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Impact of bariatric surgery on control of obstructive sleep apnea and hypopnea syndrome: comparison between gastric bypass and sleeve gastrectomy

Impacto da cirurgia bariátrica no controle da síndrome da apneia e hipopneia obstrutiva do sono: comparação entre bypass gástrico e gastrectomia vertical

Impacto de la cirugía bariátrica en el control del síndrome de apnea e hipopnea obstructiva del sueño: comparación entre el bypass gástrico em y de roux y manga gástrica

Eduardo Sávio Nascimento Godoy[1], Flávio Kreimer[1], Thiago Freire Pinto Bezerra[1], Josemberg Marins Campos[1], Josemir Lessa de Carvalho[1], Álvaro Antonio Bandeira Ferraz[1], José Gabriel Linhares Vieira[2], Wagner Menezes de Medeiros Junior[1], Ewerton Lúcio de Almeida Vilarino[1], Marcelo Palmeira Santana[1].

ABSTRACT

Objective: To evaluate apnea/hypopnea indices in individuals undergoing two bariatric surgery techniques: Sleeve Gastrectomy and Roux-en-Y Gastric Bypass**. Methods:** Prospective cohort including obese patients with Sleep Apnea Syndrome undergoing bariatric surgery, for pre- and postoperative evaluation through polysomnography. Body mass and apnea/hypopnea indexes were measured. **Results:** 30 participants were selected (60% sleeve gastrectomy). 73.3% were female, with mean age of 40.2 years (range 24-63). Mean preoperative body mass and apnea/hypopnea indexes of sleeve gastrectomy and gastric bypass were respectively 39.9 and 42.8 kg/m2, and 33.7 and 27.7 events/hour. Mean postoperative body mass and apnea/hypopnea indexes for sleeve gastrectomy and gastric bypass were 28.8 and 30.3 kg/m2, and 7.4 and 9.5 events/hour (0.3-27.3), respectively. There was no statistical difference between the groups regarding sleep apnea or weight control. **Conclusion:** Both surgical techniques are effective in controlling sleep apnea. Patients with lesser preoperative BMI were the main beneficiaries. A larger number of patients and studies may corroborate these findings.

Keywords: Obesity, Management of obesity, Obstructive sleep apnea, Obesity hypoventilation syndrome, Metabolic syndrome.

RESUMO

Objetivo: Avaliar índices de apneia/hipopneia em indivíduos submetidos a duas técnicas de cirurgia bariátrica: Gastrectomia Vertical e Bypass Gástrico em Y de Roux. **Métodos:** Coorte prospectivo incluindo pacientes obesos com Síndrome da Apneia do Sono submetidos à cirurgia bariátrica, para avaliação pré e pós-operatória por polissonografia. Índices de massa corporal e apneia/hipopneia foram mensurados. **Resultados:** Trinta participantes foram selecionados (60% Gastrectomia Vertical). 73,3% eram mulheres, com idade média de 40,2 anos (variação 24-63). Índices pré-operatórios médios de massa corporal e de apneia/hipopneia para gastrectomia vertical e bypass gástrico foram de 39,9 e 42,8 kg/m2 e 33,7 e 27,7 eventos/hora, respectivamente. Índices médios pós-operatórios de massa corporal e de apneia/hipopneia para gastrectomia vertical e bypass gástrico foram de 28,8 e 30,3 kg/m² e 7,4 e 9,5 eventos/hora (0,3–27,3), respectivamente. Não foram observadas diferenças estatísticas entre os grupos em termos de apneia do sono ou peso. **Conclusão:** Ambas as técnicas cirúrgicas são eficazes no controle da apneia do sono. Pacientes

[1] Federal University of Pernambuco, Recife – PE.
[2] Instituto de Medicina Integral Professor Fernando Figueira, Recife – PE.

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com IMC pré-operatório mais baixo foram os principais beneficiados. Maior número de pacientes e estudos poderia corroborar esses achados.

Palavras-chave: Obesidade, Manejo da obesidade, Apneia obstrutiva do sono, Síndrome de hipoventilação da obesidade, Síndrome metabólica.

