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Smoking in post-bariatric patients without regular medical follow-up and associated weight loss and regain: a cross-sectional study

Marcela P. Paula,[1] Eline C. Romagna,[2,3] Diogo M. F. Mattos,[4] Karynne G. Lopes,[2,3]
Luiz Guilherme Kraemer-Aguiar[2,3,4*]

Abstract

Introduction: Obesity and smoking are associated with an increased risk of cardiovascular disease, reduced quality of life and premature mortality. The relationship between smoking and body weight changes in patients who underwent bariatric surgery is unclear. Objective: We studied post-bariatric patients without any current medical follow-up and compared smokers and non-smokers with regard to weight loss and regain. Methodology: Ninety-four patients post-Roux-en-Y gastric bypass (n=80) or Sleeve gastrectomy (n=14), aged 42±9 years, body mass index (BMI)=32.9±6.5kg/m2, were recruited in public outpatient care and allocated into two groups according to time since surgery < or ⩾5 years (G<5y or G⩾5y, respectively). They were further divided into smokers or non-smokers. Clinical history, physical examination, anthropometrics and hemodynamics measurements were obtained. Results: The prevalence of smoking was 12.8%. BMI, neck circumference, pre-surgical BMI, and rate of weight regain (RWR) were higher in the G⩾5y group than in the G<5y (p⩽0.03) one. No differences in excess weight loss (EWL) were observed between smokers and non-smokers in both groups (p⩾0.15). Higher RWR was detected in non-smokers in G<5y (p=0.03), while no differences between smokers and non-smokers were found for RWR in G⩾5y (p=0.37). Conclusion: Smoking habits do not appear to influence weight loss after surgery. However, a higher weight regain was detected in non-smokers who had less than 5 years since surgery.

1. Departamento de Endocrinologia, Hospital Federal da Lagoa, Rio de Janeiro, RJ, Brazil.

2. Programa de Fisiopatologia Clínica e Experimental, Faculdade de Ciências Médicas, Universidade do Estado do Rio de Janeiro, Rio de Janeiro, RJ, Brazil.

3. Endocrinologia, Departamento de Medicina Interna, Faculdade de Ciências Médicas, Universidade do Estado do Rio de Janeiro, Rio de Janeiro, RJ, Brazil.

4. Programa de Pós-Graduação em Engenharia Elétrica e de Telecomunicações, Universidade Federal Fluminense, Niterói, RJ, Brazil.

5. Unidade de Obesidade, Centro de Pesquisa Clínica Multiusuário, Hospital Universitário Pedro Ernesto, Universidade do Estado do Rio de Janeiro, Rio de Janeiro, RJ, Brazil.

*Correspondence address:
E-mail: lgkraemeraguiar@gmail.com
ORCID: https://orcid.org/0000-0002-3528-5881

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Introduction

Excess body fat contributes to several health problems, including the increased risk of metabolic, cardiovascular, pulmonary, and hepatic diseases, cancer, osteoarthritis and premature

mortality.[1-4] Individuals with obesity, even without metabolic abnormalities, present a higher risk of coronary heart disease, cerebrovascular disease, and heart failure compared to normal-weight metabolically healthy individuals.[5] It is known that adipose tissue is an endocrine organ that regulates energy metabolism, insulin sensitivity and vascular homeostasis, and when dysfunctional, links obesity with many metabolic and cardiovascular disorders, and that a pro-inflammatory state probably contributes to these disorders.[6]

Bariatric surgery is considered to be an effective method of long-term treatment for severe obesity.[7] Successful bariatric surgery improves the quality of life and obesity-related metabolic comorbidities, increases self-awareness about unhealthy food habits and active lifestyle, promotes self-confidence, and improves mood and self-esteem.[8] However, the habit of smoking continues to be a concern in clinical practice.[9] For the last twenty years, smoking has been considered a neurobehavioral disease caused by nicotine addiction.[10] In smokers with obesity, medical and surgical interventions may have substantial health impacts.[11]

Abstinence from smoking is recommended for at least 6 weeks before surgery.[9,12] Smokers with obesity have an increased risk of early postoperative morbidity and mortality compared to non-smokers.[13] Infections, prolonged intubation/reintubation, sepsis, shock, and length of hospitalization may occur in these patients.[13,14] In addition, they are at higher risk of long-term cardiometabolic events.[13] Nevertheless, the resumption of smoking can occur in the post-operative period due to worries about decreased weight loss or weight regain.[8,15]

The lack of post-operative follow-up compliance is a concern, since it ensures the benefits of the surgical procedure and the screening of health status and lifestyle habits, such as smoking[9,16] Lack of counseling on smoking habits may have a negative impact on several surgical outcomes.[17] Therefore, we invited post-bariatric patients with no regular medical follow-up and compared smokers and non-smokers with regard to weight loss and regain.

