Obstructive sleep apnea in general surgery patients: is it more common than we think?

Gaurav V. Kulkarni, M.D., Anne Horst, B.S., Joshua M. Eberhardt, M.D., Sunita Kumar, M.D., Sharfi Sarker, M.D., M.P.H.

Department of Surgery, Medicine, Loyola University Medical Center, 2160 S First Ave, Maywood, IL 60153, USA

KEYWORDS:
Obstructive sleep apnea; STOP-Bang; Preoperative evaluation

Abstract

BACKGROUND: To determine the risk of obstructive sleep apnea (OSA) in preoperative surgical patients.

METHODS: Three hundred seventy-one new patients presenting to an outpatient general surgery clinic were prospectively screened for risk of OSA using the STOP-Bang questionnaire. Patients were classified as high risk with a score of ≥3 on the STOP-Bang questionnaire. Polysomnography results were reviewed when available.

RESULTS: Complete questionnaires were available on 367 (98.9%) patients. Two hundred thirty-seven patients (64.6%) were classified as high risk of OSA on the questionnaire. Polysomnography results available on 49 patients revealed severe OSA in 17 (34.5%), moderate in 8 (16.5%), mild in 14 (28.5%), and no OSA in 10 (20.5%) patients. The positive predictive value and sensitivity of the questionnaire were 76%, and 92% for the STOP-Bang questionnaire, respectively. The sensitivity increased to 100% for severe OSA.

CONCLUSION: Preoperative screening for OSA should be considered to diagnose patients at risk.

The authors declare no conflicts of interest.

* Corresponding author. Tel.: +1-708-327-2899; fax: +1-708-327-3565.
E-mail address: ssarker@lumc.edu

Manuscript received July 16, 2013; revised manuscript September 19, 2013

Obstructive sleep apnea (OSA) is a common medical condition affecting a variable percentage of the general population (2% to 26%). It is characterized by intermittent upper airway obstruction during sleep. Although most patients have the characteristic symptoms of snoring and sleepiness, many may be asymptomatic. OSA can be associated with many comorbidities such as heart failure, acute myocardial infarction, arrhythmias, hypertension, cerebrovascular disease, metabolic syndrome, and gastroesophageal reflux disease. This condition has been shown to be an independent predictor of morbidity, mortality, and is associated with increased risk of perioperative complications. Yet despite this, the majority of patients with OSA remain undiagnosed. Reasons for this range from lack of awareness among primary care providers, limited access to diagnostic services, and reluctance among patients to undergo treatment once diagnosed. Screening questionnaires offer an alternate method of identifying a patient’s risk of OSA. One such widely validated questionnaire is the STOP-Bang questionnaire developed by Chung et al. It has a negative predictive value for ruling out severe OSA of 93% to 100%. The objective of this study is to determine the risk of OSA in preoperative surgical patients in a tertiary care hospital. We hypothesize that preoperative evaluation with the questionnaire will help identify undiagnosed OSA.
and possibly lead to appropriate management of the condition.

Methods

This study was conducted in the outpatient surgery clinic at Loyola University Medical Center, Maywood, Illinois. The study was approved by the Institutional Review Board. Patients aged 18 years or older who were undergoing general surgical evaluation were included in the study. Patients with neck masses which might affect OSA symptoms and circumference measurements and patients with missing data were excluded.

All consecutive new patients seen in clinic between June 2011 and December 2011 completed the STOP part of the questionnaire. Information regarding body mass index (BMI), age, neck circumference, and gender (Bang) was collected by the clinic nurses. Data were analyzed after the 6-month period was completed. Electronic medical records were reviewed retrospectively for patient demographics, anthropomorphic assessments, comorbidities, and polysomnogram (PSG) results (when available). Primary care physicians of patients with high risk of OSA with a score of ≥3 on the STOP-Bang or ≥2 on the STOP questionnaire were notified for further evaluation with PSG.

Apnea hypopnea index (AHI) of >5 events/hour is suggestive of symptomatic OSA.11 PSG studies were performed in accredited sleep laboratories and studies were scored according to the American Academy of Sleep Medicine guidelines from 2007. Studies were interpreted by board-certified sleep specialists. OSA was diagnosed as mild (AHI 5 to 15 events/hour), moderate (AHI 15 to 30 events/hour), and severe (AHI > 30 events/hour).

