Efficacy of bariatric surgery in a Colombian population

Claudia Y. Obando León

Universidad Nacional de Colombia

William Otero Regino (✉ waoteror@gmail.com)

National University of Colombia

HERNANDO MARULANDA FERNANDEZ

Hospital Universitario Nacional de Colombia <https://orcid.org/0000-0003-3941-0704>

Hernán Ballén

Universidad Nacional de Colombia Facultad de Medicina

Elder Otero

Universidad Nacional de Colombia

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Abstract

Background

Obesity (OB) is defined as having a body mass index (BMI) of $\geq 30 \text{ kg/m}^2$. It has a high risk of mortality due to its association with comorbidities. Bariatric surgery (BS) is indicated for a BMI of 40 kg/m^2 or of 35 kg/m^2 if concurrent with a metabolic disorder.

Methods

A retrospective observational study of patients subjected to BS, such as Roux-en-Y gastric bypass (RYGB), sleeve gastrectomy (SG), and adjustable gastric band (AGB). A survey was applied to determine the BMI and patterns of comorbidities before and after BS.

Results

The study included 30 patients who underwent 25 RYGB, 4 SG and 1 AGB procedures. A total of 17 patients were evaluated at the one-year follow-up and all showed improvement in comorbidities and weight loss, with a mean excess BMI loss (%EBMIL) of 89.5%. At the two-year follow-up, 3 patients reported a %EBMIL of 75%. At the three-year follow-up, 10 patients had a %EBMIL of 70.8%, but 70% (7/10) still had a BMI $> 30 \text{ kg/m}^2$. Type 2 diabetes mellitus resolved in all (12/12) and the doses of antihypertensive drugs were reduced in 86.4% of hypertensive patients (11/13). Half of the patients followed a diet.

Conclusion

In our service, BS was effective one year after the procedure. After three years, BMI $> 30 \text{ kg/m}^2$ persisted in 70% of patients. All diabetics were cured. The doses of antihypertensives were lowered in 86.4% of hypertensive patients. Ultrasound scan detected no fatty liver diseases at the one-year follow-up of 85.7% of patients.

Background

Obesity (OB) is defined by the World Health Organization (WHO) as having a body mass index (BMI) of $\geq 30 \text{ kg/m}^2$ (1). It is a public health problem worldwide (1), with a global prevalence of 30% (2,3). In the USA, it has a prevalence of 35% in men and 40% in women, and it is estimated that 50% of the population will be obese by 2030 (4). In Asia and sub-Saharan Africa, however, OB affects less than 10% of the population (5). The National Survey of the Nutritional Situation in Colombia of 2015 found that OB affected 20% of adolescents and adults (6). OB is a risk factor for several diseases, including type 2

diabetes mellitus (T2DM), hypertension (HT), coronary heart disease, dyslipidemia, cerebrovascular disease, obstructive sleep apnea hypopnea syndrome (OSAHS), gastroesophageal reflux disease (GERD), Barrett's esophagus, and cirrhosis (7–9). It also increases the risk for several cancers, such as esophageal, thyroid, kidney, colon, endometrial, breast, and liver cancer (9,11). In addition to its excessive morbidity and mortality, it also imposes a high cost to health systems (2,12). The currently recommended treatments, such as diet and medication, have not been very effective, since, in the best of cases, there is only a weight loss of 4–10 kg in one year (13). Anti-obesity medications (liraglutide, lorcaserin, naltrexone, bupropion, orlistat, phentermine/topiramate) as an adjunct to a low-calorie diet can lead to a maximum weight loss of 5% in a year (14). Fecal microbiota transplant is an alternative and promising treatment modality, but evidence of its efficacy is still lacking (15,16). Bariatric surgery (BS) is currently the only treatment that leads to sustained weight loss, improved quality of life, and decreased mortality (2,12), in addition to being the most cost-effective therapeutic approach (17). The most common procedures are the Roux-en-Y gastric bypass (RYGB), sleeve gastrectomy (SG), and the adjustable gastric band (AGB) (18). RYGB has been the most effective procedure, allowing for a mean excess BMI loss (%EBMIL) of 60–70% after two years (17), and improvement of metabolic comorbidities such as T2DM, dyslipidemia (18), and hepatic steatosis (19). BS is currently considered the “gold standard” for obesity (20,21). A %EBMIL of 61.1% has been achieved 5 years after SG, which was statistically similar to the 73.9% loss after RYGB (22). The AGB, in contrast, is a restrictive procedure, with a %EBMIL of 39–59% (17). BS is indicated for severe obesity, which is defined as a BMI of $\geq 40 \text{ kg/m}^2$, and for a BMI of 35 kg/m^2 when associated with obesity-related complications (20). However, despite initial improvements after BS, patients may regain up to 86% of the weight they have lost (23). The progression of obese patients subjected to BS in our service in Colombia is currently unknown. The present study was therefore carried out to determine the efficacy of BS in a Colombian population.