Methodology

Patients

We invited 132 patients who had previously submitted to bariatric surgery to our unit and asked whether they would like to volunteer for this study and to start their follow-up in the outpatient care unit of the University Hospital. A criterion for inclusion was being at least one year without any regular medical follow-up. At the time of their first appointment, none of these patients had any clinical follow-up. Of the 132 patients contacted, 21 declined to participate, one was pregnant, and six dropped out during the study and 10 had <24 months after surgical procedure. A total of 94 patients with post-Roux-en-Y gastric bypass or Sleeve gastrectomy (RYGB, n=80, and SG, n=14), physically inactive, 87.2% females, aged=42±9 years, body mass index (BMI)=32.9±6.5kg/m², excess of weight loss (EWL)=88.7±18.6%, rate of weight regain (RWR)=22.9±20.3%, and mean time since surgery=6.1±4.0 years were included in the study. Patients were allocated to groups according to time since surgery, whether < or ⩾5 years (G<5y or G⩾5y, respectively), and evaluated for smoking status, EWL and RWR, obtained by self-report. Current smoking status was defined as having smoked at least once during the previous week.[8] None of the patients were using post-surgical weight loss medication or were submitted to revisional bariatric surgery. Information about the type of surgery was reported by all participants and later confirmed by digestive endoscopy.

Study design and ethics

This cross-sectional study occurred between November 2018 and December 2019 in the outpatient care unit, a public health unit of the State University of Rio de Janeiro (RJ, Brazil). Clinical history, physical examination, anthropometric and hemodynamic measurements were obtained. This study was approved by the local Ethics Committee (CAAE: 07662918.1.0000.5259) and registered at ClinicalTrials.gov (NCT04193384). All procedures were performed in accordance with the ethical standards of the Helsinki Declaration. A signed consent form was obtained from each participant.

Anthropometric and hemodynamic measurements

Body mass and height were measured using an electronic scale and stadiometer (Welmy™ W300A, São Paulo, SP, Brazil). Neck, waist, and hip circumferences were measured twice by the same trained evaluator. BMI and waist-to-hip ratio were calculated. The EWL and RWR were obtained as follows: a) EWL = (pre-surgical weight - nadir weight)/(pre-surgical weight - ideal weight for BMI of 25 kg/m²)*100, expressed in %; and (b) RWR = (current weight-nadir weight) (pre-surgical weight - nadir weight)*100, expressed in %. The pre-surgical and nadir weight were self-reported by patients, and obtained at two points in time, during the first appointment and 6 months later. Blood pressure and heart rate were measured twice in a sitting position by a semiautomated oscillometric (G-Tech™ BSP11, Hangzhou, Zhejiang, China) device, according to standard recommendations.[18]

Statistical analysis

Data normality was tested using the Shapiro-Wilk test. Between-group differences were compared by unpaired Student-t or chi-square tests and the results were expressed as mean ± standard deviation or frequency (n,%), as appropriate. Pearson correlation coefficients were calculated to test associations between data obtained by self-report (pre-surgical weight and nadir weight). All calculations were performed by NCSS™ statistical software (Kaysville, UT, USA) and KNIME 4.1.0 (KNIME AG, Zurich, Switzerland). A $p \leqslant 0.05$ was considered significant.

Results

A total of 12.8% of patients were smokers, 16% had hypertension, 5.3% had type 2 diabetes *mellitus*, and 4.3% had dyslipidemia. The majority of patients had bariatric surgery performed in the private healthcare system (80%). Anthropometric/hemodynamic measurements and surgery data are displayed in Table 1. The groups were similar in regard to all variables, except for BMI, neck circumference, pre-surgical BMI, and RWR which were higher in G≥5y than G<5y. The correlations between the two pre-surgical weights and nadir weights obtained by self-report were highly associated (r=0.97 and r=0.94; p=0.001, respectively).

