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ORIGINAL CONTRIBUTIONS

Correlation Between Age and Weight Loss after Bariatric Surgery

Juan Eduardo Contreras · Carmen Santander · Ismael Court · Jorge Bravo

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Abstract
Background Conflicting evidence exists regarding age as a predictive factor in excess weight loss after bariatric surgery. The objective of this cross-sectional study is to evaluate differences in excess BMI loss (%EBMIL) 1 year after surgery in patients older and younger than 45 years.
Methods Adult obese patients fulfilling selection criteria underwent either Roux-en-Y gastric bypass or sleeve gastrectomy and were grouped according to age < and ≥45 years with follow-up at least 1 year. Both groups were compared in terms of excess BMI loss (%EBMIL) and other clinical outcomes. Possible relationship between %EBMIL, age, surgical technique, and presence of comorbidities such as diabetes mellitus, hypertension (HT), and dyslipidemia (DL) was searched.
Results Three hundred thirty-seven patients (72.5 % female), 196 (50.1 %) younger than 45 years and 141 (49.9 %) with age ≥45 years. There was significant difference between age group and %EBMIL 12 months after surgery ($p<0.001$), showing better results in younger patients. No differences were found in terms of gender, preoperative body mass index (BMI), surgical technique, nor presence of DL. Using multiple regression, we found significant interaction effect between age group ($p<0.001$), presence of HT ($p=0.001$), and %EBMIL at follow-up.
Conclusions Patients younger than 45 years lose greater amount of excess BMI than older patients after bariatric surgery. This tendency might be useful as a preoperative weight loss predictor in bariatric patients.

Keywords Bariatric surgery (MeSH) · Age factors (MeSH) · Age · Weight loss (MeSH)

J. E. Contreras · C. Santander · I. Court · J. Bravo
Division of Bariatric and Metabolic Surgery,
Clínica Santa María, Santiago, Chile

J. E. Contreras · C. Santander · J. Bravo
Department of Bariatric and Metabolic Surgery,
Hospital Salvador, University of Chile, Santiago, Chile

J. E. Contreras (✉)
Department of Surgery, University of Chile,
El Salvador Ave 364, Santiago, Chile
e-mail: juaneduardocontreras@gmail.com

Introduction

Obesity is a growing problem worldwide with estimates of 344,221 bariatric procedures performed in 2008 [1]. It has been proved that surgical treatment, using bariatric techniques, is more effective than conservative medical treatment in achieving and maintaining a significant weight loss as well as reducing associated comorbidities in obese adult population [2].

There is no absolute certainty regarding some factors associated with the amount of excess weight loss [3]. There is conflicting evidence about age as a determinant factor, with series showing no difference [4–6] and others demonstrating less excess weight loss among patients older than 60 years in comparison to younger ones [7, 8]. Those studies present bias in patient selection and fail to consider other factors that may influence the interpretation of results found. On the other hand, the aforementioned studies compare a geriatric population (older than 60 years) with a younger group of patients. It has not been studied if the results are similar if you apply a lower age limit when comparing this outcome between both groups.

The aim of this study is to analyze the influence of age at the moment of surgery as a determinant factor in postoperative excess weight loss in a population of adults undergoing bariatric surgery procedures.

Table 1 Clinical characteristics of patients by age group

Variable	Group <45 years	Group ≥45 years	*p*
Sex	Female 145 (73.9 %)	Female 99 (70.2 %)	0.44
Age	34.1 (±6.6)	52 (±5.3)	<0.001
BMI	40.7 (±6.7)	41.6 (±6.8)	0.183
HT	72 (36.7 %)	102 (72.3 %)	<0.001
DM	13 (6.6 %)	48 (34 %)	<0.001
DL	128 (65.3 %)	103 (73.1 %)	0.123
Surgical technique	SG 140 (71.4 %), RYGB (28.6 %)	SG 89 (63.1 %), RYGB (36.9 %)	0.081

For continuous variables: mean±standard deviation, categorical variables in absolute numbers and proportions (%) showing the greatest frequency; level of significance, 95 %

SG laparoscopic sleeve gastrectomy, *RYGB* laparoscopic Roux-en-Y gastric bypass

Materials and Methods

This study was designed as a cross-sectional study. Data were obtained by review of our prospectively maintained database, clinical charts, and visits to the outpatient clinic.