Methods

This was an observational retrospective cohort study of adult patients aged over 18 years who were operated at the *Fundadores de Bogotá* Clinic from April 22, 2016 to January 31, 2019. The exclusion criteria included operated patients with incomplete medical records, or those who did not attend the medical assessment visits during the study period. Patients who underwent BS were identified through the institution's database. Each of them was contacted by phone, informed about this study, and invited to participate; those who accepted were scheduled for a formal consultation. The objectives of the study were further explained during the consultation to obtain informed consent. A structured medical assessment was then performed during the consultation, and data on sociodemographic characteristics, type of BS, main characteristics of BS, BMI, and pre-surgical comorbidities were collected. BMI was calculated by dividing the weight of each patient by the square of the height (kg/m^2), as recommended by the WHO (1). %EBMIL was calculated by the following formula (24): $\%EBMIL = (\text{initial BMI} - \text{final BMI} / \text{initial BMI} - 25) \times 100$. Total weight loss percentage (%TWL) was calculated by the following formula (24): $\%TWL = (\text{initial weight} - \text{current weight} / \text{initial weight}) \times 100$.

Post-BS weight, mean absolute weight loss, the amount of weight regained, the progression of comorbidities, and the medications used before and after surgery were also collected.

The research protocol and the informed consent were approved by the bioethics committee of the National University of Colombia and of the institution where the study was conducted. All data were analyzed using the statistical package SPSS version 22 for Windows. Discrete variables are presented as frequencies and proportions, while continuous variables as central tendency and dispersion. The main variables of interest to determine the efficacy of BS were the %EBMIL and the improvement of comorbidities. Adjusted analyses using binary logistic regression were performed by considering the dependent variables. For each of the %MEBMIL group, the type of BS, gender, prevalence of obesity-associated diseases before and after surgery, medication use, and all variables that showed significant differences in the chi-square or ANOVA test ($P < 0.05$) were evaluated.

Results

A total of 30 patients who met the inclusion criteria were included in the study. Of these, 17 (56.6%) patients were assessed after one year, 3 (10.0%) after 2 years, and 10 (33.3%) after 3 years. There were 83.3% (25/30) female patients. The mean age was 47.2 ± 8.4 years. The main characteristics of the patients are shown in Table 1.

Table 1
Sociodemographic characteristics

Variables	n	%
Gender		
Male	5	16.7
Location		
Urban	28	93.3
Rural	2	6.7
Marital status		
Married	14	46.7
Single	10	33.3
Free union	4	13.3
Separated/divorced	2	6.7
Socioeconomic status		
3.0	14	46.7
2.0	12	40.0
4.0	4	13.3
Level of education		
University	16	53.3
Specialty/Master's	13	43.3
Bachelor's	1	3.3
Profession		
Employed	23	76.7
Retired	5	16.7
Independent	2	6.7
Health regime		
Quote	28	93.3
Beneficiary	2	6.7

Clinical characteristics prior to the BS

The three comorbidities most frequently observed in the global population were fatty liver disease (n = 25, 83.3%), OSAHS (n = 22, 73.3%), and arthropathy (n = 19, 63.3%). The most frequently used drugs were proton pump inhibitors (PPIs), antihypertensives, and pain relievers, which were taken by 16 (53.3%), 13 (43.3%), and 11 (36.7%) patients, respectively. Furthermore, 29 (96.2%) received nutritionist-guided dietary control and recommendations. A total of 53.3% (16/30) stated that they had been informed about OB as an incurable disease. Other clinical variables are described in Figs. 1 and 2.

At the 1-year follow-up (n = 17), the most frequent diseases were similar to those at baseline: fatty liver disease (n = 14, 82.3%), OSAHS (n = 13, 76.4%), and arthropathy (n = 13, 76.4%). The most frequently prescribed drugs were pain relievers (n = 9, 52.9%) and PPIs (n = 8, 47%). A total of 94.1% (16/17) received dietary recommendations and 100% were on dietary control. At the 2-year follow-up, 100% (3/3) had fatty liver disease and gastroesophageal reflux disease (GERD). At the 3-year follow-up, 80% (8/10) had GERD, fatty liver, and OSAHS, representing the most frequent comorbidities. In this group, the most frequently used drugs were antihypertensives and PPIs, which were taken by 60% of patients (6/10). Only 50% (5/10) were informed about OB as an incurable disease.

