

Observational Study

Patients presenting for colonoscopy: A great opportunity to screen for sleep apnea

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Abstract**AIM**

To discover the prevalence and the feasibility of screening for obstructive sleep apnea (OSA) in patients presenting for routine colonoscopy.

METHODS

Adult patients having a colonoscopy for routine indications at our outpatient endoscopy center were eligible if they did not carry a diagnosis of OSA or had not had a prior sleep study. All patients were administered the Berlin questionnaire prior to the procedure. Mallampati, neck circumference, height, weight, and BMI were obtained for each patient. Patients were observed for any drops in oxygen saturation < 92% or the presence of snoring for > 10 s. Patients were determined to be high-risk if they met at least 2 of the 3 symptom categories for the Berlin questionnaire.

RESULTSA total of 60 patients were enrolled and completed the study; mean age was 56 years (range 23-72 year). Twenty-six patients had a positive Berlin questionnaire (43.3%), 31 patients had a negative Berlin questionnaire (51.6%) and 3 patients had an equivocal result (5.0%). Patients with a positive Berlin questionnaire were more likely to be of increased weight (mean 210.5 lbs vs mean 169.8 lbs, $P = 0.003$), increased BMI (33.0 kg/m² vs 26.8 kg/m², $P = 0.0016$), and have an increased neck circumference (38.4 cm vs 35.5 cm, $P = 0.012$).

Patients with a positive Berlin questionnaire were more likely to have a drop in oxygen saturation $< 92\%$ (76.9% vs 36.4% , $P = 0.01$). Patients with snoring were more likely to have a positive Berlin questionnaire ($8/9$ patients vs $1/31$ patients with negative Berlin questionnaire; $P = 0.0045$).

CONCLUSION

Risk for OSA is extremely common in a population presenting for a routine colonoscopy, and screening at the time of a colonoscopy offers an excellent opportunity to identify these patients.

Key words: Colonoscopy; Obstructive sleep apnea; Berlin questionnaire; Sedation; Screening

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Core tip: We sought to determine the prevalence of patients at risk for obstructive sleep apnea (OSA) and the feasibility of screening patients for sleep apnea presenting for a routine colonoscopy to our outpatient endoscopy facility. All patients were screened for OSA with the Berlin questionnaire prior to the procedure. Overall, screening patients for sleep apnea at the time of a colonoscopy offers a unique opportunity not only to screen for colon cancer but also to identify patients at high risk for OSA who should undergo further testing.

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INTRODUCTION

Obstructive sleep apnea (OSA) is extremely common and affects 2%-4% of the population^[1], yet around 92% of females and 82% males with OSA are undiagnosed^[2]. OSA has been associated with an increased cardiovascular mortality and risk for stroke^[3,4], and some studies have shown an increased perioperative morbidity and mortality^[5]. Various screening tools to identify patients at risk for OSA have been utilized including the Berlin questionnaire, the STOP questionnaire, the ASA checklist, and STOP-BANG^[6,7]. The Berlin Questionnaire has been determined to be one of the best methods for identifying patients likely to have OSA, and has been shown to be helpful in surgical patients in detecting patients at high risk of OSA^[6]. In one study, patients in the high risk group on the Berlin questionnaire predicted a respiratory disturbance index of greater than 5 with a sensitivity of 86% and a specificity of 77% with a positive predictive value of 89%^[8]. One study showed that of patients who snored greater than 10 s during their

screening colonoscopies, all were noted to have OSA^[9]. We sought to determine the prevalence of patients at risk for OSA and the feasibility of screening patients for sleep apnea presenting for a routine colonoscopy to our outpatient endoscopy facility.

MATERIALS AND METHODS

Adult patients having a colonoscopy only for routine indications at the East Carolina University Outpatient Endoscopy Center between the dates November 3, 2014 and February 12, 2015 were eligible to participate in the study if they did not carry a diagnosis of sleep apnea and had not had a prior sleep study. The study was approved by the East Carolina University and Vidant Medical Center Institutional Review Board. Written informed consent was obtained from all the patients. Enrollment was limited to days with additional personnel present to help enroll patients. Exclusion criteria included our standard exclusion criteria for the outpatient endoscopy center: BMI > 52 , age < 18 , home oxygen use, cardiac defibrillator, and ASA class 4 patients.