Study Subjects

Obese adults fulfilling selection criteria operated by the same Bariatric Surgery team in Santa María Clinic and Salvador Hospital between January 2003 and June 2010.

All cases were performed as a stand-alone procedure. Patients were evaluated preoperatively by a multidisciplinary team according to an established protocol regarding postoperative care and follow-up.

Inclusion Criteria

- Patients between 18 and 65 years with indication for bariatric surgery according to SAGES, ASMBS, and IFSO guidelines [9–11]: BMI ≥30 kg/m^2 and related comorbidities or BMI ≥40 kg/m^2 with or without related comorbidities.
- Submitted either to laparoscopic Roux-en-Y gastric bypass (RYGB) or laparoscopic sleeve gastrectomy (SG).
- Complete follow-up at least 12 months according to an established protocol.

Exclusion Criteria

- Patients with osteoarticular pathology (i.e., osteoarthritis) that makes them unable to carry out regular training program.
- Patients with psychiatric disorders that impairs adherence to nutritional guidelines or exercise.

Outcomes

To report excess weight loss, we used Percent of Excess Body Mass Index (BMI) Lost (%EBMIL) because we agree that it is currently the best method for comparisons [12].

Success in excess BMI loss after bariatric surgery is defined as a %EBMIL ≥50 % 12 months after surgery. Our primary endpoint is a comparison of %EBMIL 12 months after surgery between groups. The secondary endpoint is a comparison of patient demographics and comorbid medical conditions between groups and their possible interaction with the primary endpoint.

Surgical Technique

We perform standardized techniques for both procedures. In RYGB, we create a gastric pouch of 50-ml volume using a 28 French (Fr) bougie with an alimentary limb of 100 cm in

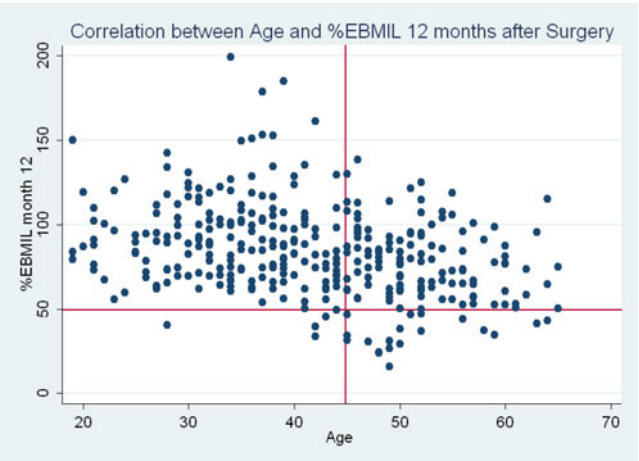

Fig. 1 Correlation between age and %EBMIL 12 months after surgery. *Reference line* in %EBMIL-axis (50%EBMIL) limits success or failure in excess weight loss. Another *reference line* in age-axis (45 years) limits age groups

Table 2 Relationship between age group, treatment variables, and %EBMIL 12 months after surgery (analysis using multiple regression techniques; level of significance, 95 %)

Variables	Age <45 years	Age ≥45 years	*p*
%EBMIL 12 months	91 % (±26.6 %)	73.1 % (±24.1 %)	<0.001
Surgical technique	SG (71.4 %), RYGB (28.6 %)	SG (63.1 %), RYGB (36.9 %)	0.361
DM	13 (6.6 %)	48 (34 %)	0.079
DL	128 (65.3 %)	103 (73.1 %)	0.031
HT	72 (36.7 %)	102 (72.3 %)	<0.001

length and a biliary limb of 70 cm in length. Both gastrojejunal and jejunojenunal anastomoses are created using mechanical stapling devices (Endo GIA™ by Covidien ™) and reinforcement of gastrojejunal anastomosis with V-Loc 180™ 3.0 (Covidien™) suture. We leave a 19 Fr closed suction drain near the gastrojejunal anastomosis.

SG is fashioned using a 32 Fr calibration gastric tube, excising an estimate 90 % stomach. We begin gastric resection 6.0 cm proximal to the pylorus using either Duet TRS™ or Endo GIA™ staplers (both by Covidien™), with suture line reinforcement using PDS™ 3.0 suture in the latter. We do not routinely use drains.