For statistical analysis, the patients were divided into the following groups based on the screening test: high (SB+) and low (SB−) risk and PSG findings confirming (PSG+) or ruling out OSA (PSG−). The groups were compared using Pearson’s chi-square test and Fisher’s exact test for discrete variables and independent samples t test and analysis of variance for continuous variables. A P value of <.05 was considered statistically significant.

STOP-Bang questionnaire

The questionnaire consists of 8 yes/no questions (answer score: 1/0) which compose the acronym STOP-Bang: Snoring, Tiredness, Observed apneas, treatment for blood Pressure, BMI >35 kg/m², Age > 50 years, Neck circumference > 40 cm, and male Gender with a range of scores from 0 to 8 (Fig. 1). We calculated the STOP and STOP-Bang scores and analyzed the results. A score of ≥3 has been shown to have a high sensitivity for detecting moderate (AHI > 15 events/hour) and severe OSA (AHI > 30 events/hour). Individuals with scores <3 are considered to be at low risk of having OSA.10,11

Results

Three hundred seventy-one patients presenting to the general surgical clinics at our hospital were administered the STOP-Bang questionnaire. Completed questionnaires were available on 367 (98.9%) patients. Two hundred thirty-seven (64.6%) patients were classified as high risk of OSA in the STOP-Bang questionnaire, while 187 (50.9%) patients were classified as high risk in the STOP questionnaire only. One hundred eighty (49%) patients were identified as high risk in both questionnaires. Demographics and anthropomorphic data are presented in Table 1. SB+ patients were older, heavier, and had significantly more comorbidities when compared to SB− patients.

Forty-six (19.4%) SB+ patients had PSG study data with AHI values available for analysis. PSG revealed severe OSA in 17 (37%), moderate in 5 (10.9%), mild in 14 (30.4%), and no OSA in 10 (21.7%) patients. Male gender was the only predictor of the severity of OSA on PSG (P = .006). There was no association between age, weight, BMI, comorbidities, or any of the components of the STOP-Bang questions and the severity of OSA (P >

STOP-Bang questionnaire

1. Snoring: Do you snore loudly (loud enough to be heard through closed doors)? Yes/ No
2. Tired: Do you often feel tired, fatigued, or sleepy during daytime? Yes/ No
3. Observed apneas: Has anyone observed you stop breathing during your sleep? Yes/ No
4. Blood pressure: Do you have or are you being treated for high blood pressure? Yes/ No
5. Body mass index (BMI): BMI more than 35 kg/m²? Yes / No
6. Age: Age over 50 year old? Yes / No
7. Neck circumference: Neck circumference >40 cm? Yes/ No
8. Gender Male? Yes/ No

High risk of obstructive sleep apnea: Yes to ≥3 questions
Low risk of obstructive sleep apnea: Yes to < 3 questions

Figure 1 STOP-Bang questionnaire.10
Three SB− patients underwent PSG, all of which revealed moderate OSA. Two of these patients had positional OSA with nonsupine AHI <5 events/hour and the 3rd underwent a sleep study for narcolepsy-related reasons. All 3 patients had undergone PSG before questionnaire. The positive predictive value and sensitivity of the STOP-Bang questionnaire in detecting OSA of any severity were 76% and 92.1%, respectively. There were no true negative findings and as such, the negative predictive value and specificity could not be calculated. The sensitivity for identifying OSA increased to 96% for AHI >15 events/hour (moderate or severe OSA) and 100% for AHI >30 events/hour (severe OSA). The STOP questionnaire had a sensitivity of 90.2% and a positive predictive value of 85.2% for any OSA, respectively.

### Comments

In this study, we show using the STOP-Bang screening questionnaire that there is an increased risk of OSA among preoperative patients. Our prevalence rate of 64.3% is consistent with previous studies, such as that by Chung et al10 in which the prevalence was 68.4%. It is higher than the 41% prevalence reported by Vasu et al12 in their cohort of elective surgical patients. This difference could be related to the higher prevalence of obesity in our Midwestern population and as one of the surgery clinics evaluated patients for bariatric surgery. In the bariatric patient population, the prevalence of OSA has been reported to be 70%.13 The STOP-Bang questionnaire is an easy to administer screening questionnaire which takes into account the known risk factors of OSA such as obesity, older age, large neck circumference, and male gender in addition to symptoms such as snoring and daytime sleepiness. We used the SB 35 version of the questionnaire where a BMI >35 kg/m² scored a yes response. Other studies have shown a higher sensitivity but a lower specificity with the use of BMI >30 kg/m².

