Evaluation of obstructive sleep apnea in obese patients scheduled for bariactric surgery[1]

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ABSTRACT

PURPOSE: To evaluate the frequency of obstructive sleep apnea (OSA) in obese patients scheduled for bariatric surgery and their identification for risk of OSA by Berlin Questionnaire (BQ) and excessive daytime sleepiness by Epworth Sleepiness Scale (ESS).

METHODS: Fifty nine patients were evaluated by BQ and ESS. Out of these individuals, 35 performed a full-night sleep study using a type 3 portable monitoring (PM). The questionnaire results were compared for gender and BMI. The presence and severity of OSA was correlated with gender and both questionnaires.

RESULTS: 94.75% of the respondents presented high risk for OSA by BQ and 59.65% presented positivity by ESS. Taking into account the AHI$\geq$ 5 per hour for OSA diagnosis, all of them presented OSA, average AHI of 45.31±26.3 per hour and 68.6% have severe OSA (AHI$\geq$30). The male patients had a higher AHI (p<0.05). There was a positive correlation between the positivity in both questionnaires as well as the severity of OSA measured by AHI (p<0.05).

CONCLUSION: The frequency and severe obstructive sleep apnea in the studied group is high. The Berlin Questionnaire and Epworth Sleepiness Scale had a positive correlation with the diagnosis of OSA in the group studied.

Key words: Sleep Apnea, Obstructive. Obesity. Obesity, Morbid. Bariatric Surgery.

Introduction

Obstructive sleep apnea (OSA) is characterized by the intermittent partial or complete upper airway collapse during sleep, leading to sleep fragmentation, hypoxemia, hypercapnia, intrathoracic pressure oscillations as well as the increased sympathetic activity[1].

Its diagnosis and severity classification are made by Apnea- Hypopnea Index (AHI). An AHI between five and 15 classifies it as mild OSA, between 15 and 30 as moderate and higher than 30 as severe[2].

OSA affects 24% of male and 9% of female in the USA[3,4]. The data concerning the Brazilian population are still very restricted, but in a recent study in Sao Paulo City, including 1042 volunteers aged from 20 to 80 years, 32.8% of the participants were diagnosed OSA[5].

Most of the patients are not aware of the problem and it is estimated that 80% of the cases of OSA that are moderate to severe remain undiagnosed[6].

Obesity is the main risk factor for the development of OSA and is its most important reversible risk factor[7-10]. It is estimated that 40%-45% of obese patients present OSA, reaching up to 71 to 91% in the morbidly obese[10-16]. Obesity is a chronic disease considered as a worldwide epidemic. Since 1980, the number of obese has doubled around the world[17]. In the USA the number of morbidly obese/class III obesity quadrupled between 1986 and 2000[15].

The bariatric surgery was recommended for obesity treatment and its comorbidities in this population and the risks of OSA have been studied by several authors[14,15,18-24]. OSA increases the morbidity as well as perioperative and post-operative mortality rate during the bariatric surgery[15,25,26]. Its diagnosis and treatment before surgery decrease such complications[18,21,23,24].

The American Academy of Sleep Medicine recommends that this group of patients should perform an objective sleep study[1]. However, due to the unavailability of sleep laboratories in addition to the high demand of individuals waiting for bariatric surgery, most part of these patients will not be investigated.

Thus, the purpose of the present study was to evaluate the frequency and classify the severity of OSA in obese patients scheduled for bariatric surgery in a University Hospital in Brazil.

Methods

The present cross-sectional study was approved by the Research Ethics Committee of Botucatu Medical School (FMB), Sao Paulo State University (UNESP), under the number 3588/2010. Written and informed consent was obtained from all the participants.

Patients over 18 years from Bariatric Surgery Outpatient at Gastro-surgery Department of Clinics Hospital, FMB – UNESP were invited and some exclusion criteria such as sedative users, patients with oxygen-dependent lung disease or decompensated and/or congestive heart failure, presence of other sleep disorders (narcolepsy, restless legs syndrome, insomnia), craniofacial deformities, diagnosis and/or previous OSA treatment were adopted.

A group of 59 subjects was submitted to anamnesis and specific physical examination. Body mass index (BMI) was calculated from body weight in kilograms (kg) and height in meters (m). The neck circumference was measured in centimeters (cm) taking the cricothyroid membrane as reference. All patients responded to Berlin Questionnaire (BQ) to estimate the risk of OSA. It investigates three categories: snoring, daytime sleepiness and/or while driving and diagnosis of systemic hypertension or obesity. A person showing two positive categories is considered as high risk for OSA[27]. They also responded to Epworth Sleepiness Scale (ESS) to evaluate daytime sleepiness[28]. The patients were invited to perform a full-night sleep study using a type 3 PM (Stardust II-Respironics. Inc., USA).

BQ and ESS outcomes were compared according to the gender and BMI. The diagnosis and severity of OSA was correlated to gender and positivity of both questionnaires.

The *t*-test for variables with symmetric distribution and Wilcoxon non-parametric test for variables with non-symmetric distribution were used for the statistical analysis. Moreover, the Chi-square test was used for qualitative variables whereas the Pearson correlation coefficient for quantitative variables. The statistical significance was considered when $p < 0.05$.