In terms of BS type, RYGB was performed in 25 patients (83.3%), SG in 4 (13.3%) and AGB in 1 (3.3%). The most frequent comorbidities that persisted after surgery were arthropathy in 13 patients (43.3%), GERD in 11 (36.6%), and depression in 10 (33.3%). There were no cases of T2DM (0.0%). Furthermore, continuous positive airway pressure (CPAP), or oral and injectable antidiabetic use were not reported. Only 5 patients (16.7%) attended physical activity programs. Overall, the pre-surgical comorbidities improved in 28 patients (93.3%), and the prescription of drugs decreased in 21 (70%). A total of 13 cases (43.3%) presented with post-operative complications, the most frequent being diarrhea (n = 11, 36.6%). Multivitamins were prescribed to 22 patients (73.3%), and were most commonly ferrous sulfate (n = 15, 50%), folic acid (n = 13, 43.3%), and vitamin B12 (n = 13, 43.3%). Other clinical variables are presented in Figs. 3 and 4.

There were no cases of T2DM or prescription of antidiabetics in all patients. At the 1-year follow-up, 100% of the group (n = 10) showed improvement in at least 1 comorbidity. Fatty liver disease (n = 12, 70.6%), arthropathy (n = 7, 41.1%), and depression (n = 5, 29.4%) persisted more frequently. There was also a reduction in at least 1 drug in 57% (8/14) of the patients. At the 2-year follow-up, dyslipidemia and OSAHS persisted in 33.3% (1/3), and the most frequent post-BS comorbidity was fatty liver disease in 66.6% (2/3). At the 3-year follow-up, there were no cases of hypertension and dyslipidemia. There was a reduction in drug prescription in 75% (6/8) of patients.

Weight loss

In the first year after surgery, 100% of patients (17/17) had a %EBMIL $\geq$ 65%, with a mean of 89.5%. The mean BMI post-BS was 27.1 kg/m², as compared to 41.2 kg/m² prior to BS. The mean absolute weight loss was 36 kg. Among the 12 patients subjected to RYGB, the mean BMI before and after surgery was 41.8 and 27.7 kg/m², respectively. The mean weight loss, %TWL, and %EBMIL were 35.2 kg, 32.3%, and 87%, respectively. The 4 patients subjected to SG had a mean BMI of 39.95 and 25.6 kg/m² before and after surgery, respectively. The mean weight loss, %TWL, and %MEBMIL were 39.5 kg, 35.6% and 96.5%,

respectively. The patient subjected to the ABG had a BMI of 38.9 and 26 kg/m² before and after surgery, respectively, with the mean weight loss, %TWL, and %EBMIL of 32 kg, 32.99%, and 93%, respectively. No weight regain was reported, but 11.7% (2/17) persisted with a BMI $\geq$ 30 kg/m², which corresponded to the RYGB group. At the 2-year follow-up, 66.6% (2/3) had a %EBMIL $\geq$ 65%, with a mean of 75.3%.

At the 3-year follow-up, the %EBMIL was $\geq$ 50% in 90% (9/10) and $\geq$ 65% in 50% (5/10) of patients, with a mean of 70.8%. In this group of patients, the BMI before and 3 years after surgery were 46.49 and 31.9 kg/m², respectively. A total of 70% (7/10) regained weight and persisted with a BMI $\geq$ 30 kg/m². Figure 5 presents the %EBMIL results.

Multivariate analysis

The logistic regression analysis revealed that patients with a %EBMIL > 65% had a greater reduction in the number of OB-related diseases ($p = 0.025$). A high education level was associated with a %EBMIL > 65% ($p = 0.020$; odds ratio, OR = 0.094; 95% confidence interval, CI: 0.010–0.891). If follow-up was performed, the %EBMIL was > 50% ($p = 0.020$, OR = 0.083, 95% CI: 0.007–0.950) and > 65% ($p < 0.05$). No other variables were found to be associated with a reduction in %EBMIL. Patients with a %EBMIL > 50% had a reduced number of drug prescriptions, and the prescription of multivitamins did not increased ($n = 18$, 60.0%; $n = 22$, 73.3%, respectively), without statistical association ($p > 0.05$).

