Surgery Research Journal

Original Article

Effect of bariatric surgery, physical activity, and weight regain on the prevalence of metabolic risk factors

Cláudia Amaro dos Santos, Manuel Gonçalves Carvalho

Integrated Responsibility Center for Bariatric Surgery and Metabolic Diseases, Hospital Espírito Santo de Évora, Évora, Portugal

Correspondence

Cláudia Amaro dos Santos

Center for Integrated Responsibility for Obesity and Metabolic Surgery (CRI.COM) of the Hospital do Espírito Santo de Évora, EPE, Portugal

E-mail: cmendes@hevora.min-saude.pt

- Received Date: 21 May 2022
- Accepted Date: 30 May 2022
- Publication Date: 05 Jun 2022

Abstract

Aim: To analyze the effect of bariatric surgery, physical activity and weight regain on the prevalence of metabolic risk factors. **Method:** Observational study with retrospective data collection. The study had the participation of 84 individuals submitted to bariatric gastric bypass surgery with follow-up of more than five years. Data collection was carried out in the form of a telephone interview to which data from the patients' clinical process were added. An evolutionary analysis was performed regarding associated health data and comortities, namely metabolic risk factors (diabetes, dyslipidemia and mean blood pressure) at baseline (before surgery), one year and 5 years after surgery. **Results:** We observed a relative improvement in the values of metabolic risk factors one year after surgery, which was maintained at five years after surgery with statistically significant values ($p < 0.007$). This result may translate a positive effect of surgical intervention. In addition, the evolution of the prevalence of metabolic risk factors after surgical intervention is not influenced by weight regain or physical activity. **Discussion:** All the comortities present a decrease with significance to the 1st and 5th year, related to the surgery itself, regardless of weight regain and the practice of physical activity, which confirms the efficacy of surgery as the most effective factor in the treatment of the comortities. **Conclusions:** We did not obtain a relationship between metabolic syndrome and physical activity, or weight regain, which shows how effective surgery is in combating the comorbidity. .

Introduction

Obesity can be defined as a condition of the body marked by excessive accumulation of fat that poses a health risk. In addition to being considered a chronic disease, it is also a risk factor for numerous other pathologies, subdivided into several levels depending on body mass index (BMI) and is responsible, on average, for about 3.5 million deaths per year.

The treatment of obesity can occur in several ways, with medical and surgical therapies. In this context, we have bariatric surgery as a surgery to treat obesity, being nowadays considered a safe and effective long-term procedure for the surgical treatment of obesity and its comorbidities. Increasingly, this type of surgery is the treatment of choice for morbid obese, with other associated pathologies [1].

Bariatric surgery began by treating severe obesity when medical responses are not effective. There are several surgical techniques and some of them imply changes in gastrointestinal anatomy and physiology, which induces improvements in metabolic syndrome, since it is a population with a high propensity for the prevalence of metabolic risk factors [2].

The impact of bariatric surgery on metabolic diseases began to emerge in the 1990s, but only at the end of this decade did it begin to consider that the remission of Diabetes could be independent of weight loss, when, accidentally, Rubino and Gagner [3] found that only one month after bariatric surgery there was a normalization of blood glucose in patients with Type 2 Diabetes before any significant weight loss. On the other hand, the decrease in insulin resistance is related to significant weight loss and increased secretion of hormones at the intestinal level, with action like glucagon [4].

In 2007, there was the first recommendation of bariatric surgery for the treatment of Type 2 Diabetes, and in 2015 guidelines were developed that recommend bariatric surgery for the treatment of Type 2 Diabetes in patients who have specific criteria [5].

We have the concept of metabolic and bariatric surgery, in which the latter is intended for cases with primary objective of

Citation: Santos CA, Carvalho MG. Effect of bariatric surgery, physical activity, and weight regain on the prevalence of metabolic risk factors. Sur Res J. 2022;2(1):1-5.

overweight loss, as advocated by several authors. However, the primary objective may be metabolic surgery, if the main intention is to improve metabolic syndrome, in patients with risk factor, regardless of BMI greater than or less than 35Kg/m2 [6].

