OBES SURG (2013) 23:287–291
DOI 10.1007/s11695-012-0806-x

CLINICAL RESEARCH

Sleep Apnea: Is Routine Preoperative Screening Necessary?

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Published online: 27 October 2012

Abstract
Background Because perioperative complications of unrecognized obstructive sleep apnea (OSA) can be severe, many bariatric surgery programs routinely screen all patients. However, many obese non-bariatric surgery patients do not get screened. We wanted to evaluate the need for routine preoperative OSA screening.
Methods Morbidly obese patients with a body mass index (BMI)>40 kg/m^2 undergoing bariatric surgery—all screened for OSA—were compared to morbidly obese orthopedic lower extremity total joint replacements (TJR) patients—not screened for OSA. Cardio-pulmonary complications were recorded.
Results Eight hundred eighty-two morbidly obese patients undergoing either bariatric (n=467) or orthopedic TJR surgery (n=415) were compared. As a result of screening, 119 bariatric surgery patients (25.5 %) were newly diagnosed with OSA, bringing the incidence to 42.8 % (200/467). Orthopedic surgery group had 72 of 415 (17.3 %) patients with pre-existing OSA. The unscreened orthopedic patients had a 6.7 % (23/343) cardiopulmonary complications rate compared to 2.6 % (7/267) for screened bariatric surgery patients. This difference was not statistically significant when adjusted for age and comorbidity (p=0.3383).
Conclusion Sleep apnea screening prior to bariatric surgery identifies an additional 25 % of patients as having OSA. In this study, unscreened morbidly obese patients did not have an increased incidence of cardiopulmonary complications after surgery compared to screened patients. Prospective randomized studies should be conducted to definitively assess utility and cost effectiveness of routine OSA screening of all morbidly obese patients undergoing surgery. Preoperative OSA screening may be safely omitted when randomizing patients for such a trial.

Keywords Sleep apnea · Bariatric · OSA · Complications

Introduction

There has been increased attention focused on obstructive sleep apnea (OSA) in the last decade with increased utilization of bariatric surgery [1–4]. Prevalence of sleep apnea increases with increasing body mass index (BMI) [5, 6]. There is also evidence that perioperative complications are increased in surgery patients with unrecognized or untreated sleep apnea [7–10]. As a result, most bariatric surgery programs engage in routine OSA screening of all prospective patients [11]. Patients that screen moderate to high risk for sleep apnea are referred to a pulmonologist and polysomnography (PSG) evaluation [12–14]. The American Society of Metabolic and Bariatric Surgery unpublished draft position statement on OSA supports consideration of testing all bariatric surgery patients, especially those with symptoms. As a result of increased screening and detection of previously unrecognized sleep apnea, there has been increased utilization of pulmonology and sleep lab resources leading to increased cost and delay of surgery for some bariatric patients. The clinical benefits of this practice are not clear. Ideally, the clinical value of routine OSA screening should be evaluated by a prospective randomized trial. However, there may be safety concerns for the control population in such a trial given the data on surgical risks associated with

Dmitry Nepomnayshy, presented at New England Surgical Society Oct 29th–31th 2010, Saratoga Springs, New York

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sleep apnea. We undertook a retrospective review of morbidly obese surgical patients comparing cardiopulmonary complications between those that were screened for OSA and those that were not.

Methods

The study protocol and data collection were approved by the hospital Institutional Review Board. All patients were cared for at the same hospital, an acute care tertiary referral teaching hospital. Two prospective databases were used for retrospective data analysis. Analysis included patients from our Bariatric Surgery Database from 2001 to 2009 as well as our Orthopedic Surgery Joint Replacement Database from 1996 to 2009. All patients in the prospective databases undergoing either bariatric or lower extremity TJR surgery with BMI≥ 40 kg/m^2 were included. Our analysis emphasized complications that would be associated with sleep apnea risk in addition to other routinely reported complications. These included aspiration, atelectasis, reintubation, need for bi-level positive airway pressure treatment (BiPAP) and pulmonary consultation. Arrhythmia, heart attack, heart failure, and escalation of care were classified as cardiac complications. Data was available for 882 patients total, 467 in the bariatric arm, and 415 in the orthopedic TJR group.