Results

Fifty-nine patients from Gastro-surgery Outpatient were evaluated (Table 1). There was no difference between the genders concerning to age and BMI. Both genders presented neck circumferences above the limit considered as a risk factor for OSA (male>43.2 cm and female> 40.6 cm), although male patients showed higher values[12].

94.7% of the respondents presented high risk for OSA by Berlin Questionnaire, with neither difference for gender (p=0.14) nor correlation to BMI (p=0.14).

The ESS was considered positive in 59.7% of the patients, with no correlation to gender (p=0.07) or BMI (p=0.95).

TABLE 1 - Clinical and anthropometric characteristics of the evaluated patients according to genders.

	Group studied	Male	Female	Value p
Total	59	25 [42.37%]	34 [57.63%]	
Variables				
Average age (years)	45.03 ±10.5 (59)	44.6 ± 11.52 (25)	45.36 ± 9.74 (34)	0.78
Average BMI (57 patients)	43.53 ± 7.4	42.41± 8.9 (23)	44.34 ± 6 (34)	0.36
Neck Circumference in cm (38 patients)	44.59 ± 4.6	48.07 ± 4.2 (14)	42.56 ± 3.5 (24)	0.0001
Positive BQ (57 patients)	54 [94.7%]	23 [100%]	31 [91.2%]	0.14
Positive ESS (57 patients)	34 [59.65%]	17 [73.91%]	17 [50%]	0.07

BMI = Body Mass Index in kg/m^2. ESS = Epworth Sleepiness Scale. BQ = Berlin Questionnaire. The data were presented like mean ± standard deviation and absolute number (n) or number (%).

A total of 35 patients underwent a full-night sleep study. Considering AHI≥5 for the diagnosis of OSA, all the patients presented OSA in the examination and 68.6% present severe OSA. Relating to male subjects, 92.86% presented severe OSA whereas the female subjects, 52.38%. Male patients showed a higher AHI, as well as in the supine position. However, 34 subjects responded BQ and 91.2% presented high risk for OSA. The ESS was positive in 51.5% of the patients. (Table 2)

TABLE 2 – Characteristics relating to the presence and severity of obstructive sleep apnea according to gender.

Variable	Group studied	Male	
	35	14	
OSA	35	14	
Age		47.1 ± 11.8	
BMI		41.3 ± 9.9	
Average AHI	45.31 ± 26.3	60.20 ± 25.20	35
Supine AHI	52.01	68.55 ± 22.30	40
Mild OSA	5 (14.3)	1 (7.14)	
Moderate OSA	6 (17.14)	0	
Severe OSA	24 (68.6)	13 (92.86)	
Positive BQ	31 (91.18)	13 (100)	
Average ESS	11.09 ± 6.9		
Positive ESS	17 (51.52)	09 (75)	

OSA = Obstructive Sleep Apnea. AHI = Apnea-hypopnea Index per hour. Absence of OSA = AHI < 5. Mild OSA = AHI ≥ 5 and < 15. Moderate = AHI ≥ 15 e < 30. Severe OSA = AHI ≥ 30. BQ = Berlin Questionnaire. ESS = Epworth Sleepiness Scale. The data were represented as mean ± standard deviation and absolute number and (%).

There was a positive correlation comparing the severity of OSA to the positivity of BQ (p=0.02). The higher the AHI, the higher was the chance of positive BQ (p=0.035). (Table 3)

TABLE 3 – Severe obstructive sleep apnea according to Berlin Questionnaire.

Severity	Berlin +	Berlin -	TOTAL	Value P
Total	31	3	34	
Without AOS	0	0	0	
Mild OSA	4 (12.9)	1	5	
Moderate OSA	4 (12.9)	2	6	
Severe OSA	23 (74.2)	0	23	
Average AHI	47.06 ± 25.2	14.67± 7.24		0.035

OSA = Obstructive Sleep Apnea. Absence of OSA = apnea-hypopnea index per hour (AHI) < 5. Mild OSA = AHI ≥ 5 and < 15. Moderate OSA = AHI ≥ 15 and < 30. Severe OSA = AHI ≥ 30. The numbers were shown in absolute number and (%) and mean ± standard deviation. The value p of the correlation Berlin positive with severity of OSA was 0.02.

Similar results were found for ESS. The more severe OSA and the higher AHI value, the higher were the chances of positivity in ESS (p=0.025 and p=0.001, respectively). In spite of this numerical correlation, the patients with negative ESS had a high mean AHI (Table 4).

TABLE 4 – Severity of obstructive sleep apnea according to Epworth Sleepiness Scale.

