

Utilization of the STOP-Bang Questionnaire as a Standardized Screening Tool for Obstructive Sleep Apnea in Veteran Administration Surgical Patients

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Purpose: Obstructive sleep apnea (OSA) affects an estimated 20% of the adult surgical population. Veteran patients have many characteristics consistent with OSA, but lack of standardized screening results in decreased detection of patients at risk for OSA.

Design: Pre-post implementation design.

Methods: Preanesthesia clinic providers were educated about OSA and the STOP-Bang questionnaire. Chart reviews evaluating screening and patient demographics were conducted before and after intervention.

Findings: Thirty-one percent of patients had an established diagnosis of OSA. Compliance rates with preoperative STOP-Bang screening were 91.3%. Of patients screened preoperatively, 44% were at risk for OSA with a STOP-Bang score of 4 or greater.

Conclusions: The prevalence of patients among the Veteran population with and at risk for OSA is higher than the general population. Utilization of the STOP-Bang questionnaire as a standardized preoperative screening tool in preanesthesia clinics can increase the identification of patients at risk for OSA.

Keywords: obstructive sleep apnea, STOP-Bang questionnaire, preoperative screening, veterans.

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OBSTRUCTIVE SLEEP APNEA (OSA) is defined as episodes of complete or partial upper airway obstruction secondary to collapsed pharyngeal tissue during sleep and is associated with

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increased postoperative complications and mortality.¹ In the general population, approximately 20% of adults experience OSA during sleep; however, an estimated 80% of surgical patients with OSA are undiagnosed.^{2,3} The gold standard for OSA diagnosis is polysomnography testing, but the use of this diagnostic tool is limited by costs, inconvenience, and prolonged patient waiting periods before testing can be completed. Surgical patients may present to the preanesthesia clinic without a preoperative diagnosis of OSA. Standardized screening tools such as the STOP-Bang questionnaire have been developed to quickly and conveniently identify patients who may be at risk for OSA. The use of standardized preoperative screening is especially important in the Veteran Administration (VA) setting as the Veteran

surgical population has characteristics and comorbidities consistent with OSA.⁴ The purpose of this study was to implement the STOP-Bang questionnaire as a standardized OSA screening tool in the preanesthesia clinic of a VA Medical Center.

Literature Review

OSA is characterized by the cessation of airflow during sleep as a result of complete or partial upper airway obstruction. These episodes of obstruction and apnea result in hypoxia, hypercarbia, and sympathetic stimulation, which lead to arousal from sleep and resuming of respirations.⁵ The gold standard for diagnosis of OSA is polysomnography testing by an overnight sleep study conducted in a laboratory. The minimal criterion for an OSA diagnosis through polysomnography is an apnea hypopnea index (AHI) of 5 or greater, meaning episodes of hypopnea or apnea occur on average of at least 5 times per hour of sleep.² The American Academy of Sleep Medicine classifies OSA severity by AHI categories; mild OSA is reflected by an AHI of 5 to 15, moderate OSA 16 to 30, and severe OSA as greater than 30 apnea or hypopnea periods per hour of sleep.² Patient characteristics associated with AHI scores of 10 or greater include male gender, heavy smoking, obesity (body mass index [BMI] 35 m/kg² or greater), hypertension, congestive heart failure, diabetes, hypothyroidism, alcoholism, head and neck cancer, and age greater than 60.⁴

OSA is associated with several perioperative complications that have considerable implications for anesthesia management. General anesthesia exacerbates the effects of OSA by decreasing pharyngeal neuromuscular tone and promoting pharyngeal collapsibility and central respiratory depression.⁴ All surgical patients diagnosed with OSA are at increased risk for respiratory complications, cardiovascular complications, difficult airway management, prolonged hospital length of stay, and unexpected need for intensive care treatment.^{6,7} Risks for complications are found to increase as the severity of OSA increases.⁸

