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Evidence Supporting Routine Polysomnography Before Bariatric Surgery

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Background: Obstructive sleep apnea (OSA) is common in morbidly obese patients, with a reported prevalence from 12 to 40%. Preoperative diagnosis of OSA is important for both perioperative airway management and the prevention of postoperative pulmonary complications. BMI has been reported to be an independent risk factor, and has been used recently in scoring systems to help predict OSA. Our hypothesis was that OSA is highly prevalent in patients presenting for bariatric surgery, and that BMI alone is not a good predictor of the presence or absence of sleep apnea.

Methods: A cross-sectional study was undertaken of the last 170 consecutive patients presenting for bariatric surgery in a single surgeon's practice. Clinical and demographic data were available from our prospective database, and polysomnography results were reviewed retrospectively. Sleep apnea was noted as present or absent, and graded from mild to severe. The patient population was stratified by BMI into severely obese (BMI 35-39.9), morbidly obese (BMI 40-49.9), super-obese (BMI 50-59.9), and super-super-obese (BMI ≥ 60).

Results: OSA had been diagnosed before surgical consultation in 26 of the 170 patients (15.3%). Sleep studies were not available in 7 patients (4.1%). The remaining 137 patients (80.6%) had sleep data available, and 105 (76.6%) had sleep apnea (based on American Board of Sleep Medicine criteria). There was no correlation of sleep apnea with BMI. The overall prevalence of OSA in this cohort was 77% (131/170).

Conclusions: In this large patient cohort, sleep apnea was prevalent (77%) independent of BMI, and most cases were not diagnosed before bariatric surgical consultation. These data support the use of routine screening polysomnography before bariatric surgery.

Key words: Morbid obesity, obstructive sleep apnea, polysomnography, bariatric surgery

Introduction

Obstructive sleep apnea (OSA) is becoming increasingly prevalent as morbid obesity continues to increase. At the same time, the surgical treatment of morbid obesity has increased, and it is estimated that approximately 100,000 surgical procedures for weight loss will be performed this year. Sleep apnea is believed to have a significant bearing on both the perioperative and postoperative care of the bariatric surgical patient, and therefore it is important that it is both diagnosed and treated preoperatively. Recent research has focused on using scoring systems to predict the presence of OSA in patients, based on a number of variables including age, sex, body mass index (BMI) and co-morbidities.[1,2]

Although these scoring systems are of merit, we did not notice such patterns in our practice with our liberal use of preoperative sleep studies. Thus our hypothesis was that OSA could not be predicted by BMI alone in our patient population. We retrospectively reviewed sleep study results in our bariatric patients, to determine if there was any correlation with the other clinical and demographic parameters collected in our prospective database, such as gender and BMI.

Materials and Methods

A retrospective analysis was performed of our prospectively maintained database, as well as the

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office-based records of the last 170 patients of a single surgeon (E.P). The data collected included the patient demographics, height, weight, initial BMI, sleep study data and type of operation. The time period for the study was from January 2001 to October 2002.

Sleep data was collated from the results of polysomnograms that were performed as part of our routine preoperative work-up of bariatric surgical patients. The polysomnograms were performed in a number of different sleep laboratories but were always reported by attending physicians in accordance with the American Academy of Sleep Medicine guidelines. The presence or absence of OSA was noted, and the severity was divided into mild, moderate or severe.

Mild OSA was defined as an apnea/hypopnea index of 5-15, moderate as 15-30 and severe as >30, as per previous studies and the American Sleep Disorders Association guidelines.[3,4] Statistical results were analyzed using SPSS statistical software. Chi-square and Fisher's exact tests were performed where appropriate and statistical significance was set at $P<0.05$, using two-tailed tests.

Results

The 170 patients consisted of 21 males and 149 females, with mean age 44 years (range 20-72). There were 104 patients who underwent Roux-en-Y gastric bypass, 60 patients had laparoscopic adjustable gastric banding, and 6 patients had a laparoscopic biliopancreatic diversion with or without duodenal switch.

There were seven patients for whom no sleep data was available. The demographic data for the remaining 163 patients is shown in Table 1. The male patients appeared to have a higher BMI distribution than the female patients, but there was no significant difference with Fisher's exact test ($P>0.05$).

A significant proportion of our patients had OSA based on either a diagnosis at the time of referral or on the polysomnogram that forms part of our routine evaluation. This percentage was as high as 86% in certain BMI groups, as shown in Table 2.

Of these 163 patients, there were 26 patients in whom a diagnosis of sleep apnea had been made before bariatric surgical consultation, and they were already being treated with CPAP or BIPAP. Therefore, full sleep study data was available in 137 patients.

Within this cohort of 137 patients, the prevalence of OSA in the severely obese group (BMI 35-39.9) was 83.3%, and 73.6% of patients in the morbidly obese (BMI 40-49.9) category. The prevalence of OSA in the super-obese group (BMI 50-59.9) was 77.1%, and this rose to 83.3% in the super-super-obese subgroup (BMI≥60). There was no statistical significance across these groups ($P>0.05$).