Statistical Analysis

The sample size estimate [13] was based on the primary endpoint of difference in %EBMIL of 10 % between both age groups. We determine that 293 patients would provide a power of 80 % to detect a difference between both groups (on the basis of a two-sided alpha level of 0.05).

Data are reported as mean±standard deviation. Categorical variables are summarized with the use of frequencies. We used the non-parametric Wilcoxon test to analyze the primary endpoint and *t* test to compare other continuous variables. Chi-square test was used to compare categorical variables. Multiple regression techniques were used to analyze the influence of other variables. All analyses were performed with the use of Stata™ software, version 11 (StataCorp, TX, USA).

Results

We studied a population of 337 patients, 244 females (72.5 %) and 93 males (27.5 %). Age had a non-normal distribution, with median of 42 years, mean age 41.6 years (±10.8) and range between 19 and 65 years with 196 (50.1 %) younger than 45 years and 141 (49.9 %) age ≥45 years.

Two hundred twenty-eight (67.8 %) patients underwent SG and 109 (32.2 %) RYGB. Mean preoperative BMI 41.1 (±6.8) and range between 30.1 and 75.2 kg/m^2. Mean %EBMIL of the group 12 months after surgery was 83.6 % (±27 %) with a range between 15.9 and 198.9 %.

In patients <45 years, we found mean preoperative BMI 40.7 kg/m^2 (±6.7; range, 30.1–75.2) and mean %EBMIL 12 months postoperative 91 % (±26.6 %; range, 33.5–198.9 %). Only five (2.6 %) patients lost less than 50 % EBMIL in this group.

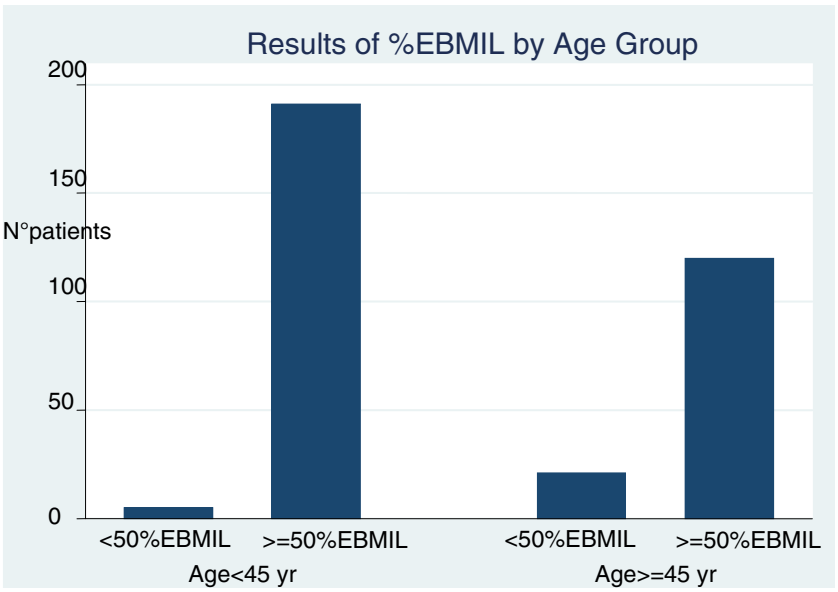

Fig. 2 Results of excess weight loss 12 months after surgery by age group. Excess BMI loss 12 months after surgery is defined as successful if %EBMIL is ≥50 % and a failure if %EBMIL is <50 %. The *bar chart* shows this result according to age group in absolute numbers of patients

Patients ≥45 years showed mean preoperative BMI 41.6 (±6.8; range, 30.7–71.6) and mean %EBMIL 73.1 % (±24.1; range, 15.9–138.1 %). Twenty-one (14.9 %) patients lost less than 50 %EBMIL.

When comparing clinical characteristics, we found no difference between both age groups regarding gender, preoperative BMI, surgical technique, nor presence of dyslipidemia (DL) (Table 1). There was significant difference among age groups in presence of diabetes mellitus (DM) and hypertension (HT), both more frequent in the older group (Table 1).

There is statistically significant difference in %EBMIL 12 months after surgery between both groups ($p<0.001$) in favor of patients <45 years (Fig. 1), who present greater BMI loss than the older patients (Table 2). Significant difference in terms of success in excess BMI loss was also found between both groups ($p<0.001$), with 97.4 % of younger patients achieving %EBMIL ≥50 % 1 year after surgery compared with 85.1 % of older patients (Fig. 2).