RESUMEN

Objetivo: Evaluar índices de apnea/hipopnea en individuos sometidos a dos técnicas de cirugía bariátrica: Manga Gástrica y Bypass Gástrico en y de Roux. **Métodos:** Cohorte prospectiva incluyendo pacientes obesos con Síndrome de Apnea del Sueño sometidos a cirugía bariátrica, para evaluación pre y postoperatoria mediante polisomnografía. Se midieron la masa corporal y los índices de apnea/hipopnea. **Resultados:** 30 participantes selecionados (60% manga gástrica). 73,3% mujeres, con edad media de 40,2 años (rango 24-63). Media de masa corporal preoperatoria y índices de apnea/hipopnea de manga gástrica y bypass gástrico fueron respectivamente 39,9 y 42,8 kg/m2, y 33,7 y 27,7 eventos/hora. Media de masa corporal postoperatoria y índices de apnea/hipopnea para manga gástrica y bypass gástrico fueron de 28,8 y 30,3 kg/m², y de 7,4 y 9,5 eventos/hora (0,3-27,3), respectivamente. No se observaron diferencias estadísticas entre los grupos en cuanto a apnea del sueño o peso. **Conclusión:** Ambas técnicas quirúrgicas son eficaces para controlar apnea del sueño. Pacientes con menor IMC preoperatorio fueron los principales beneficiarios. Mayor número de pacientes y estudios podría corroborar estos hallazgos.

Palabras clave: Obesidad, Manejo de la obesidad, Apnea obstructiva del sueño, Síndrome de hipoventilación por obesidad, Síndrome metabólico.

INTRODUCTION

Obstructive Sleep Apnea and Hypopnea Syndrome (OSAHS) is among the comorbidities controlled by Bariatric Surgery (BS). Classically involved with overweight, OSAHS can lead to the development of diabetes, secondary arterial hypertension and reduced life expectancy, reinforcing indication of BS. Obesity is the highest known risk factor for OSAHS (YOUNG T, PEPPARD PE, TAHERI S, 2005; YOUNG T, et al., 2004). Approximately 35 to 45% of BS candidates have preoperative OSAHS, and approximately 40% of these patients have severe OSAHS (WOLFE BM, et al.,2016; LOO GH, et al., 2020; MING X, et al., 2021; RAVESLOOT MJL, et al., 2012).

Pathophysiology between OSAHS and obesity is well elucidated: upper airways have greater tendency to collapse and there is disproportion in body/lung ratio, with decrease in pulmonary compliance (LADOSKY W, ET AL., 2001; PATIL SP and KIRKNESS JP, 2024; SANDS SA, et al., 2023). Increase in neck circumference is due to gain of adipose tissue. In this way, patients develop reduction in airways caliber, with greater need for support pressure for adequate ventilation (SCHWARTZ AR, et al., 2010). Enlarged tongue and displacement of hyoid bone by fat deposition worsen obstructive condition (LIN H, et al., 2020; WANG SH, et al., 2020).

In addition to anatomical factors, obesity contributes to OSAHS through significant metabolic changes. Chronic systemic inflammation and insulin resistance exacerbate effects of OSAHS on cardiovascular system, increasing risk of serious complications such as hypertension and heart disease (KURNOOL S, et al., 2023; VIEGAS CAA, 2010).

The best bariatric technique for OSAHS control is discussed. It is expected that techniques with greater metabolic impact will also present better response to the Apnea and Hypopnea Index (AHI). One hypothesis would be that OSAHS control is directly conditioned by patient's weight. Thus, surgery with greater weight impact would also have a better response in controlling apnea. In cohort study involving more than 4000 cases of BS, Currie et al. showed better control of OSAHS through Gastric Bypass (GB) and Sleeve Gastrectomy (SG) when compared to adjustable gastric banding. Quintas-Neves et al., in systematic review involving 22 articles, also demonstrated superiority of mixed vs. restrictive techniques. More rigorous surgeries, such as biliopancreatic diversion, bring better control of the condition, as analyzed in that review. However, this result

is debatable, with evidence of equivalence in treatment, or even a slight preponderance of SG over GB. Thus, there is a gap regarding best technical indication for BS regarding the control of OSAHS (WOLFE BM, et al., 2016; CURRIE AC, et al., 2021; QUINTAS-NEVES M, et al., 2016; SARKHOSH K, et al., 2013; GARG H, et al., 2017; LI J, et al., 2016; THAHER O, et al., 2022; XU C, et al., 2020; YAGHOUBIAN A, et al., 2012).