The aim of this study was to smooth out the effect of bariatric surgery, physical activity, and weight regain on the prevalence of metabolic risk factors.

Method

In this study, data were complemented by a retrospective collection made today, so it is a retrospective observational study.

Sample

In the database of the Hospital, there was 694 patients undergoing bariatric surgery, however, there were only 406 active individuals, who underwent the exclusion criteria, with a final number of 162 patients. 128 patients agreed to participate in the study and 34 refused or were not available to answer.

The sample calculation was made through the Gpower® certified software, which showed a need for 115 patients for 95% reach and about 67 to 80% sample reach.

Despite the number of patients who agreed to participate, at the time of the consultation of the clinical process, in some of the records there were no clinical or health data corresponding to the moments of evaluation of our study, so these patients were not considered.

The study was then attended by 84 individuals who underwent bariatric surgery at the hospital for more than 5 years.

Participation was voluntary and participants who showed interest in participating in the study were asked for free, and informed consent, and a questionnaire was subsequently applied during the telephone interview. To complete the registration of the questionnaire, analytical clinical data from the last 5 years after surgery were consulted.

The inclusion criteria in the sample indicated that the participants were older than 18 years, had no contraindication to the practice of exercise, had no surgical complications and agreed to participate in the study. As exclusion criteria we have problems in locomotion, psychiatric diseases, neurological disorders, and other dependencies.

Instruments

The instruments used were a health questionnaire, with evaluation of analytical parameters, anthropometric measurements, and the International Physical Activity Questionnaire (IPAQ).

Procedures

Individuals who were operated on for more than 5 years at the Hospital were approached to assess their willingness to answer the questionnaire. Informed consent was obtained from all participants, ensuring the confidentiality of the data and the consultation of health data and clinical data was performed through the electronic clinical process of each patient. The remaining data were collected by telephone interview and placed in a form created for this purpose to minimise data entry errors.

Data were collected at a single moment and some interviews were not included due to lack of patient analytical data.

After the first contacts it was necessary to redefine inclusion criteria, namely, to exclude patients who had already performed other bariatric surgeries later, patients who were pregnant, who had emigrated and who were in condition of abandonment of the consultation in the hospital.

Statistical analysis

The analysis was made using the SPSS® software, as well as the characterization of the sample based on gender, age and weight regain.

The statistical tests were adequate for each type of variable and relation to study, as well as in the results of the normality tests performed. Normality tests are used to determine whether a dataset of a given random variable is guided by a normal distribution or not. Normality was analyzed as a basis for the Shapiro Wilk test and from this result the statistical tests that best suited were selected. The internal consistency of the dimensions of the questionnaires was measured.

The collected data were productive and several analyses of association and correlation between variables was performed. The types of tests used in the various hypotheses were based on the results of the normality tests, which caused the Chi-square tests and repeated measures ANOVA to be used.

Results

The population characteristic can be seen in Table 1.

Physical activity was characteristic at three levels, according to the description of the IPAQ questionnaire, and only two levels were present in the sample studied, the low and moderate. Its correlation with weight regains allows verifying that most patients with weight regain had low levels of physical activity and through the Chi-Square test, with p=0.005, allows

Table 1. *Characteristics of participants*

	Female		**Male**		**Total**	
	77 (91,7%)		7 (8,3%)		84 (100%)	
Age	Mean	σ	Mean	σ	Mean	σ
	49,5	8,5	56,9	8,9	50,1	8,8

Table 2. *Chi-square for comparison weight regain and physical activity levels*

Level of Physical Activity					
		Low	**Moderate**	**Total**	**Sig**
Weight Regain	No	21	18	39	
	Yes	37	8	45	
	Total	58	26	84	p=0.005

