30.3 ± 3.5	28.5 ± 3.00	27.5 ± 2.90	42.1 ± 2.1	29.8 ± 3.1	28.0 ± 3.01	28.0 ± 3.01	*0.128*
Fat mass (%)	49.3 ± 5.91	36.5 ± 6.40	32.2 ± 6.22	29.6 ± 7.23	49.1 ± 5.03	34.0 ± 7.61	31.0 ± 7.70	28.5 ± 7.60	*0.151*
Lean mass (%)	28.3 ± 2.50	34.6 ± 3.90	37.0 ± 3.70	38.6 ± 5.60	28.8 ± 2.41	35.9 ± 4.10	37.7 ± 4.21	38.6 ± 5.60	*0.388*
Biochemical parameters									
Glucose (mg/dL)	96.0 ± 13.1	85.0 ± 6.01	86.0 ± 6.01	86.0 ± 7.19	97.0 ± 12.0	83.0 ± 7.10	85.0 ± 6.02	85.1 ± 6.01	*0.772*
Total cholesterol (mg/dL)	176 ± 35.1	139 ± 23.1	143 ± 25.1	144 ± 23.1	176 ± 37.3	146 ± 24.4	147 ± 20.0	148 ± 23.6	*0.775*
HDL-C (mg/dL)	35 ± 6.00	34.0 ± 7.00	42.0 ± 8.00	45.0 ±11.0	35.0 ± 8.00	38.0 ± 8.00	44.0 ± 9.00	48.0 ±10.0	***0.001***
LDL-C (mg/dL)	118 ± 32.0	88.0 ± 19.0	84.0 ± 20.0	87.0 ± 24.0	117 ± 35.0	94.0 ± 25.0	85.0 ± 19.0	84.0 ± 23.0	*0.450*
Triglycerides (mg/dL)	175 ± 78.0	107 ± 26.0	94.0 ± 28.0	95.0 ± 27.0	139 ± 49.0	106 ± 28.0	97.0 ± 34.0	96.0 ± 35.0	*0.693*

The data are presented as the means ± SD. The statistical analysis was determined using one-way ANOVA. Body mass index (BMI); High-density cholesterol (HDL-C); Low-density cholesterol (LDL-C). All results were considered statistically significant at $P < 0.05$.

In SBP-limb group the biochemical parameters presented the greatest percentage changes in total cholesterol (-31.7 ± 6.54 mg/dL), LDL-C (-30.5 ± 5.69 mg/dL) and especially triglycerides (-79.3 ± 14.8 mg/dL) after the follow-up period (Table III). As a result, hypertriglyceridemia decreased by 73.5% and 83.4% (the SBP-limb and LBP-limb groups, respectively).

Table III. Changes in the anthropometric and biochemical parameters of the participants based on surgical procedures

	SBP-limb		LBP-limb	
	Before	**Changes (%)**	**Before**	**Changes (%)**
Body composition				
Weight (kg)	108 ± 18.8	-37.5 ± 2.02	110 ± 18.7	-37.8 ± 2.05
BMI (kg/m^2)	43.9 ± 1.7	-13.4 ± 0.70	42.1 ± 2.10	-14.0 ± 0.64
Fat mass (%)	49.3 ± 5.91	-19.7 ± 1.37	49.1 ± 5.01	-20.5 ± 1.16
Lean mass (%)	28.3 ± 2.50	10.2 ± 5.32	28.8 ± 2.40	9.92 ± 3.43
Biochemical parameters				
Glucose (mg/dL)	96.0 ± 13.1	-0.71 ± 0.12	97.1 ± 12.0	-0.74 ± 0.12
Total cholesterol (mg/dL)	176 ± 35.1	-31.7±6.54	176 ± 37.3	-27.6 ± 6.16
HDL-C (mg/dL)	35.0 ± 6.00	9.41 ± 1.83	35.0 ± 8.00	13.8 ± 1.95
LDL-C (mg/dL)	118 ± 32.0	-30.5 ± 5.69	117 ± 35.1	-33.2 ± 5.79
Triglycerides (mg/dL)	175 ± 78.0	-79.3 ± 14.8*	139 ± 49.0	-43.4 ± 9.04

The data are presented as the means ± SD. The statistical analysis was determined using one-way ANOVA. Body mass index (BMI); High-density cholesterol (HDL-C); Low-density cholesterol (LDL-C). All results were considered statistically significant at $P < 0.05$.

Changes in the body compositions of the participants

After the postsurgical follow-up, the body compositions of the patients were evaluated. Table II shows the changes in body weight, BMI and fat mass and lean mass percentages observed at six, nine and twelve months. At the end of the follow-up, body weight was significantly reduced in both the SBP-limb and LBP-limb groups (72.6 ± 11 and 72.5 ± 22.4, respective) ($P < 0.004$). The difference observed in body weight may be associated with fat loss because the fat mass percentage was lower in the LBP-limb group (28.5 ± 7.60) than in the SBP-limb group (29.6 ± 7.23). In addition, significant decreases in the percentage of total weight loss (TWL), BMI and fat mass were observed, and lean mass percentages were similar in both groups (Table III). This is important because the maintenance of lean mass during weight loss may improve metabolic profile and may delay weight regain in bariatric patients.[31]

Glycosylated hemoglobin and albumin levels of the participants

The SBP-limb group glycosylated hemoglobin (HbA1c) levels tended to decrease at the end of the follow-up without a significant p value (Fig. 2). No significant change in albumin was observed in either group (Fig. 2), only a tendency to increase this level was observed at six months after surgery in the LBP-limb group.