This study aims to evaluate evolution of AHI in individuals submitted to GB and SG, with standardized team, to compare AHI between patients of both techniques, to analyze influence of demographic factors on clinical outcomes related to OSAHS, and to investigate relationship between weight loss and clinical improvement of OSAHS symptoms in patients undergoing both surgical techniques.

METHODS

This is a prospective cohort study with convenience sampling developed at a tertiary hospital on Pernambuco, Brazil. The study has been approved by the Research Ethics Committee, with the following register number: 5.624.985 and CAAE: 58912222.4.0000.5198. All methods were carried out in accordance with Brazilian guidelines and regulations, established on Law nº 14.874/2024. Informed consent was obtained from all subjects and/or their legal guardian(s).

Surgeries were performed by the same team, composed of four bariatric surgeons and three anesthesiologists. To ensure standardization of treatment, there was continuous participation of three surgeons and two anesthesiologists in each surgery.

SG and GB were techniques chosen due to their wide validation and efficacy. Guidelines highlight that GB is highly effective in resolving metabolic diseases, such as type 2 diabetes mellitus, while SG offers similar benefits in weight loss, with lower risk of nutritional complications. Both techniques also demonstrate positive impact on the reduction of AHI (ARTERBURN et al., 2020; MASHAQI et al., 2023; WARD et al., 2016).

Surgical technique did not influence choice of the platform, and both SG and GB could be performed via robotics or laparoscopy. After hospital discharge, patients returned for periodic consultations on the 1st, 3rd, 6th and 12th postoperative months.

Following variables were measured: age, gender, body mass index (BMI) -preoperatively and around 6th postoperative month; Apnea/hypopnea index (AHI) - preoperatively and around 6th postoperative month. To ensure accuracy and standardization in data collection, AHI was measured by home polysomnography. In addition, STOP-BANG Questionnaire was applied as screening tool in the preoperative period, due to its good sensitivity in identifying moderate and severe cases of OSAHS. Anthropometric data, such as BMI, were analyzed to correlate weight loss with the clinical outcomes.

Inclusion criteria were patients with BMI equal to or greater than 35 kg/m²; submitted to BS by videolaparoscopic or robotic platform; History of at least 2 years of unsuccessful clinical treatment of obesity; Diagnosis of preoperative OSAHS. Exclusion criteria were patients with surgical techniques other than SG or GB; revisional BS; Age under 18 years or over 65 years; severe psychiatric disorders; History of multiple surgical interventions in the upper abdomen, which may hinder surgical procedure; and recent diagnosis of Covid-19 (less than 30 days).

Data were measured and computed in a Microsoft Excel table. Data processing and calculations were performed in Social Science Statistics. For interval variables, comparing two samples, for parametric data, we used the Student's t-test. For non-parametric variables, Mann-Whitney test. For correlation of two quantitative variables, Pearson's correlation analysis. Results with statistical significance were those with P lower than 5%. The datasets generated and/or analysed during the current study are not publicly available due to national law (General Data Protection Law) but are available from the corresponding author on reasonable request.

RESULTS

30 patients with preoperative OSAHS underwent BS, 18 of whom underwent SG and 12 underwent GB. Two patients in GB group underwent robotic surgery, and the others underwent laparoscopic surgery, as well

as all patients in SG group. In order to evaluate homogeneity of biological and clinical characteristics selected for each technique, it was observed that there was no statistically significant difference (p = 0.419) in the comparison of groups in terms of gender distribution, with majority of female patients; however, in comparison of age, GB group had higher mean age (42.9 years) when compared to SG group (36.2 years).

