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Short term results of bariatric surgery in the Civil Hospital of Guadalajara Fray Antonio Alcalde

Resultados a corto plazo de cirugía bariátrica en el Hospital Civil de Guadalajara "Fray Antonio Alcalde"

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Key words:
Bariatric surgery, gastric bypass by Roux Y, vertical sleeve gastrectomy, morbid obesity, body mass index, type 2 diabetes, dyslipidemia, arterial hypertension, hepatic function, renal function.

Palabras clave:
Cirugía bariátrica, bypass gástrico en Y de Roux, gastrectomía vertical en manga, obesidad mórbida, índice de masa corporal, diabetes tipo 2, dislipidemia, hipertensión arterial, función hepática, función renal.

ABSTRACT

Introduction: Bariatric surgery is the best method for obesity control and its comorbidities, unfortunately there are few studies in the Mexican population. **Objective:** To evaluate the effect at 12 months of bariatric surgery in the control of obesity and its associated comorbid diseases. **Methods:** A prospective cohort study was conducted in patients of the Hospital Civil of Guadalajara Fray Antonio Alcalde in which 124 morbidly obese patients underwent gastric bypass and 36 underwent sleeve gastrectomy were included. They were evaluated before surgery and at 3, 6 and 12 months postoperative. The following variables were assessed: weight, body mass index, glycemia, liver and kidney function, dyslipidemia, blood pressure, frequency of cases of sleep apnea and osteo-articular alterations. **Results:** The initial average weight in patients with gastric bypass was 46.7 ± 8 kg/m^2 and decreased to 28.8 ± 8 kg/m^2 12 months after surgery and in the sleeve gastrectomy from 128.57 kg/m^2 to 89.20 kg/m^2. 45 patients undergoing BPGYR had type 2 diabetes, and at 12 months only one persisted. In the group of sleeve gastrectomy initially nine were diabetic and in the end none. At 12 months after surgery, improvement in liver and kidney function was observed, dyslipidemias, arterial hypertension, sleep apnea and osteoarticular alterations in both groups decreased. **Conclusions:** Our study points to, that bariatric surgery is a short term, effective treatment for morbid obesity and its associated diseases in the Mexican population.

RESUMEN

Introducción: *La cirugía bariátrica es el mejor método para controlar la obesidad y sus comorbilidades, desafortunadamente son pocos los estudios en la población mexicana.* ***Objetivo:*** *Evaluar los efectos a 12 meses de la cirugía bariátrica en el control de la obesidad y las enfermedades comórbidas asociadas.* ***Métodos:*** *Se realizó un estudio de cohorte prospectivo en el Hospital Civil de Guadalajara "Fray Antonio Alcalde" en el que se incluyeron 124 pacientes obesos mórbidos sometidos a* bypass *gástrico y 36 a manga gástrica, quienes fueron evaluados antes de la cirugía y a los tres, seis y 12 meses postoperatorios. Se midieron las siguientes variables: peso, índice de masa corporal, glucemia, función hepática y renal, dislipidemia, presión arterial y número de casos de apnea y de alteraciones osteoarticulares.* ***Resultados:*** *El peso promedio inicial en los pacientes con* bypass *gástrico fue de 46.7 ± 8 kg/m^2 y disminuyó a 28.8 ± 8 kg/m^2 a los 12 meses de la cirugía y en manga gástrica de 128.57 kg/m^2 a 89.20 kg/m^2. De los pacientes sometidos a* bypass *gástrico 45 presentaban diabetes tipo 2 y nueve en el grupo de manga gástrica, al cabo de 12 meses sólo uno del grupo* bypass *gástrico continuó con diabetes persistente. A los 12 meses de la cirugía se observó mejoría de las funciones hepática y renal, disminuyeron las dislipidemias, la hipertensión arterial, la apnea de sueño y las alteraciones osteoarticulares en ambos grupos.* ***Conclusiones:*** *Nuestro estudio indica que la cirugía bariátrica a corto plazo es un tratamiento efectivo para la obesidad mórbida y sus enfermedades asociadas en la población mexicana.*

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INTRODUCTION

Obesity and overweight have progressively increased in the past three decades in both developed and developing countries, to the point where this phenomenon could be called a "pandemic".[1]

In the 2016 National Health and Nutrition Survey in Mexico, the combined prevalence of overweight and obesity in adults above the age of 20 was 72.5% in both sexes. The percentage of obesity was higher in females, 38.6% vs 27.7% in males. The most affected age group was 40 to 49 years of age; however,

the highest degrees of obesity were observed in individuals 50 to 59 years of age.[2] The state of Jalisco occupies the tenth place in obesity (28.50%), followed by the northern border states (37.8%), the most affected states in the country.[3]