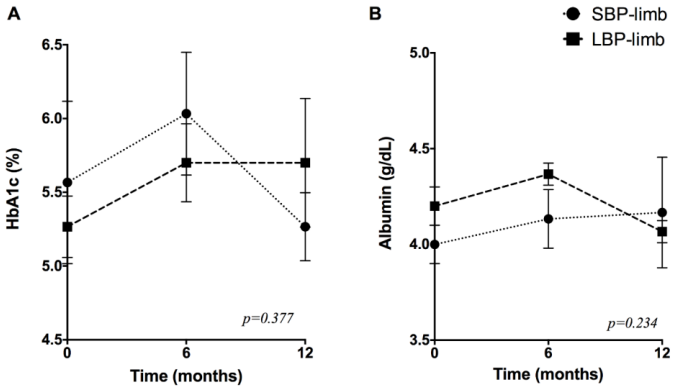

Figure 2. Glycosylated hemoglobin (HbA1c) and serum albumin levels of the patients at zero, six and twelve months after laparoscopic Roux-en-Y Gastric Bypass using a short biliopancreatic limb (SBP-limb) (n = 31) or a long biliopancreatic limb (LBP-limb) (n = 33).

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DISCUSSION

Bariatric surgery is one of the most frequently used techniques for weight loss treatment, and several factors are related to the risk of weight regain in patients who undergo this procedure. The present study was designed to compare the effects of two sizes of BP-limbs in bariatric surgery on body composition and biochemical parameters throughout a follow-up period of twelve months.

Several studies have shown that the use of an SBP-limb generates greater weight loss and improvements in the resolution of comorbidities after bariatric surgery.[18-22] Furthermore, evidence for the long-term effect of the LBP-limb technique is currently lacking in body composition. Our results demonstrate that the use of LBP-limbs is no less comparable to results obtained to the SBP-limbs. The improvement in body weight was due to a decrease in fat mass and was not associated with lean mass depletion, suggesting that the use of LBP-limbs may be a good predictor of long-term weight and fat-free mass maintenance without causing its catabolism.[21-24] It is important to emphasize this, because there are studies that show the significant loss of muscle and bone mass during the first year of surgery, so it is important to comment that with proper medical nutritional monitoring, in addition to proper monitoring and implementation of physical exercise in early stages of surgery, one can largely prevent the loss of muscle mass, so the surgical technique despite having deleterious effects on loss of fat-free mass, is not a determining factor.[8,21,23,24,30]

Our results are similar to those reported by Nergaard et al. 2010 and Zerrweck and col,[25,32] whose comparative study showed that patients with long BP-limbs had higher percentages of weight loss and greater BMI reductions as well as better control of comorbidities at one and two years of follow-up respectively ($P < 0.001$). Several mechanisms have been proposed through which the effects caused by lengthening the BP-limb can be explained, with tolerance and eating behavior being the most prominent. After bariatric surgery, the concentration of bile acids is increased in the terminal ileum, and the secretion of hormones such as insulin is stimulated due to increasing incretins in the distal intestine.[26, 27] Therefore, the metabolic effect may be due to stimulation of gastrointestinal hormones as shown by recent studies on metabolic surgery.[22, 25, 26,32] Weight loss and regulation may affect long-term metabolic control in patients with an LBP-limb. In this context, the present study shows that improvements in body composition were reflected in the biochemical parameters, which may suggest a better basal metabolic rate. A recent study evaluated the long-term effects of different lengths of BP-limbs over a ten-year follow-up period in patients with morbid obesity. In this study, greater long-term weight loss and maintenance were observed among patients with longer BP-limbs throughout the follow-up period. However, the length of the common canal is unknown in the study, and the metabolic effect may be due to a greater length of the BP-limb.[27]

Changes in body composition and normalization of biochemical parameters may be reflected in the presence of different comorbidities. In the present study, patients with an LBP-limb were not inferior in terms of outcomes in resolving comorbidities such as T2D compared to patients with an SBP-limb. Although these results may vary in the long term, greater long-term control of Type 2 diabetes has been observed after surgery with a long BP-limb.[8] Accordingly, we observed that after twelve months, the SBP-limb group showed a tendency toward decreased HbA1c levels, just the opposite of what was found in Zerrweck and cols study.[32]

In a CONSORT study conducted by Murad and Cohen in 2017,[22] in patients diagnosed with T2D and grade I obesity, implementation of the LBP-limb technique (a 200-cm BP-limb) found to decrease the severity of T2D (HbA1c < 6%) and dyslipidemia, and hypoalbuminemia was not observed in any patient (albumin < 3.5 mg/dL).[25] In the present study, albumin levels were normal (4-4.5 mg / dL) in patients with an LBP-limb, so no cases of malnutrition were found in contrast to the findings in Zerrweck and cols in 2021.[32] This outcome is important because the albumin concentration has been proposed as a prognostic marker in many pathological conditions and mainly malnutrition[28] because serum albumin has anti-inflammatory, antioxidant, anticoagulant and antiplatelet properties.[29]

CONCLUSION

The use of LBP-limbs in bariatric surgery significantly impacted weight loss over twelve months of follow-up as well as normalization of HDL-C levels. In addition, a tendency toward decreased glucose, HbA1c levels, fat and lean mass percentages were equal observed, while malnutrition associated with albumin levels was not observed. The implementation of the LBP-limb surgical technique is not inferior to the SBP-limb surgical technique, it is a safe and effective technique, and the fact that during the first year there is no significant loss of lean mass could be a promising indication that it is a technique with greater long-term effectiveness in maintaining both weight and comorbidities, given that the maintenance of muscle mass is essential for basal metabolism.

Limitations

The number of patients is low and the one-year follow-up is relatively short on the additional maintenance of weight loss and body composition, however it is the beginning to observe long-term results in a greater number of patients.

Conflict of interest

The authors have declared no conflict of interest.

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