The American Society of Anesthesiologists (ASA) practice guidelines for perioperative management for patients with OSA supports the use of a standardized preoperative screening protocol to

assess OSA risk.⁹ The STOP-Bang questionnaire was developed to be a succinct and convenient screening tool for use in the preoperative setting.¹⁰ The STOP portion of the questionnaire is composed of four patient assessment questions—do you snore loudly, are you tired during the day, have been observed to stop breathing in your sleep, and do you have high blood pressure. The Bang portion consists of four physical characteristics—BMI greater than 35 kg/m,² age greater than 50 years, neck circumference greater than 40 cm, and male gender.¹⁰ Scores are calculated by the number of positive responses; a score of 3 or greater is associated with 93% sensitivity and 43% specificity for detecting moderate to severe OSA.¹⁰ Chung et al¹¹ found that with increasing STOP-Bang scores, there was a corresponding increase in the predicted probability, odds ratio, and specificity for the presence of OSA, moderate to severe OSA, and severe OSA, and concluded that stratification according to STOP-Bang scores could be useful to reduce the incidence of false positives and triaging patients most in need of formal evaluation and treatment.

The STOP-Bang questionnaire not only demonstrates clinical use in predicting patients at risk for having OSA, it also identifies patients at risk for perioperative complications. Surgical patients with STOP-Bang scores of 3 or greater had significantly higher rates of difficult airway management, postoperative respiratory complications, and longer postanesthesia care unit lengths of stays.^{12,13} The STOP-Bang questionnaire has also been used preoperatively to stratify patients at risk for perioperative complications; higher STOP-Bang scores are associated with a corresponding increase in the risk for intraoperative and early postoperative hypoxia, hemodynamic instability, and dysrhythmias.¹⁴

The primary aims of this quality improvement project were to initiate the STOP-Bang questionnaire as a standardized screening tool in the preanesthesia clinic of a VA Medical Center and to evaluate compliance of its use. Surgical patients among the Veteran population have many characteristics and comorbidities associated with OSA.⁴ By identifying patients at risk for OSA, anesthesia providers can best develop safe anesthetic plans to ensure optimal patient outcomes.

Methods

Study Design and Ethical Considerations

A pre-post implementation designed quality improvement project was conducted between July and September 2016. This study met the requirements for patient privacy and was exempt from review by the Institutional Review Board of the University and the VA Medical Center.

Organizational Setting and Sample

This project took place at a VA Medical Center in the Southeast. The institution includes 82 acute care beds and performed 3,954 surgeries in 2016. The patient sample consisted of all patients aged 18 years or older scheduled for elective surgery. Exclusion criteria included hospital inpatients who visit the preanesthesia clinic and patients scheduled for cataract surgery. Before implementation of this project, a standard preoperative screening for OSA did not exist.

Implementation

All patients scheduled for elective surgery visit the preanesthesia clinic approximately 2 weeks before their scheduled procedure with the exception of patients undergoing cataract surgery and patients currently hospitalized. Patients are evaluated by nurse practitioners assigned to the preanesthesia clinic. The preanesthesia visit consists of obtaining baseline vital signs, a review of the patient's medical and surgical history, pertinent laboratory tests, a physical assessment, and an airway examination. The results of this visit are recorded on a preanesthesia evaluation form in the patient's electronic medical record and available to the anesthesia provider and surgeon to review the day before surgery.

An educational session reviewing the pathophysiology and perioperative complications related to OSA, the STOP-Bang questionnaire use, calculation, and interpretation, and the current ASA guidelines for management of patients with OSA was given to the nurse practitioners. Preoperative screening using the STOP-Bang questionnaire was added to the preanesthesia visit after the educational session. Laminated copies of the STOP-Bang questionnaire and measuring tape to

measure neck circumference were distributed to promote ease of adoption.

The STOP-Bang scores were included in the respiratory section of the preanesthesia evaluation form. For patients with a STOP-Bang score of 4 or greater, a note marking the patient as at risk for OSA was also included in the "perioperative risk consideration" section at the end of the evaluation form. Both the STOP-Bang score and OSA risk assessment were available to the anesthesia providers preoperatively.

Data Collection

A chart review of 200 randomly selected patients who met inclusion criteria and were scheduled for surgery during the 3-month period before implementation was conducted. Variables included current medical conditions including a prior OSA diagnosis, documentation of OSA screening, age, gender, ASA status, BMI, surgical procedure, and nine comorbidities associated with OSA. A postimplementation chart review of 200 randomly selected patients scheduled for surgery in the 3-month period after the implementation of the STOP-Bang screening tool was conducted. Variables collected included prior OSA diagnosis, age, gender, ASA status, BMI, surgical procedure, comorbidities associated with OSA, along with the compliance with STOP-Bang screening and the calculated STOP-Bang score. Compliance was measured by the presence of a STOP-Bang score in the preanesthesia evaluation form.