Table 3. *Distribution of metabolic risk factors*

Variables	Baseline	1 year	5 years old	Sig
Weight (Kg)	113.86±17.76	74.92±10.55	78.42±12.90	p=< 0.001
BMI (Kg/m^2)	44.77±4.99	27.54±3.78	31.85±9.20	p=< 0.001
Cholesterol (mg/dl)	167.51±39.90	158.55±34.12	168.29±36.87	p=0.007
Glucose (mg/dl)	95.93±25.70	86.26±10.17	94.13±20.31	p=< 0.001
TAM (mmHg)	96.24±13.40	86.86±8.93	86.66±10.29	p=< 0.001
Vit D (ng/ml)	19.10±6.16	18.90±7.46	21.78±6.70	p=0.001

Note: Statistically significant variation obtained by the ANOVA test
TAM: Mean Blood Pressure
BMI: Body Mass Index

Table 4. *ANOVA of repeated measures to compare the evolution of metabolic risk factors as a function of physical activity levels and weight regain*

		Level of Physical Activity (NAF)			Weight Regain (RP)		
		Low	Moderate	Time*NAF	Yes	No	Time*RP
Cholesterol	Baseline	173.29±41.13	154.61±34.29	p= 0.059	174.36±39.10	159.62±39.83	p= 0.134
	1 year	161.16±35.23	152.73±31.39		160.62±30.08	156.15±38.54	
	5 years old	172.83±38.46	158.15±31.39		174.11±34.48	161.56±38.81	
Glucose	Baseline	96.33±27.39	95.04±21.95	p= 0.765	96.04±26.44	95.80±25.17	p= 0.701
	1 year	85.48±8.27	88.00±13.53		84.76±8.21	88.00±11.92	
	5 years old	93.86±19.35	94.73±22.70		93.67±18.98	94.67±21.98	
TAM	Baseline	97.35±13.75	93.77±12.49	p= 0.082	98,022±12.53	94.18±14.23	p= 0.224
	1 year	87.31±9.47	85.85±7.65		87.47±7.86	86.31±10.11	
	5 years old	88.57±10.82	82.39±7.54		88.65±10.58	84.36±9.56	

TAM: Mean Blood Pressure

to assume a statistically significant relationship, as shown in Table 2.

An evolutionary analysis was performed for health data and associated comorbidities, including metabolic risk factors. This evolution comprises three evaluations, baseline (before surgery), one year after surgery and five years after surgery.

We have, mostly, lower values for the first year after surgery, but raise it to five years after surgery, with statistically significant values (p <0.007), which means that we have a positive effect in relation to the surgery itself. To highlight that vitamin D values are adjusted with pharmacological treatment, since most patients underwent a pharmacological support treatment of Vitamin D during some period of the postoperative period (Table 3).

When we specifically evaluate each metabolic risk factor, we have an initial evaluation of 23 patients with medication controlled HTA, which decreased to 8 after one year of surgery. At five years after surgery we have an increase to 12, of patients with disease who take medication to control HTA. Of course, that after surgery there are no patients with uncontrolled HTA.

In diabetes we have at baseline 10 patients with controlled disease with clinical measures, which decreases to 7 in the first year and to 4 in the fifth year after surgery. In dyslipidemia, we have in the first evaluation 21 patients taking medication to control the disease, which went down to 7 to the first year, but that at the 5th year rose to 9 patients in need of clinical measures to control the disease.

We also evaluated the comorbidity of Obstructive Sleep Apnea Syndrome, which there were 7 people with the disease controlled with clinical measures, which decreased to 2 in the first year and maintained at 5 years after surgery.

Table 4 shows the relationship between metabolic risk factors, physical activity and weight regain, whose p values do not reveal significant differences between different levels of physical activity or weight regain as a function of time. We can only infer that there may be a biased ly significant relationship between cholesterol, mean blood pressure and physical activity, in which moderate levels of physical activity are related to lower cholesterol levels and mean blood pressure.

Discussion

The main objective of the present study was to analyze the effect of bariatric surgery, physical activity, and weight regain on the prevalence of metabolic risk factors.