Bariatric surgery has become the best option for the treatment of morbid obesity. It regularly leads to a sustained weight loss and resolution or control of comorbidities such as type 2 diabetes mellitus (DM), high blood pressure (HBP), hyperlipidemia, osteoarthritis, and sleep apnea.[4-10]

The incidence of DM has reached alarming proportions in our country, where there are 13.26 million individuals with the disease which, in turn, is closely related to obesity.[3]

In a meta-analysis that included 22,000 patients, Buchwald et al. observed that the Scopinaro technique (duodenal switch) controlled 98.9% of DM cases; Roux-en-Y gastric bypass (RYGB), 83%; vertical gastroplasty, 71%; and an adjustable band, only 50%; this proved that bariatric surgery is an effective alternative for the mid- and long-term treatment of obesity and its comorbidities.[10] Another retrospective study of patients operated on for the management of obesity revealed a decrease in mortality due to cardiovascular disease and cancer after a 7.1-year follow-up.[9]

Obesity acts as a precursor of the metabolic syndrome, a crucial phase in many diseases with chronic inflammation, and also contributes to conditions such as arthritis, steatohepatitis (without inflammation: non-alcoholic fatty liver disease [NAFLD]; with inflammation: non-alcoholic steatohepatitis [NASH]), cancer, cardiovascular disease, premature death, asthma and Alzheimer´s disease, due to excessive and prolonged inflammatory responses.[11,12] Previous studies have shown that systemic inflammation in obese subjects decreases significantly after a bariatric surgical procedure,[13] and that the latter is a low-risk therapeutic alternative with low morbidity and mortality.[14]

Bariatric surgery is divided into two types, i.e., gastric restrictive procedures and combined restrictive plus malabsorptive procedures. Currently, vertical sleeve gastrectomy (VSG) or gastric sleeve is the most commonly used restrictive procedure. Laparoscopic adjustable gastric banding (LAGB) has lost popularity due to its poor results and post-operative complications.[15]

VSG was initially introduced as the first step in the duodenal switch procedure but is now an independent procedure. A large section of the greater curvature and the gastric body is removed, leaving a tubular stomach that leads to highly beneficial endocrine changes. Due to the technique's simplicity and the acceptable weight loss that ensues, its practice is currently tending to increase.[15]

Gastric bypass was introduced in the decade of the 70's and, since then, several modifications have been made to the technique, improving its short- and long-term results. The most common version is the laparoscopic Roux-en-Y reconstruction (RYGB).[15]

Currently, bariatric surgery is the best method to control obesity and its comorbidities. Unfortunately, few studies have been conducted in Mexican population. Therefore, in this study, we evaluated the short-term (12 months) effects of bariatric surgery in the control of obesity and some of its associated comorbidities.

METHODS

Type of study: prospective cohort study.

Subjects

A short-term, 12-month follow-up was conducted on patients admitted to the Bariatric Surgery Clinic and who underwent elective obesity surgery between November 1, 2009 and April 30, 2016 at the *Hospital Civil de Guadalajara "Fray Antonio Alcalde"* (HCGFAA). One hundred and sixty out of the 162 patients operated by April 30, 2016 were assessed after completing a 12-month follow-up, with four evaluations of the pre-specified variables, i.e., before surgery and at 3, 6, and 12 months. Thus, we worked with a convenience sample. Two patients were excluded: one died three months after surgery as a result of a stroke and the other underwent

a pancreatic diversion and was not properly followed.

The average age was 34 years. One hundred and eight patients underwent a Roux-en-Y gastric bypass (RYGB), and 36 a vertical sleeve gastrectomy (VSG), all by a laparoscopic approach. The procedures were performed in compliance with the multidisciplinary protocol of the HCGFAA Bariatric Surgery Clinic and the Official Mexican Standard NOM-008-SSA3-2010.[16]

Patients recruited were 18 years of age or older, had a body mass index (BMI) over 35 kg/m^2 and were assessed by our multidisciplinary team (nutrition, psychology, cardiology, pulmonology and endocrinology). To determine whether the patients were candidates for RYGB or VSG, we considered their BMI, the coexistence of metabolic, cardiac or respiratory disease, osteoarthritis (particularly of the spine, hip, knees and ankles), and gastroesophageal reflux disease. Inclusion criteria for VSG were: age between 18 and 25 years, no comorbid metabolic disease, no hiatal hernia or gastroesophageal reflux. A patient with a BMI over 50 kg/m^2 was included in this group, due to severe cardio respiratory compromise. Although a VSG was initially performed in this patient, several months later, once he had lost weight and his cardio respiratory status had significantly improved (reevaluated by pulmonology and cardiology), he underwent conversion surgery, from VSG to RYGB. Patients with a BMI between 35 and 40 kg/m^2 and associated comorbidities, or a BMI over 40 kg/m^2 and no comorbidities, underwent a RYGB.