Table 1 - Comparison of the biological and clinical characteristics of patients undergoing bariatric surgery according to the surgical technique.

Characteristics	Gastric Bypass (n=18)	Sleeve Gastrectomy (n = 12)	p-value
Sex			0,419
Female	12 (66,7%)	10 (83,3%)	
Male	6 (33,3%)	2 (16,7%)	
Age			
Average ± SD	42,9 ± 10,1	36,2 ± 8,9	0,076
Surgeon			0,464
A	9 (50,0%)	9 (75,0%)	
B	5 (27,8%)	2 (16,7%)	
C	3 (16,7%)	0 (0%)	
D	1 (5,6%)	1 (8,3%)	
Pre-surgery BMI			
Average ± SD	39,9 ± 3,7	42,8 ± 7,7	0,187
AHI – pre-surgical			
Median (P25 – P75)	28,6 (8,0 – 56,8)	19,1 (13,0 – 44,0)	0,767
Time between polysomnography and surgery (in months)			
Median (P25 – P75)	4,2 (2,3 – 9,0)	3,1 (2,4 – 4,4)	0,289

Source: Godoy ESN, et al., 2025.

Statistical significance of age comparison was borderline (p = 0.076), which suggests an age-adjustment analysis in the comparison of outcomes between the groups. There was predominance of performing surgeons, with no significant difference (p = 0.464).

There was no significant difference in comparison of preoperative BMI (p = 0.187) and preoperative AHI (p = 0.767) between the groups. Regarding time between polysomnography in the preoperative period and surgery, median time in GB group was 4.2 months and in SG group was 3.1 months, with no statistically significant difference between them (p = 0.289) (**Table 1**). After surgical procedure, patients were reassessed with new polysomnography and outpatient evaluation with bariatric surgeon, as seen in **Table 2**.

Table 2 - Comparison of pre- and post-surgical BMI and apnea-hypoapnea index (AHI) of patients undergoing bariatric surgery according to surgical technique.

Outcomes	Gastric Bypass (n=18)	Sleeve Gastrectomy (n = 12)	p-value (between-groups)
BMI - Mean ± SD			
Preoperative	39,9 ± 3,7	42,8 ± 7,7	0,187
Postoperative	28,8 ± 3,1	30,4 ± 7,4	0,414
p-value (intra-group)	**<0,001**	**<0,001**	-
Postoperative reduction (kg/m2)	11,2 ± 3,0	12,4 ± 2,7	0,500
Postoperative reduction (%)	27,8 ± 6,3	29,5 ± 6,9	0,500
AHI - Median (P25 – P75)			
Preoperative (events/hour)	28,6 (8,0 – 56,8)	19,1 (13,0 – 44,0)	0,767
Postoperative (events/hour)	5,7 (2,0 – 10,9)	5,8 (1,9 – 15,4)	0,832
p-value (intra-group)	**<0,001**	**0,006**	
Postoperative reduction (events/hour)	20,3 (5,7 – 46,0)	11,7 (9,9 – 27,5)	0,672
Postoperative reduction (%)	76,7 (67,4 – 84,1)	70,6 (49,6 – 87,6)	0,498

Source: Godoy ESN, et al., 2025.

Comparing BMI and AHI in the pre- and post-surgical phases in the different techniques (intragroup), a statistically significant reduction (p<0.001) was observed in both groups, both in BMI and AHI measurements. In GB group there was mean reduction in postoperative BMI of 11.2kg/m^2, and in percentage terms, this reduction was on average 27.8% of preoperative BMI. In SG group, reduction was an average of 12.4 kg/m2 postoperatively, and in percentage terms this reduction was an average of 29.5%. Comparing the groups, there was no statistically significant difference (p = 0.500) in BMI mean reduction.