We were able to notice that, in the long term, the higher the levels of physical activity, the lower the weight regain, but

the same cannot mention about metabolic risk factors, since it is not possible to verify a relationship with the practice of physical activity or with weight regain.

When we approach weight regain in bariatric surgery, we considered a weight regain greater than 5% of the minimum weight reached [7], which in our sample was mostly achieved, the first year after surgery. The correlation between weight regain infers in a strong connection with physical activity, as mentioned in other studies, changes in lifestyle, monitored or not, allows to decrease the rates of weight regain [8]. In 2011, Livhits [9] reported that weight regain occurs on average 27 months after bariatric surgery and that it appears, above all, and is higher in patients with low levels of physical activity.

The characteristic of our sample in relation to the practice of physical activity found that the levels of physical activity are only two and most practice only in a light way, which is in line with the one mentioned in several studies that indicate that these patients, in the postoperative period, fall far short of the recommendations of the EASO regarding the practice of physical activity for the prevention of weight regain [10].

Although we only had patients with low and moderate levels of physical activity, patients who practiced physical activity, regardless of level, did not have on average weight regains at 5 years after bariatric surgery, which is in line with other authors' assessment, that physical activity allows the maintenance of long-term weight loss [11]. However, those who had moderate physical activity levels had fewer situations of weight regain. We emphasize that, in addition to none of the patients having vigorous or high activity, neither had structured physical exercise, which reinforces the need for follow-up by a physical exercise professional in the multidisciplinary evaluation of these patients.

Metabolic risk factors, when present, infer important repercussions on the complications, namely diabetes, HTA, dyslipidemia and Obstructive Sleep Apnea Syndrome [12]. All comortities have a significance to the first and fifth year, related to the surgery itself. As stated in a recent study that bariatric surgery is the most effective treatment in the treatment of comortities, regardless of weight regain and physical activity [1]. In our study, only patients who underwent gastric bypass were included, so we related the positive resolution of comorbidities with the performance of combined surgical procedures, with restriction and deficient absorption [13].

Our data report that after 5 years there are no patients with uncontrolled pathology, however without any statistically significant relationship with weight regain or physical activity, which we can verify in several studies, which prove that the improvement in comorbidities is independent of weight loss [3]. These results are in line with other studies, namely an RCT study developed in 2019, with 165 patients, with intervention program, in which there was no difference in metabolic risk factors between control and intervention groups [14].

Conclusion

The results of this study allowed to inferred way in which weight regain and physical activity may be related to risk factors in patients undergoing bariatric surgery.

Metabolic risk factors were factors addressed in our study with a lot of exploration of the entire framework, namely, regarding its improvement or not, over the postoperative period. In fact, there are benefits, but we can only associate with the surgery itself, since we have no significant relationship that allows us to affirm that metabolic risk factors improve or manage to maintain their decrease with the non-occurrence of weight regain or with the practice of physical activity.

Weight regains is one of the most important predictors for surgical failure, however we have simple and useful tools that allow to eliminate or decrease this threat. We realize that the practice of physical activity is started autonomously, without any or little follow-up, which allows us once again to reinforce that the follow-up of these patients by professionals with skills to do so would be an asset for patients and the national health system, since it will prevent several surgical procedures, several follow-up consultations for deterioration of the physical and psychological condition of patients, as well as the development of new pathologies.

For all that we have studied and researched, we realize and prove that bariatric surgery, gastric bypass, is the surgery with more evidence in improving the metabolic condition, in addition to the decrease in weight, which can maintain in the long term.

Metabolic risk factors have a good response in the first year after surgery, but mostly, they can only be maintained with long-term levels of physical activity, as reported in our systematic review of the literature. From the point that the pathology of diabetes is the one that has the best response, that is, surgery has a strong potential for metabolic improvement, technically effective in solving them, and the concomitant practice of physical activity does not seem to be significant or with contradictory results. This may be related to the level of reach of the sample used, in this case less than 95%.