Measurements

Each patient was assessed before surgery and 3, 6, and 12 months after the procedure. The variables measured were: weight, BMI (kg/m^2), 12-hour fasting serum glucose, glycated hemoglobin, serum insulin, urea, creatinine, C-reactive protein, cholesterol, triglycerides, liver enzymes –alkaline phosphatase (AP), alanine aminotransferase (ALT), aspartate aminotransferase (AST) and gamma-glutamyl transpeptidase (GGT)– and blood pressure. Serum variables were considered within normal range if consistent with those currently valid at the *Hospital Civil de Guadalajara "FFA"* laboratory. Weight, height and blood pressure were measured by two of the investigators with a digital scale (FECA®) and the sphygmomanometer of the HCGFAA Bariatric Surgery Clinic, both calibrated every six months.

Procedure

All patients were seen in the first-time consultation, where their chart was opened and a registration number was assigned. They were subsequently assessed by the departments of Surgery, Psychology and Nutrition in the Bariatric Surgery Clinic. After obtaining all baseline results, the multidisciplinary team discussed the surgical procedure choice, according to the aforementioned criteria. Finally, after evaluation by the Endocrinology, Cardiology and Anesthesiology departments, patients were scheduled for surgery.

In the post-operative period, clinical, psychological and nutritional follow-up was conducted in accordance with the protocol established by the Bariatric Surgery Clinic at the HCGFAA.

Statistical analysis

All variables were captured in an electronic database and statistically analyzed with SPSS (version 21.0; IBM Corp., Armonk, NY, USA). Qualitative study variables are presented as frequencies and/or percentages, while quantitative variables are presented as measures of central tendency (means) and measures of dispersion (standard deviation). Subsequently, and in order to find out whether there were differences between the types of surgery (VSG and RYGB) and between baseline laboratory values and those measured 3, 6, and 12 months after surgery, an analysis of variance in split plot design (2 × 4) was carried out, combining between-group comparisons (type of surgery) and intra-group comparisons (time periods). Also, in order to understand the meaning of differences, post hoc analyses were performed and adjusted with the Bonferroni

method. A value of $p < 0.05$ was considered significant.

Ethical considerations: Ethical aspects of this study were in accordance with the Regulations of the General Health Act Regarding Health Research *(Reglamento de la Ley General de Salud en Materia de Investigación para la Salud)* and the 1975 Declaration of Helsinki and its amendments, as well as the current national and international guidelines on Good Research Practice. The study was authorized under number 044/11, assigned by the Registry of the Committee on Ethics in Research, and number 002/15, assigned by the Research Committee.

RESULTS

We present the short-term results of our experience during the first 6.6 years of activity of the Bariatric Surgery Clinic at HCGFAA. We included 160 patients with full preoperative assessment and follow-up at 3, 6, and 12 months. The variables assessed in the preoperative period are presented in *Table 1*.

Table 1: Preoperative study variables in Roux-en-Y gastric bypass and vertical sleeve gastrectomy.

	* RYGB	** VSG
*** BMI	46.7 ± 8.5	43.1 ± 9.9
Glycated Hb	7.1 ± 1.7	6.4 ± 1
Glucose	134.8 ± 64.2	108.8 ± 29.4
Plasma insulin	22.7 ± 10.9	24.4 ± 11.9
Urea	28.7 ± 9.1	24.9 ± 7.3
Creatinine	0.83 ± 0.24	0.77 ± 0.15
Cholesterol	198.67 ± 52.8	185.8 ± 49.1
Triglycerides	166.4 ± 83.3	161.3 ± 50.1
C-reactive protein	8.82 ± 4.5	7.8 ± 4.4
Alkaline phosphatase	100.2 ± 49.4	70.6 ± 11.7
AST	62.7 ± 59.7	57.1 ± 52.2
GGT	49.4 ± 33	45 ± 38.1
ALT	63.3 ± 60.8	59 ± 55

* RYGB = Roux-en-Y gastric bypass.
** VSG = Vertical sleeve gastrectomy.
*** BMI = Body mass index.

Weight loss and body mass index (kg/m^2)

The RYGB group had an average initial weight (AIW) of 132.42 kg that decreased to only 86.55 kg at one year, with an average initial BMI of 46.82 kg/m^2 and 30.65 kg/m^2 at one year, which meant an average loss of 45.86 kg (34.63%) of their baseline weight. The 52 patients who were treated with a gastric sleeve had an AIW of 128.57 kg and 89.20 kg at one year, with an average BMI of 43.69 (kg/m^2) and 30.43 kg/m^2 at one year, an average loss of 39.36 kg (30.62%) from their preoperative weight.

The analysis of variance (ANOVA) showed that, although no significant differences were found in these variables between both types of surgery (VSG and RYGB), a significant decrease was obtained after surgery at all the assessed periods *(Figure 1)*.