We analyzed the relation between age, surgical technique, and presence of comorbidities (independent variables) and %EBMIL 12 months after surgery (dependent variable) using multiple regression techniques. There was a significant interaction effect between age and %EBMIL ($p<0.001$) and between the presence of HT and %EBMIL ($p=0.001$) 12 months after surgery. The other analyzed variables (surgical technique, presence of DM, and DL) do not modify the association between age and %EBMIL ($p=0.361$, $p=0.079$, $p=0.031$, respectively) (Table 2).

Discussion

Our study shows a statistically significant difference in %EBMIL 12 months after surgery between patients younger and older than 45 years in favor of the younger group. We might conclude that these patients may have a potential greater excess BMI loss after bariatric surgery.

In order to state that this statistic difference is also clinically relevant, we have tried to make both groups comparable by applying selection criteria and a study protocol to all patients. The said protocol entails nutritional controls, psychological support, and an exercise program.

By applying these criteria, we try to control some selection bias avoiding patients that are unable to perform exercise or will not follow nutritional indications. Unfortunately, we cannot assess, at least in this study, the level of adherence to physical activity nor dietary recommendations, which can bias result interpretation.

This study has several limitations. Even if patients were sorted applying selection criteria to limit bias, there are factors that can influence our results, such as incidence of comorbid conditions such as hypertension, which shows interaction with the primary endpoint and it is not equally distributed among groups.

We set follow-up time to 12 months after surgery because success in excess weight loss was thus defined, and we also believe that it is the most appropriate period showing the effect of any bariatric operation in terms of BMI loss.

Older patients might lose less weight because of impaired metabolic capacity and greater presence of sarcopenia compared to younger population. Their associated comorbidities have longer duration and might have an influence in their baseline physical condition.

Further studies, ideally prospective cohort studies, with larger number of patients and longer follow-up are needed. They should have selected patients with similar characteristics (besides age) between groups and accurate report of adherence to rule out age as a strong predictor of excess BMI loss after bariatric surgery.

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Conflicts of interest The authors declare that there are no conflicts of interest as related to this article.

References

1. Buchwald H, Oien D. Review: Metabolic/Bariatric Surgery Worldwide 2008
2. Padwall R, Klarenbach S. Bariatric surgery: a systematic review of the clinical and economic evidence. J Gen Intern Med. 2011;26 (10):1183–94.
3. Coleman K, Toussi R, Fujioka K. Do gastric bypass patient characteristics, behavior and health differ depending upon how successful weight loss is defined? Obes Surg. 2010;20:1385–92.
4. Wool D, Bellatorre N, Wren S, et al. Male patients above age 60 have as good outcomes as male patients 50–59 years old at 1-year follow-up after bariatric surgery. Obes Surg. 2009;19:18–21.
5. Sosa JL, Pombo H, Pallavicini H, et al. Laparoscopic gastric bypass beyond age 60. Obes Surg. 2004;14:1398–401.
6. Singhal R, Kitchen, Bridgwater S, et al. Age ≥50 does not influence outcome in laparoscopic gastric banding. Obes Surg. 2009;19:418–21.
7. Sugerman H, DeMaria E, Kellum J, et al. Effects of bariatric surgery in older patients. Ann Surg. 2004;240(2):243–7.
8. St. Peter S, Craft R, Tiede J, et al. Impact of advanced age on weight loss and health benefits after laparoscopic gastric bypass. Arch Surg. 2005;140:165–8.
9. SAGES Guidelines Committee. SAGES guideline for clinical application of laparoscopic bariatric surgery. Surg Endosc. 2008;22 (10):2281–300.
10. Ailles L, Blankenship J, Buffington C, et al. ASMBS Allied Health Nutritional Guidelines for the Surgical Weight Loss Patient. Surg Obes Rel Dis 2008; 4:S73-S108.
11. Fried M, Hainer V, Basdevant M, et al. Inter-disciplinary European guidelines on surgery of severe obesity. Int J Obes (Lond) 2007; 31(4):569–77.
12. Deitel M. Editorial: reporting weight loss 2007. Obes Surg. 2007;17:565–8.
13. Fernández P. Determinación del tamaño muestral. Cad Aden Primaria. 1996;3:138–14.