Also in our study, the results agreed with the one mentioned, since there was an initial decrease in metabolic risk factors and some increased one or two years after surgery with patients requiring resuming medication and without positive relationship with physical activity and weight regain, only the mean blood pressure in some approximation.

This point is central and extremely relevant to the objective of our work, with the perception that these patients need guidance regarding the practice of regular physical activity, not only by prescription and follow-up, but throughout a referral to achieve the best results for all those involved in this process, focusing on patients and their needs. Bariatric surgery is successful in the treatment of severe obesity, with great potential to be maintained if it is fed by the practice of physical activity.

Limitations

The fact that the study is retrospective, with the collection of self-reported data, becomes a limitation of the data collected, as well as the sample size.

On the other hand, other motivational variables could have been evaluated, such as barriers and facilitators of physical activity, as well as the motivational profile, during this post-surgical process. In this sense, it could be interesting in future studies, controlling and differentiating these variables.

References

1. Rozier MD, Ghaferi AA, Rose A, Simon NJ, Birkmeyer N, Prosser LA. Patient Preferences for Bariatric Surgery: Findings From a Survey Using Discrete Choice Experiment Methodology. JAMA Surg. 2019;154(1):e184375.
2. Ahmad U, Danowski TS, Nolan S, Stephan T, Sunder JH, Bahl VK. Remissions of diabetes mellitus after weight reduction by

jejunoileal bypass. Diabetes Care. 1978;1(3):158-165.

3. Rubino, F., & Gagner, M. (2002). Potential of Surgery for Curing Type 2 Diabetes Mellitus. Annals of Surgery, 236(5), 554–559.
4. Kini S, Herron DM, Yanagisawa RT. Bariatric surgery for morbid obesity--a cure for metabolic syndrome? Med Clin North Am. 2007;91(6):1255-7.
5. Rubino F, Gagner M. Potential of surgery for curing type 2 diabetes mellitus. Ann Surg. 2002;236(5):554-9.
6. Rubino F. From bariatric to metabolic surgery: definition of a new discipline and implications for clinical practice. Curr Atheroscler Rep. 2013;15(12):369.
7. King WC, Hinerman AS, Belle SH, Wahed AS, Courcoulas AP. Comparison of the Performance of Common Measures of Weight Regain After Bariatric Surgery for Association With Clinical Outcomes. JAMA. 2018;320(15):1560-1569.
8. Kessler Y, Adelson D, Mardy-Tilbor L, et al. Nutritional status following One Anastomosis Gastric Bypass. Clin Nutr. 2020;39(2):599-605.
9. Livhits M, Mercado C, Yermilov I, et al. Patient behaviors associated with weight regain after laparoscopic gastric bypass. Obes Res Clin Pract. 2011;5(3):e169-e266.
10. Busetto L, Dicker D, Azran C, et al. Obesity Management Task Force of the European Association for the Study of Obesity Released "Practical Recommendations for the Post-Bariatric Surgery Medical Management". Obes Surg. 2018;28(7):2117-2121.
11. Villa-González E, Barranco-Ruiz Y, Rodríguez-Pérez MA, et al. Supervised exercise following bariatric surgery in morbid obese adults: CERT-based exercise study protocol of the EFIBAR randomised controlled trial. BMC Surg. 2019;19(1):127.
12. Baillot A, Romain AJ, Boisvert-Vigneault K, et al. Effects of lifestyle interventions that include a physical activity component in class II and III obese individuals: a systematic review and meta-analysis. PLoS One. 2015;10(4):e0119017.
13. Pujol-Rafols J, Al Abbas AI, Devriendt S, et al. Conversion of Adjustable Gastric Banding to Roux-en-Y Gastric Bypass in One or Two Steps: What Is the Best Approach? Analysis of a Multicenter Database Concerning 832 Patients. Obes Surg. 2020;30(12):5026-5032.
14. Hanvold SE, Vinknes KJ, Løken EB, et al. Does Lifestyle Intervention After Gastric Bypass Surgery Prevent Weight Regain? A Randomized Clinical Trial. Obes Surg. 2019;29(11):3419-3431.