Statistical Analysis and Outcome Measures

Data were analyzed using IBM SPSS Statistics, version 24 (IBM Corp, Armonk, NY). Descriptive statistics were analyzed for frequencies, means, standard deviations, and compliance. Comparisons of patients with STOP-Bang scores of 3 or less to patients with scores of 4 or greater were conducted using χ^2 tests.

Results

Patient Demographics

The results of the project included 200 patients in the preimplementation chart review and 200 patients in the postimplementation chart review.

Patient demographics are reported in [Table 1](#). The average age was 64.1 years and 96.3% of the sample was male. The overall average BMI was 30.1 kg/m², and an ASA classification of 3 or 4 was documented in 72.3% of the population. A documented diagnosis of OSA before visiting the preanesthesia clinic was present in 31.5% of the preimplementation group and 31.0% of the postimplementation group.

Preoperative STOP-Bang Screening

Patients were not screened in the preanesthesia clinic for OSA using a standardized screening tool before implementation of this project. In the preimplementation group, 137 patients (68.5%) did not have a preoperative diagnosis of OSA. During the postimplementation period, 138 patients (69.0%) had no diagnosis of OSA. After the implementation of this project, 126 patients (91.3%)

were screened using the STOP-Bang tool. Of those screened preoperatively for OSA, 55 patients (43.6%) had a STOP-Bang score of 4 or greater. Patients with STOP-Bang scores of 4 or greater had a mean age of 67 years, a BMI of 31.8 kg/m², a significantly greater number of comorbidities (4 to 6) when compared with patients with STOP-Bang score of 3 or less, 30 (54.4%) were categorized as an ASA 3, and 14 (25.5%) were categorized as an ASA 4 ([Table 2](#)).

Discussion

The purpose of this quality improvement was to implement the STOP-Bang questionnaire as a standardized preoperative OSA screening tool, to aid in identification of VA surgical patients at risk for OSA and to assess the compliance with the preoperative STOP-Bang questionnaire screening by the preanesthesia clinic providers. The results of this

Table 1. Patient Demographics of VA Patients Presenting for Preoperative Evaluation

	Total (N = 400)	Preimplementation (n = 200)	Postimplementation (n = 200)
	Mean (SD)	Mean (SD)	Mean (SD)
Age (y)	64.1 (11.1)	63.5 (11.4)	64.7 (10.8)
BMI (kg/m ²)	30.1 (5.8)	30.1 (5.9)	30.1 (5.6)
Number of comorbidities	2.8 (1.5)	2.9 (1.5)	2.8 (1.5)
	N (%)	N (%)	N (%)
Gender			
Male	385 (96.3)	193 (96.5)	192 (96.0)
Female	15 (3.7)	7 (3.5)	8 (4.0)
Number of comorbidities			
0-3	266 (66.5)	137 (68.5)	129 (64.5)
4-6	133 (33.2)	62 (31.0)	71 (35.5)
≥7	1 (0.3)	1 (0.5)	—
ASA			
1-2	111 (27.7)	53 (26.5)	58 (29.0)
3	211 (52.8)	108 (54.0)	103 (52.5)
4	78 (19.5)	39 (19.5)	39 (19.5)
OSA diagnosis			
Yes	125 (31.3)	63 (31.5)	62 (31.0)
No	275 (68.7)	137 (68.5)	138 (69.0)
			(N = 138)
STOP-Bang screening			
Yes			126 (91.3)
No			12 (8.7)

ASA, American Society of Anesthesiologists; BMI, body mass index; OSA, obstructive sleep apnea; VA, Veteran Administration.