Figure 1 presents the EWL and RWR of the groups studied. There were no differences in LWR between smokers and non-smokers in both groups ($p \geqslant 0.15$). Higher RWR was detected in non-smokers than smokers in those who had less time since surgery (p=0.03). On the other hand, no differences were detected between smokers and non-smokers in G≥5y (p=0.37).

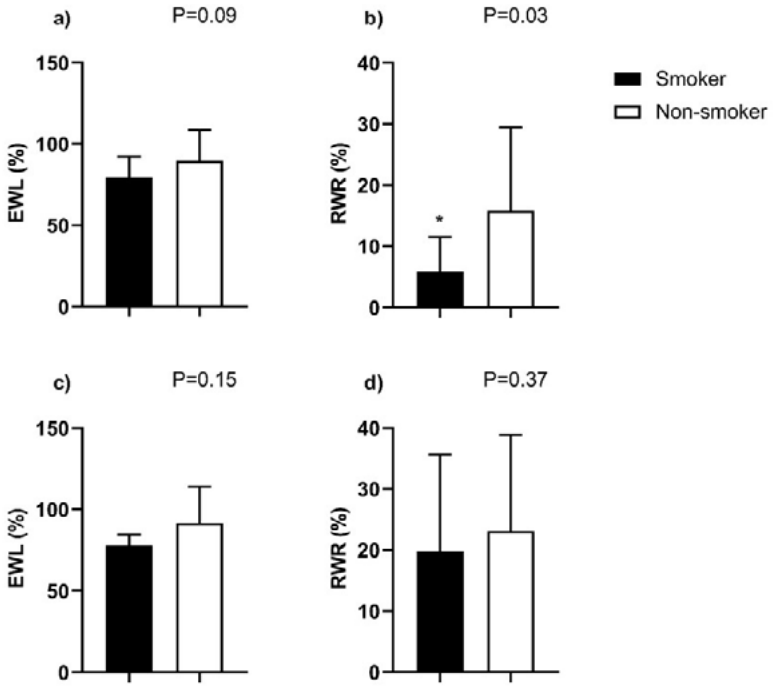
Table 1. Anthropometric/hemodynamic measurements and bariatric surgery data of post-bariatric patients with no regular medical follow-up.

Variable	Pooled sample (n=94)	G<5y (n=55)	G≥5y (n=39)	*p* value
BMI (kg/m²)	32.9±6.5	30.7±4.9*	35.7±7.4	<0.001
Neck circumference (cm)	36.0±3.8	35.3±3.0*	36.7±4.2	0.03
Waist-to-hip ratio	0.83±0.13	0.82±0.20	0.81±0.17	0.80
SBP (mmHg)	124.7±15.7	123.3±15.5	126.8±16.1	0.14
DBP (mmHg)	79.2±11.7	78.4±11.8	80.1±11.7	0.24
Heart rate (bpm)	77±12	75±11	78±10	0.10
Pre-surgical BMI (kg/m²)	48.6±7.7	47.4±7.0*	50.4±8.4	0.03
Nadir weight (kg)	75.8±15.4	74.7±13.6	76.6±17.4	0.27
EWL (%)	88.7±18.6	88.2±18.5	89.9±18.8	0.33
RWR (%)	22.9±20.3	14.5±13.2*	33.7±22.9	<0.001

Legend: G<5y, time since surgery <5 years; G≥5y, time since surgery ≥5 years; BMI: Body mass index; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; EWL: Excess weight loss; RWR: Ratio of weight regain *p value, unpaired Student t-test; results expressed as mean±SD

Source: The authors (2022).

Figure 1. Excess weight loss and ratio of weight regain of post-bariatric patients.



Legend: Excess weight loss (EWL, a,c) and ratio of weight regain (RWR, b,d) of studied groups (time since surgery <5 years and ≥5 years, respectively).*P value, unpaired Student t-test; results expressed as mean±SD.

Source: The authors (2022).

Discussion

The present study anaklysed post-bariatric patients with no regular medical follow-up, comparing those with time since surgery < *versus* ⩾5 years according to smoking habits and their relationship to weight loss and regain. All these data were obtained during their first appointment, immediately after consent was given to participate in the study. As expected, the BMI, neck circumference, pre-surgical BMI, and RWR were higher in those with more time since surgery. Loss of weight did not differ between smokers and non-smokers in both groups, while a higher rate of weight regain was detected in the non-smokers than in smokers in those with less than 5 years since surgery.