There was median AHI reduction of 20.3 events/hour in BG group, and in percentage terms this reduction was 76.7%. In SG group, median AHI reduction was 11.7 points, and in percentage terms this median reduction was 70.6%. Comparing groups in relation to AHI reduction, there was no statistically significant difference (p = 0.672) between techniques. None of the patients required postoperative CPAP.

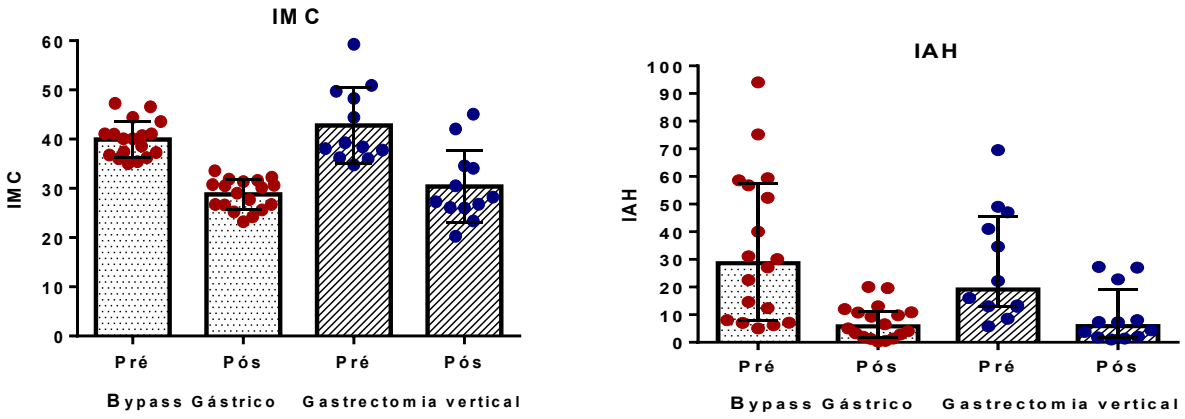
Table 3 - Crude and adjusted reduction in BMI and apnea-hypoapnea index (AHI) 6 months postoperatively between gastric bypass and sleeve gastrectomy techniques among patients undergoing bariatric surgery according to surgical technique.

Outcomes	Difference between groups Reduction (95% CI)	p-value	Age-adjusted between-group difference Reduction (95% CI)	p-value
BMI				
Age-adjusted postoperative reduction (kg/m2)	1.22 (-0.98 to 3.34)	0,266	0.97 (-1.39 to 3.33)	0,409
Age-adjusted postoperative reduction (%)	1,69 (-3,33 a 6,67)	0,500	1,31 (-4,07 a 6,70)	0,621
IAH				
Age-adjusted postoperative reduction	8,15 (-23,8 a 7,5)	0,295	6,21 (-22,9 a 10,5)	0,453
Age-adjusted postoperative reduction (%)	12,0 (-31,7 a 7,7)	0,221	7,8 (-28,4 a 12,9)	0,447

Source: Godoy ESN, et al., 2025.

Table 3 presents results of comparison of crude and age-adjusted reduction in BMI and AHI postoperatively between GB and SG groups. There was no significant difference (p>0.05) between the techniques in any evaluation when adjusted for age. As previously mentioned, the need for adjustment was due to the groups were not homogeneous in terms of age, which could be a confounding factor in estimating reduction in BMI and AHI. These results are summarized in **Figure 1**, showing the impact and dispersion of results of both techniques.

Figure 1 - BMI and apnea-hypoapnea index (AHI) measurements of pre- and post-surgical patients undergoing bariatric surgery according to surgical technique.



Source: Godoy ESN, et al., 2025.

Considering the equivalence of both surgical techniques in the literature and the homogeneity of demographic data, as well as similar results mentioned above, correlation analysis between the percentage reductions in AHI and BMI was carried out in order to show the populations that would benefit most from BS, without separating them by technique, as shown in the **Table 4**.

Table 4 - Analysis of Pearson's correlation between BMI reduction and AHI, both preoperatively and postoperatively.