Biochemical variables related to glucose metabolism

There were 37 prediabetic patients (23.12%; glucose between 100-124 mg/dl), 30 of which underwent a RYGB and seven, a VSG. After 12 months, only four patients (10.81%) were still prediabetic, three in the RYGB group and one in the VSG group. Fifty-four (33.75%) patients were preoperatively found to have DM, 45 of which underwent a RYGB and 9, a VSG. After 12 months, only one patient (1.85%) in the RYGB had persistent diabetes and continued with fasting glucose levels of 126 mg/dl or above.

Initial serum insulin levels were measured only in 76 patients. Out off these, 37 (48.68%) had initial hyperinsulinemia and usually presented high initial glucose levels.

Initial glycated hemoglobin was determined only in 90 patients, out of which it was increased in 64 (71.11%). Twelve months later, all patients had normal values.

Finally, the ANOVA revealed there were no significant differences in glucose, glycated hemoglobin (HbA1c) and plasma insulin when comparing both types of surgery (VSG and RYGB). Furthermore, after surgery, both glucose and glycated hemoglobin levels decreased significantly and gradually over

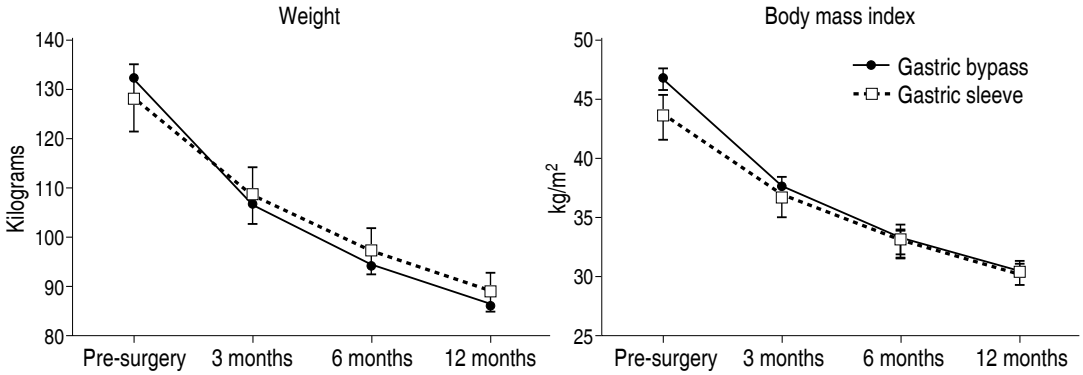

Figure 1: *Weight and BMI (X ± SEM) prior to RYGB or VSG and 3, 6, and 12 months after surgery. Both weight ($F_{3,396}$ = 363.86, p < 0.000, μ^2 = 0.734, n = 134) and BMI ($F_{3,393}$ = 402.12, p < 0.000, μ^2 = 0.754, n = 133) showed significant differences over time.*

time. Plasma insulin only showed a non-significant trend to decrease over time (p < 0.091) *(Figure 2)*.

Biochemical variables related to kidney function

To date, no protocol aimed at treating patients with obesity and renal dysfunction has been established. Although 25 patients (15.63%) were preoperatively found to have abnormal values of urea and/or creatinine, their levels returned to normal one year after surgery.

No significant differences were detected by ANOVA between type of surgery and urea and creatinine levels. Although urea levels decreased significantly and gradually over time, a change between baseline value and the post-operative control was only observed at 3 months; there were no statistically significant differences at 6 and 12 months *(Figure 3)*.

Cholesterol and triglycerides

As for blood lipids, only total cholesterol or triglycerides were considered, and a patient was diagnosed as dyslipidemic if one or both parameters were increased. Thus, 76 patients (55%) were found to have abnormal lipids; 12 months later, only one patient (0.62%) had persistently elevated triglycerides, but cholesterol levels decreased to normal ranges in all cases.

No significant differences were established by ANOVA for type of surgery. Furthermore, as shown in *Figure 4*, the levels of both lipid parameters decreased significantly and gradually after surgery.

C-reactive protein

During the preoperative evaluation, 37 patients had increased C-reactive protein. At 12 months, it remained high only in three cases; these were the same patients that had inflammation and liver fibrosis. No significant differences were detected by ANOVA between both types of surgery either in pre-operative or in post-operative measures.

Liver profile

Before surgery, alkaline phosphatase was increased in 56 patients (35%), ALT in 59 (36.8%), AST in 54 (33.7%), and GGT in 52 (32.5%). In 69 patients (43.13%), there was evidence of liver dysfunction, i.e., at least one enzyme was elevated. Liver variables were measured at 12 months in 142 patients; values remained persistently elevated only in 13 of them (9.15%). Out of these, three were diagnosed with inflammation and fibrosis grade 2 (NASH); the condition subsided with pharmacological treatment in two, and one evolved to cirrhosis.