We show that the STOP-Bang questionnaire had a sensitivity of 100% in identifying patients with severe OSA and 96.2% sensitivity for moderate and severe OSA. These findings are also similar to Chung’s study. This is significant as we expect the risk of perioperative complications to be higher in patients with moderate and severe OSA compared to mild OSA as shown in several studies.4

Our study indicates that a majority of patients at risk for OSA have not been evaluated with PSG. In our sample, only 46 of the 238 (19.3%) patients identified as high risk by the STOP-Bang questionnaire had a PSG. This is consistent with the observations of Young et al1 that 80% of men and 90% of women with OSA remain undiagnosed. Another pertinent finding in our study is the higher prevalence of comorbidities in the high risk group compared to those in the low risk of OSA. This too is consistent with studies which show a higher morbidity in patients with OSA with higher prevalence rates of hypertension, heart disease, diabetes, and arrhythmias.2,3 This finding likely plays a role in the high risk of perioperative complications in these patients.

A STOP-Bang score of <3 allows the medical team to maintain a low suspicion for OSA-related complications. Scores of 5 to 8 are highly predictive of moderate-to-severe OSA and should prompt initiation of measures to reduce the risk of OSA-related complications in the immediate postoperative period. Scores of 3 to 4 need to be viewed with caution and interpretation needs to be clinically correlated with patient factors, comorbidities, and STOP positivity values.14

The American Society of Anesthesiologists guidelines from 2006 stress the importance of preoperative diagnosis and appropriate perioperative management of patients with

<table>
<thead>
<tr>
<th>Variable</th>
<th>All patients (n = 367)</th>
<th>High risk on STOP-Bang (n = 237)</th>
<th>Low risk on STOP-Bang (n = 130)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (y)</td>
<td>52</td>
<td>55</td>
<td>45</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Mean weight (kg)</td>
<td>93</td>
<td>103</td>
<td>76</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Mean BMI (kg/m²)</td>
<td>32</td>
<td>35</td>
<td>27</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Men</td>
<td>183 (50%)</td>
<td>143 (60%)</td>
<td>40 (31%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Diabetes</td>
<td>57 (16%)</td>
<td>53 (22%)</td>
<td>4 (3%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Hypertension</td>
<td>164 (45%)</td>
<td>144 (61%)</td>
<td>20 (15%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td>132 (36%)</td>
<td>106 (45%)</td>
<td>26 (20%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>CAD</td>
<td>26 (7%)</td>
<td>22 (9%)</td>
<td>4 (3%)</td>
<td>.026</td>
</tr>
<tr>
<td>CHF</td>
<td>10 (3%)</td>
<td>10 (4%)</td>
<td>0</td>
<td>.017</td>
</tr>
<tr>
<td>Arrhythmia</td>
<td>23 (6%)</td>
<td>20 (8%)</td>
<td>3 (2%)</td>
<td>.02</td>
</tr>
<tr>
<td>COPD</td>
<td>11 (3%)</td>
<td>11 (5%)</td>
<td>0</td>
<td>.012</td>
</tr>
<tr>
<td>Asthma</td>
<td>27 (7%)</td>
<td>20 (8%)</td>
<td>7 (5%)</td>
<td>.278</td>
</tr>
<tr>
<td>Other respiratory disorders</td>
<td>34 (9%)</td>
<td>24 (10%)</td>
<td>10 (8%)</td>
<td>.426</td>
</tr>
</tbody>
</table>

Data are expressed as number (percentage). BMI = body mass index; CAD = coronary artery disease; CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease.
OSA to avoid postoperative complications. Identifying the undiagnosed population at risk is the first step to avoiding adverse events.15

The strength of our study is that the sample is representative of a diverse patient population seen at surgical clinics in a tertiary care center. Some of these patients already carried a diagnosis of OSA and some even had undergone PSG evaluations. We were able to validate the strength of the questionnaire by comparing its performance in the 46 patients who had been previously evaluated with a sleep study. The limitations to the study were primarily related to the relatively modest sample size and the availability of sleep studies on a small subset of the entire sample being studied (<12%) including the small number of SB—patients with PSG data, limiting our ability to quantify the negative predictive value of the questionnaire.