Table 2. Demographics of Veteran Patients at Risk for OSA as Determined by STOP-Bang Screening

	STOP-Bang Score ≤ 3 (n = 71)	STOP-Bang Score ≥ 4 (n = 55)	
	Mean (SD)	Mean (SD)	P
Age (y)	62.7 (14.0)	67.1 (9.0)	< .05
BMI (kg/m ²)	26.6 (4.0)	31.8 (4.6)	< .001
	N (%)	N (%)	
Gender			
Male	67 (94.4)	54 (98.2)	
Female	4 (5.6)	1 (1.8)	
Number of comorbidities			
0-3	54 (76.1)	31 (56.4)	
4-6	17 (23.9)	24 (43.6)	< .05
ASA			
1-2	35 (49.3)	11 (20.0)	
3	25 (35.2)	30 (54.5)	
4	11 (15.5)	14 (25.5)	< .005

ASA, American Society of Anesthesiologists; BMI, body mass index; OSA, obstructive sleep apnea.

study demonstrated that 43.6% of the sample screened using the STOP-Bang questionnaire was found to be at risk for OSA as measured by a STOP-Bang score of 4 or greater. In addition, 31.3% of the surgical population had a preoperative diagnosis for OSA, which is notably higher than the estimated 20% of the general population.² The patients in the high-risk group were found to be significantly older, more likely to be obese, a higher ASA status, and had significantly more comorbidities found in patients with OSA such as congestive heart failure, diabetes, hypertension, and current smokers.⁴ Designation of high-risk screening can alert the anesthesia providers not only to the risk for OSA, but also to the susceptibility for perioperative complications.

Implementation of standardized screening tools has been shown to increase overall screening rates by health care providers.^{15,16} Standardized screening tools also allow for increased detection of high-risk patients as compared with subjective screening. Studies have demonstrated that significantly more patients with diagnosis of OSA were identified by the STOP-Bang questionnaire compared with subjective assessment by anesthesia

providers and surgeons.^{17,18} The use of screening tools in preanesthesia clinics for high-risk populations such as Veteran surgical patients can help to promote preoperative screening practices and improve identification of high-risk patients.

Although a STOP-Bang score of 3 or greater has been used to denote a high-risk for OSA, the developers of this project and the preanesthesia clinic nurse practitioners jointly chose to use a score of 4 or greater to designate high-risk patients. Because this population largely consists of males older than 60 years, it was likely that most patients would have a score of at least 3 and flagged as high risk, which could result in anesthesia provider desensitization to high-risk designations. The literature has shown that increasing STOP-Bang scores are associated with a corresponding increasing risk for OSA and perioperative complications, and STOP-Bang scores could be used to stratify high-risk patients.^{11,14} Although only patients with scores of 4 or greater were denoted to be high-risk patients, in this project, all patient STOP-Bang scores were recorded in the preanesthesia evaluation and were available to the anesthesia providers.

Successful integration of clinical tools and promotion of provider use of the tool is dependent on adequate education, providers' attitude related to the tool's efficacy, barriers to use, and institutional processes that foster adoption.¹⁹ This quality improvement project yielded a 91.3% compliance rate for completion of the STOP-Bang questionnaire by the preanesthesia clinic nurse practitioners during the preanesthesia evaluation. The success of this initiative was largely because of the nurse practitioners' belief that the STOP-Bang questionnaire was a useful tool for identifying those at risk for OSA and perioperative complications, as well as its ease of use during the patients' preanesthesia evaluation. Compliance rates can be further improved by creating system processes that will ensure screening on all patients. Dixon et al²⁰ achieved a STOP-Bang screening compliance of 100% by creating a mandatory STOP-Bang score field in the computerized preoperative evaluation charting. Although hard stops in the computer charting system were not available at this site, increased compliance could be achieved by including STOP-Bang scores in preoperative safety checklists and time outs.

Limitations

Limitations to this project were related to patient data collection. Manual chart reviews limited the number of patients that could be included in the sample. Electronic data query could have allowed for a larger sample size, and the use of International Classification of Diseases (ICD-9) codes would have provided a more comprehensive evaluation of patient comorbidities. Another limitation is that this was a single institution study, and the inclusion of multiple VA Medical Centers could yield valuable information regarding this population.

Implications and Conclusions

The initiation of this project provides several opportunities for further evaluation. It would be

valuable to examine patient outcomes, especially in the postanesthesia care unit, after the implementation of the STOP-Bang tool. Implementation of evidence-based protocols for management of patients with and at risk for OSA may result in decreased perioperative complications in these patients. The results of this quality improvement project demonstrated the value of using the STOP-Bang questionnaire in the preoperative setting of a VA Medical Center. A large proportion of the Veteran population is at risk for undiagnosed OSA, and the use of a standardized screening tool can allow for detection of these individuals. Identification of patients at risk for OSA and associated perioperative complications allows for the development of best practices to ensure patient safety and optimal outcomes.

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