Perioperative care for bariatric surgery patients includes routine screening using the Sleep Apnea Questionnaire and the Epworth Sleepiness Scale. Patients were referred for further evaluation with PSG if they screened moderate or high risk for sleep apnea. The diagnosis of OSA is based on the apnea hypopnea index (AHI) of >5/h. The severity of OSA is defined as mild (AHI 5–14), moderate (AHI 15–29) and severe (>30). All morbidly obese patients with any degree of OSA are recommended for treatment with continuous positive airway pressure (CPAP). Postoperative bariatric surgery patients with known OSA were monitored with continuous pulse oximetry and CPAP at night. Routine telemetry and intensive care unit (ICU) monitoring were not performed. Orthopedic patients were not screened for OSA and received routine postoperative monitoring on a med–surg. floor.

Outcomes were described using simple proportions and means. Fisher's exact test and Student's t test were employed as appropriate. A univariate screen was used to examine each predictor variable's relationship to our outcomes of interest. The level of significance was $p<0.05$. To adjust for confounding, multivariate analysis was performed using logistic regression. Strength of association was expressed using odds ratios (OR) with 95 % confidence intervals (CI). Estimates were considered statistically significant if the 95 % CI did not encompass 1 or if $p<0.05$. Because of the small number of cardiopulmonary events, we only included two terms in our multivariable analysis (age and history of pulmonary disease).

Results

Eight hundred eighty-two morbidly obese patients (BMI> 40 kg/m^2) undergoing either bariatric surgery (n=467) or orthopedic TJR surgery (n=415) were compared. In the bariatric population, 81 out of 467 patients had pre-existing sleep apnea (17.3 %). As a result of screening, 119 patients (25.5 %) were newly diagnosed, bringing the total incidence of OSA in the bariatric surgery group to 42.8 % (200/467). Orthopedic TJR surgery arm had 72 out of 415 patients (17.3 %) with pre-existing sleep apnea. Mean BMI was 45.0 and 46.7 kg/m^2 for the bariatric and orthopedic group respectively. Mean age for the bariatric patients was 47 years, compared to 63 years for orthopedic arm (Table 1).

No deaths were reported during the study period. In the orthopedic TJR surgery arm 16.7 % (12/72) of patients with sleep apnea had cardiopulmonary complications compared to 6.7 % (23/343) in patients without sleep apnea (Table 2).

Table 1 Demographics

	Bariatric (N=467)	Orthopedic total joint replacement TJR (N=415)	p value
Age	47	63	<0.0001
Gender, % male	21.4 % (100/467)	27.2 % (113/415)	0.0440
Body mass index *mean*	45.0±4.9	46.7±9.7	0.0002
Sleep apnea—before screening	17.3 % (81/467)	17.3 % (72/415)	1.000
Sleep apnea—after screening bariatric patients only	42.8 % (200/467)	17.3 %	<0.0001
High cholesterol	50.3 % (235/467)	38.5 % (159/413)	0.0004
Diabetes	25.3 % (118/467)	32.0 % (132/413)	0.0280
Hypertension	52.2 % (244/467)	70.5 % (291/413)	<0.0001
Cardiac disease hx	8.1 % (38/467)	19.1 % (79/413)	<0.0001
Pulmonary disease hx	55.2 % (258/467)	28.1 % (116/413)	<0.0001

Table 2 Orthopedic population: comparison of perioperative complications between patients with and without sleep apnea (N=415)

Complication	Sleep apnea (N=72)	No sleep apnea (N=343)	p value[a]
Aspiration	1.4 % (1/72)	0.6 % (2/343)	0.47
Atelectasis	1.4 % (1/72)	1.5 % (5/343)	0.97
Congestive heart failure	0 %	0 %	
Reintubation	0.0 % (0/72)	0.6 % (2/343)	0.52
Bi-level positive airway pressure (BiPAP) postop	8.3 % (6/72)	0.9 % (3/343)	<0.0001
Hypoxemia	2.8 % (2/72)	0.6 % (2/343)	0.0831
Pulmology consult	8.3 % (6/72)	2.0 % (7/343)	0.0053
Cardiology consult	6.9 % (5/72)	2.6 % (9/343)	0.0649
Cardiac complication	5.6 % (4/72)	5.0 % (17/343)	0.84
Any cardiopulmonary complication	16.7 % (12/72)	6.7 % (23/343)	0.0057

In the bariatric surgery arm, 4.5 % (9/200) of patients with sleep apnea had cardiopulmonary complications compared to 2.6 % (7/267) without sleep apnea (Table 3).