		BMI Reduction	AHI Reduction	Preoperative BMI	Preoperative AHI	Postoperative BMI	Postoperative AHI
BMI Reduction	%	1,000	0,477	-0,110	0,218	-0,594	-0,072
	p		0,008	0,563	0,248	0,001	0,706
AHI Reduction	%	0,477	1,000	-0,465	0,211	-0,639	-0,421
	p	0,008		0,010	0,263	0,000	0,021
Preoperative BMI	%	-0,110	-0,465	1,000	0,397	0,862	0,654
	p	0,563	0,010		0,030	0,000	0,000
Preoperative AHI	%	0,218	0,211	0,397	1,000	0,179	0,589
	p	0,248	0,263	0,030		0,343	0,001
Postoperative BMI	%	-0,594	-0,639	0,862	0,179	1,000	0,547
	p	0,001	0,000	0,000	0,343		0,002
Postoperative AHI	%	-0,072	-0,421	0,654	0,589	0,547	1,000
	p	0,706	0,021	0,000	0,001	0,002	

Source: Godoy ESN, et al., 2025. p: p-value.

AHI reduction showed strong correlation with BMI reduction and with preoperative BMI (p-value of 0.008 and 0.010, respectively), with no clear statistical correlation with the preoperative AHI (p-value of 0.263).

DISCUSSION

The results of the research were consistent with what has been reported in the literature. In a meta-analysis involving SG, GB and adjustable gastric banding, without division by technique, Mashaqi S, et al. (2023) found reduction in AHI of 23.2, with reduction in BMI of 11.6 kg/m2. Same meta-analysis compared oxygen desaturation indexes, minimum SaO2, and mean SaO2 in a fraction of the studies, all with evident improvement. These results reinforce positive impact of BS not only on weight loss, but also on significant improvement of respiratory parameters, corroborating previous data highlighting importance of surgical intervention in risk reduction associated with OSAHS. The proportionally greater reduction in AHI compared to BMI reflects the direct influence of fat redistribution in upper airways, especially decreasing cervical circumference (ARTERBURN DE, et al., 2020; MASHAQI S, et al., 2023; CARNEIRO G e ZANELLA MT, 2018; WANG SH, et al., 2020).

AHI reduction of 74.4% in SG patients and 62.4% in GB patients, i.e., a decrease of 26.4 points and 18.2 points, respectively, when compared on average, and 70.6 and 76.7 points, when compared in terms of median, can be justified by shorter follow-up time of our sample, when compared to Mashaqi S, et al. (2023) meta-analysis, which presented articles with follow-up of up to 60 months. In addition, studies indicate that metabolic and hormonal mechanisms modulated by BS can positively influence respiratory outcomes, regardless of length of follow-up. Hormones such as ghrelin and leptin show important changes after BS, with ghrelin showing significant reduction and leptin, related to adipose tissue, also showing reduction proportional to weight loss. These changes impact upper airway regulation and respiratory sensitivity, which may explain the benefits observed even in the short term (CARNEIRO G e ZANELLA MT, 2018; WANG SH, et al., 2020).

In fact, the proportionally greater reduction in AHI when compared to BMI seems to be related to weight loss, regardless of the form in which it is obtained (lifestyle change, anti-obesity drugs or CB). This may explain the great advantage of BS when compared to non-surgical initiatives, as well as the statistical indifference between SG and GB. These observations highlight that BS acts as intervention with broad metabolic impact,

with benefits that go beyond weight loss itself. Improvement in pulmonary function, observed through increased forced vital capacity and oxygen saturation, also corroborates these findings (MALHOTRA A, et al., 2023; MASHAQI S, et al., 2023; CARNEIRO G e ZANELLA MT, 2018).

Association between AHI reduction in a more exuberant way than BMI reduction is described in **Table 4**. In this study, due to statistical equivalence of both surgeries controlling OSAHS, it was possible to add both groups to make inferences about behavior of comorbidity in the face of BS, without segmenting it. AHI and BMI, when compared at the same time (preoperative or postoperative), show a strong correlation, as already discussed, and thus, the reduction of both indices is also extremely and positively correlated, as expected.