Bariatric surgery is an effective treatment for obesity because it yields substantial and sustained weight loss and reduces cardiometabolic risk factors.[19,20] Our data confirmed these findings, since the mean EWL was 88.7% and only 16% of the patients had hypertension, 5.3% had type 2 diabetes mellitus, and 4.3% had dyslipidemia. However, high RWR was detected in our sample, especially in those with more time elapsed since surgery (mean of 33.7%). Although multidisciplinary follow-up is recommended,[9] non-compliance with treatment is considered a significant problem by health professionals, since this is associated with an increased risk of weight regain, and consequently, the risk of relapse of comorbidities, reduced quality of life, and several psychological problems.[21,22]

The total number of bariatric surgery operations performed worldwide continues to rise, with nearly 256,000 procedures performed in the U.S. in 2019.[23] The situation in Brazil is similar. According to a survey released by the Brazilian Society of Bariatric and Metabolic Surgery between 2011 and 2018, the number of bariatric surgeries performed increased by 84.73%. However, the lack of medical follow-up in the long-term post-surgery gives cause for concern. In our study, 80% of patients had surgeries performed in a private healthcare system, but failed to maintain a regular medical follow-up due to their declining socioeconomic conditions.

Smoking was self-reported by 12.8% of our cohort. Smoking behavior may vary at different times post-surgery.[15] King and colleagues, 2022[15] detected a rate of increase from 9.6% one-year post-RYGB to 14% in 7 years. Therefore, it is possible that more patients will relapse or start smoking as time passes since surgery. This possibility is very worrying given the relationship between obesity and smoking in relation to increased risks of cardiovascular and chronic obstructive pulmonary diseases, type 2 diabetes *mellitus*, cancers, and also mortality.[11]

A recent systematic review suggested that smoking presents little to no impact on weight loss after surgery compared to abstinence from smoking.[24] Our findings also showed no difference in loss of weight between smokers and non-smokers. However, a higher weight regain was detected in non-smokers with less than 5 years since surgery. Previous studies have documented a relationship between smoking and lower BMI compared to non-smokers in the general population.[25] It is well-known that BMI increases after cessation of smoking, which can be observed even up to 20 years after cessation, according to the Framingham Heart Study.[26] The physiological mechanisms associated with weight gain after smoking cessation are not well understood.[27,28] But, among the factors recognized as being involved are the increase in energy expenditure and the suppression of appetite induced by nicotine, which lead to reduced food intake and changes in eating behavior that alter the energy balance.[27,28]

In recent years, concerns have been raised about the associations of weight gain with poorer clinical outcomes that could attenuate the benefits of quitting smoking.[29-31] Kim and col-

leagues, 2018[29] showed a reduction in the risk of myocardial infarction and stroke regardless of post-cessation BMI change. More recently, a cohort study conducted by Sahle and colleagues, 2021[11] demonstrated that adults who stopped smoking had less risk of mortality than those who continued to smoke, regardless of weight gain. All these data provide important evidence for health care professionals to advise patients before and after bariatric surgery on the importance of clinical and behavioral treatment for both smoking cessation and weight management, and the resultant effects on general health.

This study has some limitations. The cross-sectional design limits our discussion, precluding causal relationships. In addition to that, we considered current self-reported smoking status, and some patients may have stopped or decreased their use of tobacco some time earlier. Although all patients achieved an adequate EWL, different medical teams and experiences with bariatric procedures may imply different surgical technical factors among patients. Finally, considering that weight loss and regain are multifactorial, other etiological factors could be associated with changes in these post-surgery outcomes.

Conclusion

A high prevalence of smokers was detected in our cohort of patients who underwent bariatric surgery and had been without regular medical follow-up for at least one year. The habit of smoking does not appear to influence weight loss after surgery. However, smoking was associated with a lower weight regain in the first 5 years since surgery. Our findings suggest that post-surgery medical follow-up compliance is important to maintain or promote healthier habits and the benefits of surgery in long-term. Further research is warranted to investigate the relationships between smoking and changes in body weight in post-bariatric patients, especially regarding the assessment of cardiovascular risk.

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Conflict of interest

No conflicts of interest.

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