None of the variables in the liver profile showed significant differences when the two

types of surgery were compared by ANOVA. As described in *Figure 5*, the levels of alkaline phosphatase, ALT, AST and GGT decreased significantly and gradually after surgery.

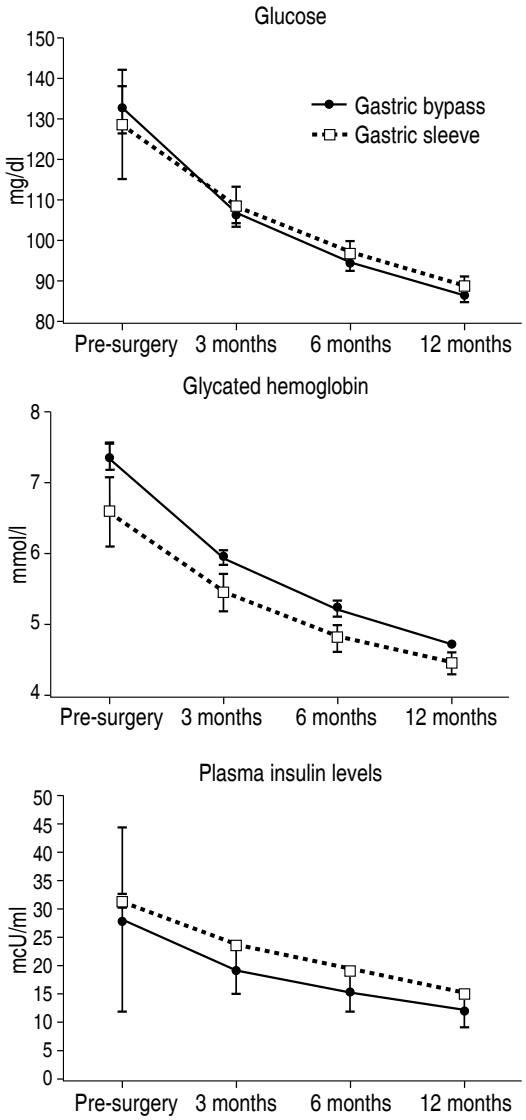

Figure 2: *Glucose, glycated hemoglobin and plasma insulin levels (X ± SEM) prior to RYGB or VSG and 3, 6, and 12 months after surgery. Both glucose ($F_{3,396}$ = 28.79, p < 0.000, μ^2 = 0.179, n = 134) and glycated hemoglobin ($F_{3,246}$ = 101.976, p < 0.000, μ^2 = 0.554, n = 135) decreased significantly and gradually over time. Only a non-significant trend towards decreasing over time was seen for plasma insulin ($F_{3,183}$ = 2.950, p < 0.091, μ^2 = 0.046, n = 136).*

Blood pressure

Before surgery, 67 patients (41.8%) had high blood pressure; after 12 months, HBP persisted only in seven (4.93%), a resolution percentage of 89.56%. The ANOVA indicated that there were no significant differences in changes in blood pressure when comparing both types of surgery, but a significant decrease in systolic and diastolic pressure was observed six months after surgery *(Figure 6)*.

Sleep apnea

Finally, 28 patients (17.5%) had preoperative sleep apnea, a condition that persisted after 12

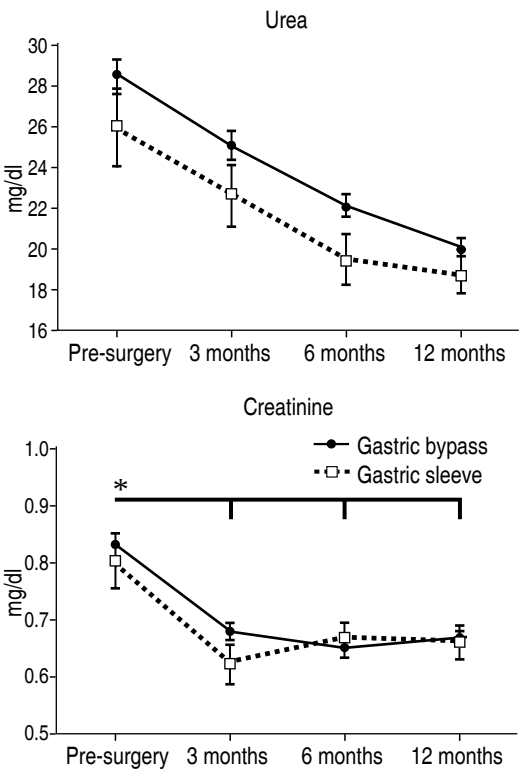

Figure 3: *Urea and creatinine levels (X ± SEM) prior to RYGB or VSG and 3, 6, and 12 months after surgery. All differences in urea over time are significant ($F_{3,399}$ = 101.751, p < 0.000, μ^2 = 0.433, n = 135), whereas creatinine showed a significant difference only at 3 months after surgery ($F_{3,402}$ = 18.384, p < 0.000, μ^2 = 0.121, n = 136).*