All patients had a determination of their height, weight, BMI, Mallampati score, neck circumference, and whether they had a history of hypertension. The Mallampati was calculated by both the gastroenterologist and the nurse anesthetist, and a consensus was reached prior to performing the procedure. All patients were administered the Berlin questionnaire prior to the procedure by either the attending or the research fellow. Patients were determined to be high-risk if they met at least 2 of the 3 symptom categories for the Berlin questionnaire. If the patient was negative by category 2 or 3, and if they were not aware whether they snored, they were given an equivocal result. The group determined to have a high likelihood of sleep-disordered breathing based upon a positive result on the Berlin questionnaire were recommended to follow-up with the primary care physician to consider a sleep study per standard medical care.

The colonoscopy was performed under standard monitoring for all patients to include blood pressure and continuous heart rate and oxygen saturation monitoring with 2 L of oxygen per nasal cannula. Nurse anesthetist-administered propofol was used for all cases. Patients were given a bolus of propofol by the nurse anesthetist with additional injections every few minutes titrated to a moderate sedation level. Any drops in oxygen saturation $< 92\%$ were noted, and patients were also observed for the presence of snoring for > 10 s.

Statistics analysis

Data were entered manually, and statistical analysis was performed using SAS Version 9.1 (SAS Institute, Cary, NC). Statistical review was performed by a biomedical statistician. Descriptive statistics were performed using standard methods. χ^2 test and Fischer's exact test were used to test direct association between drop in oxygen saturation $< 92\%$ with the results of the Berlin

Table 1 Patient measurements

	Mean	Std Dev	Minimum	Maximum
Age	55.8	10.8	23.0	72.0
Height (inches)	66.7	4.1	55.0	74.0
Weight (lbs)	189.3	50.4	90.0	335.0
BMI (kg/m ²)	29.9	7.3	17.0	52.0
Neck circumference (cm)	36.7	4.3	27.0	48.0

BMI: Body mass index.

questionnaire and snoring and with the results of the Berlin questionnaire. A two sample *t*-test was used to test direct association between height, weight, BMI, neck circumference, and the Berlin questionnaire.

RESULTS

A total of 60 patients were enrolled and completed the study; mean age was 56 (range 23-72 year). The baseline demographics are listed in Table 1. The ASA classification results were as follows: ASA class 1-10 patients (16.7%); ASA class 2-30 patients (50.0%); ASA class 3-20 patients (33.3%). There were no ASA class 4 patients as they were not eligible for our outpatient endoscopy facility.

The indications for the procedures included screening for colon cancer (34 patients), history of colon polyps (10 patients), rectal bleeding (4 patients), inflammatory bowel disease surveillance (3 patients), change in bowel function (2 patients), heme-positive stools (2 patients), diarrhea (2 patients), abdominal pain (2 patients), and a history of colon cancer (1 patient). The baseline Mallampati results can be seen in Table 2.

Twenty-six patients had a positive Berlin questionnaire (43.3%), 31 patients had a negative Berlin questionnaire (51.6%) and 3 patients had an equivocal result (5.0%). The patients with the equivocal Berlin questionnaire results were excluded from the analysis. Nine of the 57 patients had snoring > 10 s (15.8%), and 13 of the 57 patients (22.8%) had a drop in oxygen saturation < 92%.

Patients with a positive Berlin questionnaire were more likely to have an increased neck circumference (38.4 cm vs 35.5 cm, $P = 0.012$), increased weight (mean 210.5 lbs vs mean 169.8 lbs, $P = 0.003$), and have an increased BMI (33.0 kg/m² vs 26.8 kg/m², $P = 0.0016$). Patients with snoring were more likely to have a positive Berlin questionnaire (8/9 patients vs 1/31 patients with negative Berlin questionnaire, $P = 0.0045$). Patients with a positive Berlin questionnaire were more likely to have a drop in oxygen saturation < 92% (76.9% vs 36.4%, $P = 0.01$).