This questionnaire can improve the collaboration among surgeons, anesthesiologists, and sleep physicians for better patient outcomes.12,13 If patients get diagnosed earlier, they could receive expedited treatment for OSA in addition to a more streamlined perioperative care with potential of long-term health benefits.15 Several studies have shown improved disease outcomes with the treatment of OSA.5,6 Decreased perioperative morbidity in patients treated with OSA is also described.7 In our experience, patients are more likely to get testing for OSA done when this is a prerequisite for surgery than when recommended by their primary care physicians alone.

Conclusions

A significant number of patients presenting to a general surgery clinic are at high risk of OSA. However, very few have undergone appropriate evaluation. Further investigation as to the implications of preoperative diagnosis and treatment of OSA on postoperative care and complications is needed.

References


Discussion

James G. Tyburski (Detroit, MI): What percentage of the patients were undergoing bariatric evaluation? Do they have a higher incidence going on with that? Two, if you just took BMI 35, I realize your BMI averaged 32, but did it significantly change the patient population just not identifying those people with BMI that was greater than 35? The intermediate score on this set of 3 to 4, what do you do with that? Finally, if you identify somebody at high risk and then had sleep apnea, what interventions are you, the anesthesiologists, what are you doing about them when you get them?

Kulkarni: We had 1 bariatric surgeon who was involved whose patients were involved in the study. The total number of patients that were being evaluated by that surgeon were about 9 or 10%, but I don’t think all of them were bariatric evaluations. So I’d say about 6 or 7% would probably be like a fair number. Rest of them would be minimally invasive, which was also done by the same surgeon. For the BMI greater than 35, so there have been studies about the same questionnaire using BMI of 30 and 40, compared to others. Tools like the Stanford Sleepiness Scale, where people tried to establish a middle way and see which of these were best suited for using the general patient population, and they found that unless you are evaluating a patient population that is already at a sleep clinic, the BMI of 35 is the mean that should be used for this. If there’s a patient that fit that patient profile and had the score of 3, which is considered to be in the middle, then those would be the patients
to definitely screen more. Anything more than 3 should be considered for further screening anyways. Your last question was, what interventions are we considering pre- and periop for patients who are already OSA positive. I would say just knowing the fact that the patient is OSA positive is the most important thing. There is awareness in the perioperative team of anesthesiologists, surgeons, residents.

Nicholas J. Zyromski (Indianapolis, IN): I am going to follow up on the last point. If somebody has a newly diagnosed sleep apnea, do you put them on C-PAP in the postoperative period or BiPAP? And how does your group feel about using positive pressure in the setting of proximal GI anastomosis, say esophagectomy, gastrectomy and pancreaticoduodenectomy?

Kulkarni: We did not have many of those patients in this study. There was no proximal anastomoses patients. These were just pure non-oncologic, for the most part, general surgical patients. Especially patients who are having proximal anastomoses, I think the upper GI surgeons at our institute are not very in favor of doing C-PAP on postop day 1 on the night of postop day 1. In patients who cannot tolerate being without their C-PAP, we always recommend them to get it from home.

Raymond P. Onders (Cleveland, OH): This is a very interesting questionnaire. It’s very sensitive. So you have 64% of every patient should undergo a sleep study that shows up at the general surgery clinic, which is incredibly expensive. And what that means for the average general surgical case, a gallbladder or hernia, is probably meaningless, since most of the time we don’t do that. So you have now done a study where you have now opened yourself up for. Because I barely send anybody for pre-admission testing in my practice, and they all would meet your criteria based on BMI and age. So we have a problem that you are identifying something that probably has no relevance in most general surgical practices. This is a very sensitive, but I don’t know if it has any meaning in our quality of general surgical case.

Kulkarni: I’d say that if we did administer a STOP-Bang questionnaire to all the patients who are undergoing general surgical evaluation, like you said correctly, 60 to 70% of them would probably show up positive on it. This is for managing perioperative complications if they arise. Also knowing in advance the patient is high risk may entail us to look more closely at the score on the questionnaire. If the score is really high, then even the American Society of Anesthesiology task force for perioperative management recommends that these patients should undergo, at least consult with a sleep physician, if not a direct sleep study.