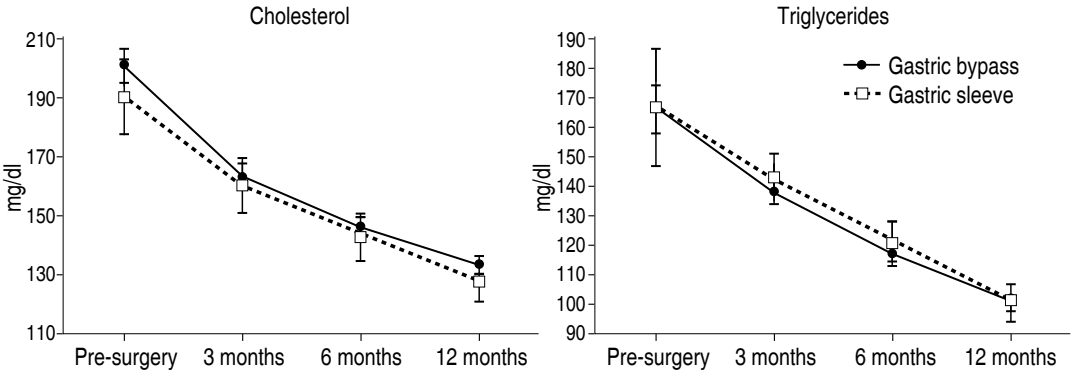

Figure 4: *Cholesterol and triglyceride levels (X ± SEM) prior to RYGB or VSG and 3, 6, and 12 months after surgery. All differences over time are significant (cholesterol: $F_{3,327} = 89.572$, $p < 0.000$, $\mu^2 = 0.451$, $n = 111$; triglycerides: $F_{3,321} = 38.325$, $p < 0.000$, $\mu^2 = 0.264$, $n = 109$).*

months only in one case, although this patient showed a modest improvement.

DISCUSSION

Bariatric surgery performed within the context of a multidisciplinary team program and by certified surgeons has proven to be a safe and effective procedure for the loss of excessive weight in individuals with morbid obesity and to control metabolic, blood pressure, respiratory, and osteoarticular disorders, as well as fertility in young women; overall, it changes the patients' life expectations socially, work-wise and sexually, and significantly improves their self-esteem.[6,8,10,13,15] Weight loss also relies on patient reeducation in terms of the way they eat, incorporating physical activity into the new lifestyle if possible, and being under close follow-up during the first post-operative months, until the goals set by the multidisciplinary bariatric group are achieved.

Short-term results in our cases have shown that both RYGB and VSG are two adequate surgical procedures for the treatment of morbid obesity and its associated comorbidities, in patients at the HCGFAA. Although both types of surgery were useful in decreasing excessive weight and comorbid diseases in obese patients, follow-up will continue to determine the long-term effects.

It is worth noting that patients who underwent a bypass had greater baseline weights and BMIs, and that the percentage weight loss during the first year was greater in this group, but there was no statistically significant difference between groups *(Figure 1)*. Our results at one year in this study are consistent with those published in the literature.[8,10,17-21]

Weight loss after a bariatric procedure depends on an important restriction in caloric intake; however, in malabsorptive and combined procedures, the secretion of various gastrointestinal hormones regulating the entero-insular axis –known as incretins– is altered, particularly the glucose-dependent insulinotropic peptide (GIP), the glucagon-like peptide 1 (GLP-1), ghrelin and peptide YY among others, leading to increased insulin secretion and improved cellular insulin sensitivity.[10,13,15] Studies in humans and animals have shown that RYGB modifies the composition of the microbiota, a factor that influences weight loss with this procedure. The microbiota plays an important role in energy storage, so it is also involved in the development of obesity.[22]

In the preoperative period, 56.87% of patients had glucose values above 100 mg/dl, but only 54 (33.75%) were considered diabetic (level over 126 mg/dl), with increased plasma insulin levels greater than 23 μU/ml and HbA1c over 6%. In the end, only in one patient (1.85%) with a gastric bypass glycemia continued in the range of 200 to 300 mg/dl, but three weeks after surgery she no longer required insulin therapy and was treated with metformin. Therefore, DM control was reached in 98.15%