However, strong negative correlation between preoperative BMI and the proportional reduction in AHI is noteworthy, i.e., the greatest beneficiaries in terms of OSAHS control were precisely those with lower BMI. Thus, it seems to us that BS can be an excellent control option for OSAHS even in those patients with borderline obesity from the weight point of view, as is suggested nowadays with Metabolic Surgery for severe diabetes control. This is possibly the most powerful finding in our study.

Results are suggestive that there is also some hormonal/metabolic benefit after BS related specifically to the control of OSAHS. In our experience, patients already show great improvement in sleepiness and snoring even in the first weeks of surgery, although not measured in the study; however, equivalent weight loss, with purely clinical measures, does not seem to reflect in syndromic improvement. Finding laboratory markers to understand this relationship is a source of curiosity and challenge for those who study obesity (DAY K, et al., 2023; CARNEIRO G and ZANELLA MT, 2018; FURLAN SF, et al., 2021).

BS is also consistently related to improve sleep architecture. In meta-analysis involving 24 studies in BS patients with OSAHS, a large decrease in AHI, increased oxygen saturation, increased preponderance of REM and N3 sleep, less sleep fragmentation, as well as improved lung function, verified through increased total forced capacity, were evidenced (QIN H, et al., 2023).

Improved sleep quality reflects not only AHI reduction, but also better oxygenation and balance of autonomic nervous system. These factors are crucial for overall improvement of quality of life, corroborating positive results reported in our sample. These findings reinforce importance of BS as comprehensive therapeutic approach, with systemic effects including metabolic, respiratory, and neurological improvement (MAGNE F, et al., 2019; QIN H, et al., 2023). Among limitations of the study, we can evidence that all patients underwent polysomnography at home. Although laboratory polysomnography is more accurate in obese patients due to the greater intensity of OSAHS, this diagnosis would hardly be overlooked in home study (VAN VELDHUISEN SL, et al., 2022).

Due to small size of our sample, secondary to difficulty of adherence to postoperative PSG, there was no division or analysis regarding other comorbidities that entail an increased risk of OSAHS. In addition to classic predictors such as higher BMI, male gender, smoking/chronic obstructive pulmonary disease, and older age, other comorbidities can capriciously increase this risk, such as hypothyroidism, gastroesophageal reflux disease, and acromegaly (CHEN W, et al., 2021; ERRIDGE S, et al., 2021; RAVESLOOT MJL, et al., 2012; VAN VELDHUISEN SL, et al., 2022).

Currently, there is discussion about indication of magnetic resonance imaging (MRI) for airway evaluation and diagnosis of OSAHS. Through this, it is possible to evaluate retropalatal and retroglossal obstruction, position of hyoid bone, and distance between uvula and tongue. In these cases, in addition to the already presumed diagnosis of OSAHS, MRI would also help in otorhinolaryngological surgical planning. In our sample, a large reduction in AHI was observed in most cases. Thus, there was no complementation with MRI (GAMALELDIN O, et al., 2021; LI Y, et al., 2023). Despite such expressive findings regarding BS control, there is reasonable prevalence of postoperative OSAHS, especially in those patients with more severe preoperative apnea. In prospective multicenter study with 132 participants, prevalence of 20% of moderate/severe OSAHS was found after GB, with cure or improvement in 78% of the patients. This finding is compatible with literature, around 25% (PEROMAA-HAAVISTO P, et al., 2017; DE RAAFF CAL, et al., 2016; DEMAEYER N e BRUYNEEL M, 2024; YANG J, et al., 2024).

Negative correlation between preoperative BMI and AHI reduction suggests that benefits in OSAHS control may be due not only to weight effect, but also to hormonal mechanisms. This finding, which highlights a proportionally more favorable response to AHI reduction in patients with lower preoperative BMI, contributes to discussion about the efficacy of bariatric surgery even in cases of borderline obesity.