The prevalence of sleep apnea in this subgroup (137 patients) closely matched that of the larger group (170), which included those already diagnosed with OSA on referral. Interestingly, as well as the prevalence of OSA being similar across all BMI strata, there was also no difference between severity of OSA and BMI, as shown in Table 3.

Table 1. Demographic data

	Males	Females
Age (years)	24-72	20-64
BMI 35-39.9 kg/m²	2	11
BMI 40-49.9 kg/m²	6	73
BMI 50-59.9 kg/m²	10	38
BMI ≥60 kg/m²	3	20
Total	21	142

$P = 0.109$ for Male vs Female gender by BMI stratification

Table 2. Number of patients with OSA stratified by BMI (includes those patients who already had a diagnosis of OSA at time of referral)

	No OSA	OSA	Total No.	% with OSA
BMI 35-39.9	2	11	13	84.6
BMI 40-49.9	19	60	79	75.9
BMI 50-59.9	8	40	48	83.3
BMI ≥60	3	20	23	86.9
Total			163	80% (131/163)

$P>0.05$ between all groups (NS). OSA = obstructive sleep apnea. Note: 7 out of the 170 patients did not have sleep studies performed.

Table 3. Severity of OSA, stratified by patient BMI

Severity of OSA	Mild	Moderate	Severe
BMI 35-39.9	8	1	1
BMI 40-49.9	20	17	16
BMI 50-59.9	6	13	8
BMI ≥60	3	6	6
Total	37	37	31

P >0.05 between all groups (NS).

However, of the 21 male patients in this study, all were either previously diagnosed with OSA, or a diagnosis was made at the time of polysomnography. This was highly statistically significant at the P=0.008 level. In addition, although we only had full sleep-study data for 10 male patients, 7 of them had severe sleep apnea (Table 4). In contrast, sleep apnea in female patients was more evenly distributed between the mild, moderate, and severe categories. This increased severity of sleep apnea in males compared with females was statistically significant (P=0.006).

Discussion

Although bariatric surgery has been described as a form of treatment for OSA secondary to morbid obesity for over 20 years,[5-7] controversy remains over how important it is to diagnose and treat this condition preoperatively. There is no doubt that the development of morbid obesity can lead to sleep apnea[8] as well as other recognized obesity-related co-morbidities, although the exact mechanisms are not entirely understood. There appear to be patient-specific factors, which appear to act in the development of pulmonary symptoms, which are above and beyond the patient's BMI.[7]

Table 4. Severity of OSA versus gender

Severity of OSA	Mild	Moderate	Severe
Female	37	34	24
Male	0	3	7
Total	37	37	31

P = 0.006 between genders.

Our hypothesis was that BMI alone is not a sufficient predictor of the presence of sleep apnea and that polysomnography is an integral part of the preoperative work-up. Our results have shown that OSA is highly prevalent in this population across all BMI groups, and that male sex is a strong predictor of the presence of OSA, as has been previously reported.[7,9]

The incentive to diagnose sleep apnea preoperatively is to reduce the perioperative complication rate of bariatric surgery. In a recent review of over 3,000 cases from a single institution, sleep apnea was found to be a positive predictive factor for anastomotic leaks.[10] In fact, the presence of sleep apnea can cause an increase in the complication rates of any surgical procedure, as noted by Gupta and colleagues[11] in their orthopedic population undergoing hip or knee replacement surgery; they found not only that complication rates were higher in patients with untreated OSA, but also that the hospital stay was significantly longer.

The Epworth Sleepiness scale and simple pulse oximetry have been found to be poor predictors of OSA[12] and recently attention has focused on various scoring systems.[9,13] These may help to highlight those patients at high risk of having OSA, but we believe that this is not a substitute for full overnight polysomnography reported by a pulmonologist. Polysomnography allows sleep apnea to be accurately diagnosed and treatment recommendations to be given, often on the same visit. Although this study can cause delay in the patient's surgical procedure and may cause extra costs, we believe that this is a necessary step in the evaluation of co-morbidities before bariatric surgery.

Our results indicate that the preoperative diagnosis of OSA is most clearly defined by sleep studies, and that sleep apnea is very prevalent (75.9 to 86.9 %) across all BMI groups presenting for bariatric surgery. Unlike other studies, we did not find a correlation between BMI and severity of OSA in these obese patients. However, unlike other studies which used selective criteria before ordering polysomnography,[9] all our patients were referred for this investigation. Also, the criteria that we used for diagnosis of sleep apnea were very rigid, and patients were classified as having sleep apnea, whether or not it was considered necessary to institute treatment by the pulmonologist. Thus, the possibility exists that our results are exaggerated in terms of the clinical relevance of the diagnosed OSA. Also, the number of patients in each group is small and may have skewed the subset analysis.

A prospective study examining the previously described scoring systems would enable us to evaluate the utility of polysomnography in our particular patient population and help to validate the model. It would also be interesting to evaluate the benefits versus disadvantages of treating mild OSA in this population

In conclusion, until we have a reliable method to predict the presence of OSA, we recommend routine overnight polysomnography before bariatric surgery in all patients, regardless of BMI.

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