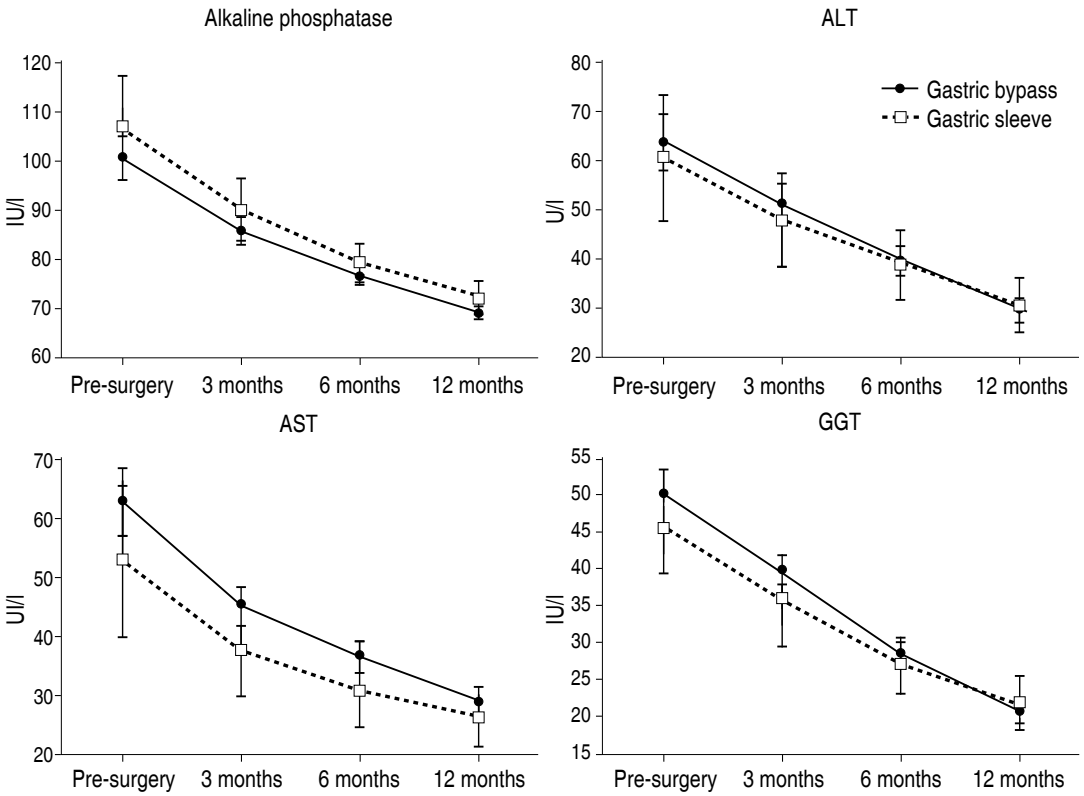

Figure 5: *Alkaline phosphatase, ALT, AST and GGT levels (X ± SEM) prior to RYGB or VSG and 3, 6, and 12 months after surgery. All differences over time are significant (alkaline phosphatase: $F_{3,390} = 47.825$, $p < 0.000$, $\mu^2 = 0.269$, $n = 132$; ALT: $F_{3,396} = 39.150$, $p < 0.000$, $\mu^2 = 0.229$, $n = 134$; AST: $F_{3,396} = 37.147$, $p < 0.000$, $\mu^2 = 0.220$, $n = 134$; and GGT: $F_{3,399} = 89.450$, $p < 0.000$, $\mu^2 = 0.397$, $n = 135$).*

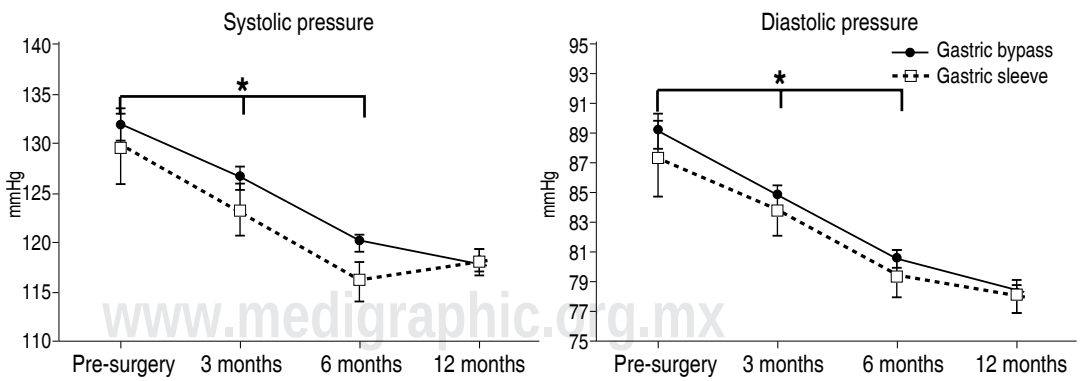

Figure 6: *Systolic and diastolic blood pressure (X ± SEM) prior to RYGB or VSG and 3, 6, and 12 months after surgery. Differences over time are significant between the preoperative evaluation and those 3 and 6 months after surgery (systolic pressure: $F_{3,396} = 30.233$, $p < 0.000$, $\mu^2 = 0.186$; diastolic pressure: $F_{3,396} = 39.920$, $p < 0.000$, $\mu^2 = 0.195$ (* $p < 0.001$) $n = 134$).*

of our gastric bypass patients. Of the 91 cases with glucose levels above 100 mg/dl, only four (4.39%) remained within the prediabetic range.