GROUP COMPARISON The four groups (bariatric + OSA, bariatric—OSA, orthopedic + OSA, orthopedic—OSA) were compared adjusting for age and pulmonary comorbidities to see if the differences in complications were statistically significant (Table 4). Only the presence of pre-existing OSA in orthopedic patients resulted in statistically significant difference in complications (p=0.0322). The presence of sleep apnea by itself was not a risk factor for increased complications (p=0.2793), unscreened orthopedic patients did not experience a higher rate of complications when compared to bariatric patients who were screened (p=0.3383).

Using the bariatric surgery patients without sleep apnea (lowest detected complication rate) as reference, we show that there was no statistically significant increase in risk of cardiopulmonary complications in unscreened orthopedic TJR patients undergoing surgery (OR 1.6, CI 0.6–4.3, p=0.0003) (Table 5).

Discussion

This study revealed that there may be no clinical relevance of routine preoperative screening for undiagnosed OSA in all morbidly obese patients. To do this, we retrospectively reviewed two sets of morbidly obese patients undergoing surgery—one that was screened for undiagnosed OSA (bariatric) and the other that was not (orthopedic TJR) and compared their rates of cardiopulmonary complications. We showed that there was no difference in cardiopulmonary complications between the unscreened orthopedic surgery group and the screened bariatric surgery group when the groups were risk-adjusted.

This study has several implications for surgical treatment of morbidly obese patients. Routine OSA screening of all bariatric surgery patients increases the cost of perioperative

Table 3 Bariatric population: comparison of perioperative complications between patients with and without sleep apnea (N=467)

Complication	Sleep apnea (N=200)	No sleep apnea (N=267)	p value[a]
Aspiration	0.5 % (1/200)	0.0 % (0/267)	0.2474
Atelectasis	1.5 % (3/200)	0.7 % (2/267)	0.4353
Congestive heart failure			
Reintubation	0.5 % (1/200)	0.0 % (0/267)	0.2474
Bi-level positive airway pressure (BiPAP) postop	0 %	0 %	
Hypoxemia	1.0 % (2/200)	0.4 % (1/267)	0.4025
Pulmonology consult	1.5 % (3/200)	0.7 % (2/267)	0.4353
Cardiology consult	2.0 % (4/200)	1.1 % (3/267)	0.4405
Cardiac complication	1.5 % (3/200)	1.9 % (5/267)	0.7588
Return to operating room	1.0 % (2/200)	0.4 % (1/267)	0.4025
Readmissions—90 day	8.0 % (16/200)	9.0 % (24/267)	0.7056
Any cardiopulmonary complication	4.5 % (9/200)	2.6 % (7/267)	0.2695

Table 4 Group comparisons for prevalence of cardiopulmonary complications

Group	Comparison	Risk-adjusted *p* values[a]
Ortho +OSA vs −OSA[a]	Effect of having OSA in Orthopedic patients	0.0322
Bari +OSAvs −OSA	Effect of having OSA in bariatric surgery patients	0.8242
+OSA vs −OSA	Compare effect of having sleep apnea vs. no sleep apnea for both groups	0.2793
Ortho –OSA vs Bari −OSA	Compares the UNSCREENED Orthopedic Surgery group without OSA to the SCREENED Bariatric Surgery group without OSA	0.3383
Ortho −OSA vs. Bari +OSA	Compare UNSCREENED Orthopedic patients without OSA to Bariatric Patients with OSA	0.2206

Adjusted *p* values are based on the Likelihood Ratio chi-square, and are adjusted for age and history of pulmonary disease