Discussion

The present retrospective study assessed 30 obese patients subjected to BS. RYGB was performed in 25 patients, SG in 4 and AGB in 1. At the 1-year follow-up, 17 patients were assessed, with 12 RYGB, 4 SG, and 1 AGB. The 12 RYGB patients reported a mean BMI of 41.8 and 27.7 kg/m² before and after surgery, respectively ($p < 0.05$), and lost an average of 89.5% of their excess BMI (%EBMIL). The %EBMIL after one year was excellent, but no long-term data for this group was available. Other studies with larger sample sizes reported a %EBMIL of 60–70% after one year (17), and of 73.9% after five years (22). After one year, none of our patients had weight gain, but 16.6% (2/12) persisted with a BMI $\geq$ 30 kg/m². The 10 patients assessed at the 3-year follow-up had a mean BMI of 46.49 and 31.6 kg/m² before and after surgery, respectively, and a mean %EBMIL of 70.8%. Overall, 70% (7/10) had weight regain and persisted with a BMI $\geq$ 30, while 50% (5/10) had a BMI of $\geq$ 35 kg/m². Several strategies have been proposed for weight reduction in patients with insufficient weight loss or weight regain, including surgical or endoscopic re-interventions (25–27). More recently, drugs such as glucagon-like peptides 1 (GLP-1) (28,29), phentermine, and topiramate (30) have been studied. There are so far no specific recommendations on when these BS-adjuvant drugs should be indicated. However, encouraging results from the aforementioned studies have suggested such adjuvants as a safer alternative to post-BS reoperations which carry a greater morbidity and mortality risk than initial surgery (26), and can be used at the discretion of the physician. In our case series, liraglutide was used in patients who regained weight. Weight regain is multifactorial (25) and is associated with genetic factors, surgical modifications of the gastrointestinal tract, hormonal imbalances, and non-adherence to lifestyle interventions (25). In this case

series, only 53% of patients were informed about OB being incurable and, therefore, about the need to follow a strict diet. Patients with a high education level (university) were significantly associated with greater weight loss ($p = 0.02$), similar to patients who were followed up after surgery ($p = 0.02$). These findings demonstrated the importance of establishing a follow-up center after BS (31), since the risks inherent to OB would reappear when weight is regained (25,31).

The 4 patients subjected to SG had a mean BMI of 39.95 and 25.6 kg/m² before and after surgery, respectively ($p < 0.04$). The patient subjected to AGB had a BMI of 38.9 and 26 kg/m², respectively, and reported no weight regain. Preoperative comorbidities were found to improve significantly. Overall, 28 patients (93.3%) showed improvements in at least 1 disease. There was a 100% remission in T2DM (12/12), and no antidiabetic drugs were taken in all 12 cases. The 11/13 (84.6%) hypertensive patients reported dose reduction of antihypertensive drugs. Overall, 70% (21/30) discontinued at least one medication for their comorbidities. However, the metabolic impact found in this case series contrasted with that reported by other authors, with a 44.5% remission in T2DM (32) and 51.0% in hypertension (33). The significant improvement, and even complete resolve, of T2DM observed in this study has been well recognized, and was in line with BS being considered a metabolic surgery (34). Ultrasound scans did not detect fatty liver disease at the one-year follow-up in 85.7% of our patients, although liver biopsy would have been the best method to determine this (8). With liver biopsy, improvement or remission of hepatic steatosis, steatohepatitis, and liver fibrosis has been reported in 88%, 59%, and 30% cases, respectively (8).

Only 73.3% (22/30) of patients had a regular prescription of multivitamins, although vitamin prescription has been recommended to all BS patients (31), since OB is frequently associated with decreased serum vitamin levels. This decrease in vitamin levels is further exacerbated after BS (35), probably due to the decrease in the surface area for absorption (36).

Conclusions

This small retrospective case series has demonstrated that BS is effective in reducing weight and cure T2DM. It has been found that the lack of preoperative patient education probably contributed to weight regain. Therefore, provision of adequate preoperative information is essential to ensure strict patient adherence to a healthy diet and lifestyle.

Abbreviations

BMI: body mass index ; BS:Bariatric surgery; RYGB:Roux-en-Y gastric bypass; sg:sleeve gastrectomy; AGB:adjustable gastric band; EBMIL:mean excess BMI loss; OB:Obesity; WHO:World Health Organization; T2DM:type 2 diabetes mellitus;HT:hypertension; OSAHS:obstructive sleep apnea hypopnea syndrome; GERD:gastroesophageal reflux disease

Declarations

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Clinica fundadores of Bogota, and written informed consent was obtained from the patients in our center.

Consent for publication

Not Applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

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None

Authors' contributions

OW, designed and supervised the study

OW, OC, MH, OE and BH conceived the study and drafted the manuscript.

All authors read and approved the final manuscript.

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References

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Figures

Figure 1

Concomitant diseases before surgery. Type 2 diabetes mellitus†, hypertension‡, gastroesophageal reflux disease§, obstructive sleep apnea hypopnea syndrome¶

Figure 2

Medication used before surgery. Continuous positive airway pressure‡, bi-level positive airway pressure†, proton pump inhibitors§

Figure 3

Concomitant diseases after surgery. Type 2 diabetes mellitus†, hypertension‡, gastroesophageal reflux disease§, obstructive sleep apnea hypopnea syndrome¶

Figure 4

Medication used after surgery. Continuous positive airway pressure‡, bi-level positive airway pressure†, proton pump inhibitors§

Figure 5

Percentage of mean excess BMI loss (%EBMIL). Mean excess BMI loss (%EBMIL) during monitoring.