DISCUSSION

In our study, 43% of patients had a positive Berlin questionnaire, and thus were considered to be at high risk for OSA. This demonstrates the reality that many patients with sleep apnea are not being identified, and

Table 2 Mallampati

Mallampati	Frequency	%
1	10	16.67
2	30	50.0
3	18	30.0
4	2	3.3

this underscores the need to develop novel methods to identify patients at risk for OSA. Making screening for OSA routine at the time of a screening colonoscopy would greatly increase the screening of the population for OSA and ensure that a large portion of the population is screened at the age of 50. This is similar to the rationale for screening patients for hepatitis C during the visit for a routine colonoscopy that has been suggested by some^[10]. Screening patients for OSA with the Berlin questionnaire at the time of the procedure is less labor-intensive than screening for viral hepatitis and involves a simple questionnaire.

Forty-three percent of patients in our study had a positive Berlin questionnaire. This is similar to results observed by Mehta *et al*^[11] in which 48% had a positive score on the STOP-BANG questionnaire administered at the Cleveland Clinic. In the study by Cote', 43% of patients presenting to a tertiary medical center for endoscopic retrograde cholangiopancreatography or endoscopic ultrasound had a positive score on the STOP-BANG test^[12] and were more likely to have hypoxemia or require the need for airway maneuvers. Mador *et al*^[13] also showed that 39% of patients at a Veterans Affairs outpatient endoscopy center identified as high-risk for OSA as defined by the Berlin questionnaire. Our study illustrates that a large portion of patients presenting to our university-based outpatient endoscopy center are likely to have undiagnosed OSA. This agrees with the results of other studies showing that many patients with OSA are not being screened and identified. Screening patients for OSA at the time of their colonoscopy offers a unique opportunity to increase the screening rate for OSA as we also strive to increase the screening rate for colorectal cancer. With rising obesity rates, undiagnosed OSA is likely to increase^[11].

Snoring during a colonoscopy has been noted to be a strong predictor of OSA. In the study by Sharara *et al*^[9] all the patients investigated who snored during conscious sedation for their colonoscopy were diagnosed with OSA, with 70% of these found to have moderate to severe OSA. In our study, patients with snoring > 10 s were more likely to have a positive Berlin questionnaire. Endoscopists should monitor their patients closely for the presence of snoring > 10 s during colonoscopy. If this is noted, these patients should be referred for further sleep testing as there is a very strong likelihood that they have OSA.

We found patients with a positive Berlin questionnaire were more likely to have a drop in oxygen saturation. Some other studies have also noted more oxygen

desaturations in patients with high risk for OSA^[12], although Khiani and Mador did not find an increased risk^[13,14]. However, in the study by Mehta *et al*^[11] patients with undiagnosed sleep apnea undergoing routine upper endoscopy or colonoscopy with propofol sedation were not noted to have an increased risk of "sedation-rated adverse events". Mador *et al*^[13] noted a similar finding in that patients with OSA undergoing endoscopic procedures with conscious sedation did not have an increased risk of cardiopulmonary complications.

Endoscopists carefully evaluate the airway of each patient who undergoes sedation for gastrointestinal procedures, including colonoscopy. They are responsible for the sedation of large numbers of patients and offer a select group of physicians with the skill and experience to carefully evaluate patients at risk for OSA. Overall, screening patients for sleep apnea at the time of a colonoscopy offers a unique opportunity not only to screen for colon cancer but also to identify patients at high risk for OSA who should undergo further testing.

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COMMENTS

Background

Obstructive sleep apnea (OSA) is extremely common and affects 2%-4% of the population, yet many patients with OSA are undiagnosed or never undergo screening for OSA.

Research frontiers

Sharara *et al* noted that of patients who snored greater than 10 s during their screening colonoscopies, all were noted to have OSA. The authors sought to determine the prevalence of OSA and the feasibility of screening these patients with the Berlin questionnaire at the time of their routine colonoscopy.

Innovations and breakthroughs

Endoscopists carefully evaluate the airway of each patient who undergoes sedation for gastrointestinal procedures, including colonoscopy. Screening patients for sleep apnea at the time of a colonoscopy offers a unique opportunity not only to screen for colon cancer but also to identify patients at high risk for OSA who should undergo further testing and adds little overall time to the procedure.

Applications

Screening patients for sleep apnea at the time of a screening colonoscopy is not only feasible but adds little time to the overall procedure, and offers a unique opportunity to screen patients for OSA that otherwise may never be screened.

Peer-review

This is an interesting study of screening for patients for sleep apnoea during colonoscopy. The paper is well written and presents a convincing proposal which may not have been addressed before as it crosses a field not handled

normally by gastroenterologists.

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