Severity	Positive ESS	Negative ESS	TOTAL	Value P
TOTAL	17	16	33	
OSA absence	0	0	0	
Mild OSA	1 (5.9)	4 (25)	5	
Moderate OSA	1 (5.9)	5 (31.25)	6	
Severe OSA	15 (88.24)	7 (43.75)	22	
Average AHI	56.5 ± 25.7	29.12±16.8		0.001

OSA = Obstructive Sleep Apnea. Absence of OSA = apnea-hypopnea index per hour (AHI) < 5. Mild OSA = AHI ≥ 5 and < 15. Moderate OSA = AHI ≥ 15 and < 30. Severe OSA = AHI ≥ 30. ESS = Epworth Sleepiness Scale. Positive ESS = > 10. Negative ESS = ≤ 10. The numbers were shown in absolute number and (%) and mean ± standard deviation. The value p of the correlation positive ESS with the severity of OSA was 0.025.

Discussion

The present study evaluated the frequency of obstructive sleep apnea in a group of obese patients scheduled for bariatric surgery. All the patients presented OSA in the full-night sleep study, the majority presented the severe form. Our data were similar to the study of Lettieri *et al*.[14] who evaluated the polysomnographic results of 24 obese individuals before and one year after the bariatric surgery, finding OSA diagnosis for all and severe OSA for 71%. Other studies also showed high prevalence of OSA in pre-operative bariatric surgery, varying from 58.3% to 100%, but only 15% to 19% were diagnosed previously[15,16,18,20-22,24].

In the present study, genders are similar concerning to age and BMI. However, male presented a higher average AHI and an average higher supine AHI. Such data are similar to the data in literature, suggesting that male subjects would be prone to presenting OSA and its more severe form due to anatomical factors and/or more impaired ventilatory control during sleep[8,23,29]. However, the exact frequency of OSA in female is still uncertain, as they show different symptomatology and may be misdiagnosed[30]. Perhaps further studies will show a reduction of the gender difference as in the study of Franklin et al.[30] who found a frequency of 50% of OSA in adult female (20-70 years).

Due to the high prevalence of OSA and the difficulty in accessing objective sleep studies, several methods are used in order to perform a screening of patients who would be referred to a Sleep Study. BQ and ESS are the most commonly used questionnaires in a sleep laboratory, even though other questionnaires were developed for surgical patients, as STOP (snoring, tiredness during daytime, observed apnea and high blood pressure) or STOP-Bang (BMI, age, neck circumference and gender)[31]. We decided for BQ and ESS, as they are more complete questionnaires.

In our study, the BQ was positive in almost all patients, and correlated to OSA severity; a negative BQ was observed in mild and moderate OSA maybe such patients would not be recognized by BQ in larger material.

The high frequency of BQ positivity observed in our study, may be related to the fact, that all pre-operative bariatric surgery patients are obese, so they automatically will present one positive category of BQ what may interfere in the test specificity.

In other studies, the BQ sensitiveness reached up to 86% and its specificity was 77%, considering an AHI>5 as a cutoff point[12,27,32]. In patients scheduled for any surgery, BQ presented sensitiveness of 68.9% to 87.2% in moderate to severe OSA patients[32]. Another study showed that in patients of a sleep clinic the use of a modified BQ presents sensitiveness (68%) and lower specificities (48%).[33]

The ESS showed not such a good positivity, although it correlated to the severity of OSA and a high AHI. There was a tendency for positivity of ESS in male patients; probably in a larger sample we would find significance, what corroborates to literature data where OSA diagnosis in women has no correlation to daytime sleepiness[30].

In several studies, the ESS has been applied in pre-operative bariatric surgery patients [15,18,20-22]. Some authors claim that the use of ESS as a screening method is clinically acceptable, cost-effective, easy to use and shows a sensitivity of 75% to predict moderate and severe OSA[13,19]. Others authors did not find any relation between the severity of OSA and ESS. The subjective complaints of daytime sleepiness and snoring were not recognized as predictors of OSA in obese patients[15,16,18,21,24,34].

We expected a higher positivity of ESS in our study, as we considered that as soon as AHI increases, more symptomatic the patient becomes due to physiological consequences induced by hypoxemic events[22]. Our interpretation was that some patients may have denied their symptoms fearing that surgery will not be performed. Another reason would be the incapacity to recognize daytime sleepiness and other OSA symptoms. Obese patients present other problems related to weight such as nocturia, sexual dysfunction, gastro-esophageal reflux, depression, articulation pain, dyspnea limiting daily activities. Thus, patients may believe that functional disabilities are not due to sleep disorders[24]. Also, many are users of serotonin reuptake inhibitors for treatment of depression and eating disorders, which also affect the daytime sleepiness[15].

Due to the fact that there are few patients with non-severe OSA and no one without OSA in the present study, it is difficult to analyze the sensitivity and specificity in the questionnaires for diagnosis of OSA and the statistical analysis was limited.

Further studies on screening methods and diagnosis are necessary for a better evaluation in this population due to the high frequency of OSA and the difficulty in performing polysomnography in a large number of people.

Conclusion

Patients scheduled for bariatric surgery present a high frequency of obstructive sleep apnea, mostly classified as severe. The evaluated patients presented high chance of OSA by Berlin Questionnaire and excessive daytime sleepiness by Epworth Sleepiness Scale. Both presented a positive correlation with OSA diagnosis. However it was not possible to predict the specificity of OSA diagnosis of each questionnaire in this group of patients.

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