A relevant aspect to be highlighted is the relationship between residual OSAHS after bariatric surgery and regional patterns of adiposity. Fat accumulation in the cervical and pharyngeal compartments, even when overall BMI decreases, can sustain partial upper airway obstruction and account for persistent disease. Studies have shown that tongue fat, parapharyngeal fat pads, and airway lengthening related to weight gain significantly affect AHI severity and response to weight loss interventions (LIN H, et al., 2020; WANG SH, et al., 2020). This reinforces the importance of going beyond global anthropometric indices and considering body composition and regional fat distribution in the evaluation of surgical outcomes.

Interplay between obesity, systemic inflammation, and OSAHS pathophysiology also deserves mention. Obesity is characterized by a chronic low-grade inflammatory state, mediated by adipokines such as leptin, TNF-α, and IL-6. These mediators promote upper airway collapsibility and worsen ventilatory control during sleep (CARNEIRO G e ZANELLA MT, 2018; PATIL SP and KIRKNESS JP, 2024; SANDS SA, et al., 2023).

Bariatric surgery induces significant reductions in systemic inflammation, which may partly explain the disproportionate improvement in respiratory outcomes compared to weight loss alone. This mechanism aligns with evidence suggesting that metabolic and hormonal effects, including reductions in leptin and ghrelin, play a role in OSAHS improvement after surgery (CARNEIRO G and ZANELLA MT, 2018).

Another dimension involves the cardiovascular implications of OSAHS remission or improvement. Untreated OSAHS is an independent risk factor for systemic hypertension, arrhythmias, pulmonary hypertension, and cardiovascular mortality (KURNOOL S, et al., 2023; YOUNG T, et al., 2004).

By reducing AHI and improving oxygenation, bariatric surgery mitigates sympathetic activation and improves cardiometabolic stability. Large registry and cohort studies have confirmed that OSAHS remission following bariatric surgery is associated with improvements in blood pressure and a decrease in long-term cardiovascular morbidity (ARTERBURN DE, et al., 2020; CURRIE AC, et al., 2021; QUINTAS-NEVES M, et al., 2016). Therefore, improvements in sleep-disordered breathing can be considered an important mediator of the cardioprotective effects of bariatric surgery.

Quality of life and neurocognitive outcomes should also be acknowledged. Sleep fragmentation and nocturnal hypoxemia in OSAHS patients are associated with excessive daytime sleepiness, memory impairment, and reduced productivity (VIEGAS CAA, 2010).

Improvement in sleep architecture after bariatric surgery, including increased REM and N3 sleep stages, has been consistently demonstrated (MAGNE F, et al., 2019; QIN H, et al., 2023). These findings indicate that benefits extend beyond physiological outcomes to encompass psychosocial functioning and overall well-being.

Finally, it is important to emphasize the heterogeneity of outcomes. Preoperative AHI severity, BMI, fat distribution, and comorbidities such as hypothyroidism and COPD can influence postoperative results (CHEN W, et al., 2021; ERRIDGE S, et al., 2021; RAVESLOOT MJL, et al., 2012).

Complementary strategies, including continued CPAP in selected patients or adjunctive ENT procedures in refractory cases, may optimize control of OSAHS (GAMALELDIN O, et al., 2021; LI Y, et al., 2023). Thus, bariatric surgery should be considered part of a comprehensive and individualized approach rather than a stand-alone intervention.

In summary, the evidence reinforces that bariatric surgery improves OSAHS through multiple mechanisms—mechanical, metabolic, hormonal, and inflammatory. The strong and disproportionate reduction of AHI compared to BMI underlines the systemic nature of these effects, supporting its role as a cornerstone therapy for obese patients with sleep-disordered breathing (CARNEIRO G and ZANELLA MT, 2018; MASHAQI S, et al., 2023; QIN H, et al., 2023).

CONCLUSION

SG and GB promoted significant reductions in both BMI and AHI, with no statistically significant differences between techniques, even when adjusted for age. None of the patients required postoperative CPAP. In the sample studied, reduction in AHI is strongly and inversely associated with reduction in BMI, as well as with preoperative BMI. Future studies with larger samples and longer follow-ups may deepen understanding of mechanisms involved and confirm robustness of these findings.

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