[a] *OSA* obstructive sleep apnea, *+OSA* with obstructive sleep apnea, *−OSA* without obstructive sleep apnea

care, complexity of care, and time to surgery. Many other morbidly obese patient populations (orthopedic or gynecologic) do not undergo routine OSA screening. The clinical value of routine screening is undermined by a paucity of data on the outcomes of screening and the optimum perioperative management for patients newly identified as having OSA. Duration of perioperative treatment with CPAP therapy is not standardized [15]. Compliance with treatment is also an issue, with a reported incidence as low as 29 % at 6 months [16, 17]. There is no consensus on the optimum postoperative care of patients with OSA. Some studies advocate for routine ICU monitoring of all patients with OSA while others describe excellent results with routine unmonitored care [18, 19]. Resolution of OSA is also unclear, with studies documenting that even though the degree of subjective symptoms usually improves significantly as a result of bariatric surgery, as many as 60 % of patients still have OSA when re-evaluated with a sleep study [20, 21]. This finding may be interpreted as supporting the idea that some patients may have a clinically insignificant form of OSA. In our practice, we see that many patients simply stop using their CPAP when they lose weight because of the subjective improvement in their symptoms. Because of the many unanswered questions surrounding the perioperative care of these patients, a prospective randomized trial should be conducted to identify the true clinical benefit of routine OSA screening of all morbidly obese surgical patients, not just those undergoing bariatric surgery.

Table 5 Univariate and multivariate analysis of complications

Group	Unadjusted odds ratio and 95 % confidence interval (CI)	Adjusted odds ratio and 95 % CI
Bariatric no OSA[a] (screened)	1.0 (reference)	1.0 (reference)
Orthopedic no OSA (unscreened)	2.7 (CI 1.1–6.4)	1.6 (CI 0.6–4.3)

Multivariable Model Fit Statistics: $p=0.0003$ [Akaike Information Criterion (AIC)=379.2, Receiver Operator Characteristic (ROC)=0.66] for unadjusted comparison and $p=0.0160$ [AIC=372.7 ROC=0.73] for risk-adjusted comparison using age and history of pulmonary disease

[a] *OSA* obstructive sleep apnea

Orthopedic TJR patients in our study had a high rate of cardiopulmonary complications (16.7 %) associated with having pre-existing OSA. This difference was the only statistically significant finding when comparing all groups. There are several possible explanations for this. OSA severity varies. Patients already diagnosed with OSA may have the more severe/symptomatic form. Orthopedic surgery patients with pre-existing OSA (similar to all non-bariatric surgery patients in our institution) are not routinely placed in a monitored setting like the bariatric surgery patients. These factors, combined with their greater age and comorbidity likely explains the higher complication rate.

There are several important strengths of this study. Perhaps the most important is that it reveals the rate of newly diagnosed OSA as a result of routine screening of morbidly obese patients with a questionnaire (25.5 %). Additional validity is demonstrated by examining the rate of OSA before screening. It was exactly the same (17.3 %) among the bariatric surgery population and orthopedic surgery group. This provides strong indirect support that the orthopedic surgery cohort had a similar undiagnosed rate of OSA of about 25 % if they were screened and tested. The baseline prevalence of OSA has been shown to be 17–24 % in other studies, which is similar to our findings [2]. Another strength is the high number of patients in the study. And finally, the reported complications were specific to OSA rather than the standard outcome complications typically reported in bariatric surgery data such as leaks or deep vein thrombosis (DVT).

The study has several important weaknesses. It is a retrospective study of two patient populations that varied significantly in age and comorbidities. We attempted to correct for this through a risk-adjusted model, but because of the low number of cardiopulmonary complications, we were only able to statistically correct for the two biggest variables, age and pulmonary disease. Postoperative care for the groups was not standardized leading to an additional confounding factor. The types of surgery that the patients underwent were different. Even though the risk of OSA is related to anesthesia and sedation, TJR probably confers a higher risk of DVT and resultant cardiopulmonary complications.

Conclusion

In conclusion, routine OSA screening may not have significant clinical benefit for the morbidly obese patient undergoing surgery. As a result of routine screening, we identify an additional 25 % of bariatric surgery patients as having OSA. This is the first study that suggests avoiding routine screening for OSA. Given the limitations of this study, it does not provide convincing evidence to change the current practice of routine OSA screening for bariatric surgery patients. However, this study clearly provides rationale that it is safe to perform a prospective randomized trial to evaluate the clinical implications of routine OSA screening in bariatric surgery patients. Additionally, trials should assess OSA screening of all morbidly obese surgery patients, not just bariatric surgery patients. Finally, orthopedic TJR patients with known OSA, should be observed more carefully postoperatively and receive CPAP and continuous pulse oximetry monitoring.

Acknowledgments The authors would like to acknowledge Pamela O'Brien RN, MSN, NP and Robin Ruthazer MPH, and John Garfi BS, without their help this manuscript would not be possible

Conflict of interest None.

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