On this subject, a meta-analysis by Buchwald et al. (2004) documented the resolution of DM in 83.7% of patients that underwent a YRBGP.[10] In another meta-analysis conducted 10 years later in patients treated with a RYGB, the same author found that DM was controlled in 84.2% of cases.[17] Other recent studies have reported the resolution of DM in 92% and 86% of cases.[6,8,13] However, there are many reports (some with small samples) in which remission of DM fluctuates from 100%[23] to 38.2%[24] of cases. Conflicting results in these studies may depend on the type of surgery, the duration of DM, the duration of patient follow-up and the date the cohort was created.

Another cardiac and metabolic risk frequently associated to obesity is increased levels of blood lipids. For practical purposes, we only considered high levels of total cholesterol and triglycerides, and established that "dyslipidemia" applied to patients with elevation of one or both parameters. We thus found that 55% of patients initially had dyslipidemia, whereas 12 months later, only 0.62% had an abnormal lipid profile. Therefore, it can be stated that bariatric surgery is an excellent alternative to achieve normal blood lipids in obese patients. In Buchwald´s meta-analysis (2004),[10] 1,985 patients with dyslipidemia were analyzed after undergoing restrictive and combined surgical procedures; mean resolution was 85.62%. The best results were obtained after biliopancreatic diversion (99.5%), followed by gastric bypass (93.6%), and the least satisfactory results were found after adjustable gastric band procedures (71.1%). The effectiveness of sleeve gastrectomy was not evaluated in this meta-analysis. In a more recent meta-analysis by Li et al. (2016),[25] 14 comparative studies including a total of 1,269 patients were analyzed (gastric bypass versus gastric sleeve). The authors observed dyslipidemia control in 95% of patients in the gastric bypass group. Other recent reports have shown very similar results.[6,17,19,26]

Although all obese patients have hepatic steatosis, it is not associated to inflammation in all. Our study showed that close to 85% of patients had inflammation, i.e., non-alcoholic steatohepatitis (NASH). Inflammation subsided with surgery in all but three patients. Two of these received medical treatment; laboratory tests and elastography revealed that the inflammatory process disappeared; the third patient went on to develop cirrhosis. Several publications have proven that bariatric surgery decreases the degree of steatosis, inflammation and hepatic fibrosis.[27,28] Hafeez and Ahmed found 12 reports accounting for 576 obese patients with NASH, with a remission rate of inflammation and fibrosis between 83% and 50%.[29]

Before surgery, 67 out of 160 patients (41.8%) were found to be hypertensive. One year after surgery, this condition persisted in seven patients (4.93%), which amounts to an 89.56% resolution of HBP at one year. These figures are higher than those reported in the meta-analysis by Buchwald et al.[10] in his bypass group, where it subsided in 75.4% and improved in 87.1%. On the other hand, our results were inferior to those reported in the recent meta-analysis by Li et al., in which hypertension resolved in 95% of cases in the VSG group.[25]

Out of 28 patients with sleep apnea, the problem persisted 12 months later only in one patient whose baseline weight was 258 kg. A gastric sleeve was initially performed, and conversion surgery (to a RYGB) was carried out two years later. This led to further weight loss and his respiratory problem resolved after two more years. The two aforementioned meta-analyses reported an average 95% resolution of respiratory problems, mainly with RYGB.[10,25]

Likewise, out of the 22 patients with established spinal, hip, ankle and knee osteoarthritis, only one case continued with symptoms and was referred to the orthopedics service for surgical management of the knees.

Finally, it is worth noting that 25 patients were found preoperatively to have high urea or creatinine, although none required dialysis therapy. One year later, all levels were normal.

CONCLUSIONS

We were able to find out the short-term results of bariatric surgery in 160 patients

who underwent Roux-en-Y gastric bypass and vertical sleeve gastrectomy at the *Hospital Civil de Guadalajara "Fray Antonio Alcalde"*.

Bariatric surgery is a safe therapeutic alternative for the control of obesity and its comorbidities, mainly DM, dyslipidemia, NASH, HBP; overall, it controls metabolic syndrome and decreases the risk of early death.

Our results are consistent with those in the current international literature.

In order to obtain the best results, we consider that it is crucial to establish a multidisciplinary team, with updated management protocols and the participation of qualified surgeons.

Although our results are very encouraging in terms of all the variables measured until the end of follow-up, we intend to continue the follow-up and evaluation of these patients in the future, to determine the long-term effects of bariatric surgery.

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