Preoperative Screening for Obstructive Sleep Apnea Prior to Endoscopic Skull Base Surgery: A Survey of the North American Skull Base Society

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Abstract

Background: Obstructive sleep apnea (OSA) is a commonly seen comorbidity in patients undergoing endoscopic skull base surgery and its presence may influence perioperative decision-making. Current practice patterns for preoperative screening of OSA are poorly understood.

Objective: The objective of this study was to assess how endoscopic skull base surgeons screen for OSA, and how knowledge of OSA affects perioperative decision-making.

Methods: Seven question survey distributed to members of the North American Skull Base Society.

Results: Eighty-eight responses (10% response rate) were received. 60% of respondents were from academic centers who personally performed >50 cases per year. Most respondents noted that preoperative knowledge of OSA and its severity affected postoperative care and increased their concern for complications. Half of respondents noted that preoperative knowledge of OSA and its severity affects intraoperative skull base reconstruction decision-making. 70% of respondents did not have a preoperative OSA screening protocol. Body mass index and patient history were most frequently used by those who screened. Validated screening questionnaires were rarely used. 76% of respondents agreed or somewhat agreed that a preoperative polysomnogram should ideally be performed for patients with suspected OSA; however, 50% of respondents reported that <20% of their patients with suspected OSA are advised to obtain a preoperative polysomnogram.

Conclusion: This study reveals that most endoscopic skull base surgeons agree that OSA affects postoperative patient care, but only a minority have a preoperative screening protocol in place. Additional study is needed to assess the most appropriate screening methods and protocols for OSA patients undergoing endoscopic skull base surgery.

Keywords
anterior skull base, endoscopic skull base surgery, chronic disease, post-operative, skull base repair, obstructive sleep apnea, from index medicus

Introduction

Obstructive sleep apnea (OSA) is a condition characterized by repeated episodes of upper airway obstruction during sleep, leading to ventilatory disruption, oxygen desaturation, and arousal. Notably, the diagnosis of OSA is a risk factor for increased all-cause mortality. OSA is extremely common with prevalence in the United States estimated at greater than 25%, and increasing...
rates in older age groups. Prevalence may continue to increase due to an association with the global obesity epidemic, and the disease remains underdiagnosed. Specific pathologic conditions can be associated with a greater chance of developing OSA, such as acromegaly. In addition, patients with idiopathic intracranial hypertension have a greater risk of cerebrospinal fluid leaks and OSA.

The perioperative timeframe is a period in which patients with OSA are at high risk for complications due to adverse effects from anesthesia, narcotics, and other sedatives. The gold standard treatment of OSA is continuous positive airway pressure (CPAP) and some patients may require CPAP in the immediate postoperative period to manage OSA symptoms. Positive airway pressure may present risks to postoperative patients with skull base defects and most recent research has focused on postoperative management of OSA in patients undergoing endoscopic skull base surgery – from timing of CPAP initiation to modification of skull base reconstruction.

Preoperative screening of surgical patients for OSA has been identified as a way to anticipate and mitigate potential postoperative risks posed by OSA. However, little is currently known about practice patterns by endoscopic skull base surgeons to screen for OSA in this patient population. The purpose of this study was to assess how endoscopic skull base surgeons screen patients for OSA preoperatively and how knowledge of OSA affects perioperative decision-making.

**Methods**

A seven-question voluntary online survey was generated by consensus opinion among authors. The survey received previous approval from the North American Skull Base Society (NASBS) and was electronically distributed to the 920 members of the NASBS. Responses were received over the period of one month and were anonymous. Survey questions are presented in Figure 1. Of note, responses to Question 5 were contingent upon respondents answering “Yes” or “Working on it” to Question 4.

Descriptive statistics, Chi-square tests, and multinomial regression analysis with alpha <0.05 were performed using IBM® SPSS® Statistics 26.0 statistical analysis software (IBM Corp. Released 2019. IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp.).

**Results**

**Respondent Background**

Eighty-eight responses were received with a total response rate of 9.6%. However, the NASBS is a diverse society with a range of subspecialties represented. Further clarification of the membership revealed that 584 members self-identified their specialty as either “neurosurgery” or “rhinology.” These specialities would be most relevant to our survey. Using this number as a surrogate for the total relevant membership (i.e., excluding less relevant specialties such as radiation oncology, otology/neurotology, etc), the response rate would be estimated at 15%.

In the survey, respondents were asked to describe their surgical practice setting (academic center vs private practice), case volume (more or less than 50 cases per year), and years of experience (more or less than 5 years). Respondents from academic medical centers with greater than 5 years of experience and greater than 50 cases per year represented the largest demographic (43%). Overall, 84% of respondents were from academic medical centers, 73% had more than 5 years of experience, and 76% had surgical volume greater than 50 cases per year. This background information for all respondents is depicted in Figure 2.

**Estimation of Suspected OSA**

Sixty percent of respondents estimated that the proportion of suspected or confirmed OSA in their patient population was between 5–25%. Eighteen percent of respondents believed the prevalence to be less than 5% of their patient population, whereas 6% of respondents felt that OSA comprised greater than 25% of their patient population. However, 16% reported that they did not know and could not estimate the prevalence of OSA in their patient population.

**Effect of OSA on Decision-Making**

Most respondents felt that knowledge of a patient’s OSA status and its severity had an effect on perioperative decision-making. Knowledge of OSA was reported to affect: postoperative monitoring including need for critical care (63% agreed), level of concern for postoperative complications (55% agreed), and recommendations for restarting CPAP (84% agreed). Fifty percent of respondents said that knowledge of OSA and its severity impacted their intraoperative decision on skull base reconstruction. Most (72%) reported that knowledge of OSA did not affect their patients’ length of hospitalization. Complete responses to survey question #6 are listed in Table 1.

**Preoperative OSA Screening**

Only 18% of respondents noted that they have a preoperative OSA screening protocol in place, while 12% reported that they are working on a protocol. The most frequently used variables for screening include
1. I would define my clinical practice as follows
- Academic center, surgical volume less than 50 cases per year, surgical experience of less than 5 years
- Academic center, surgical volume less than 50 cases per year, surgical experience of more than 5 years
- Academic center, surgical volume more than 50 cases per year, surgical experience of less than 5 years
- Academic center, surgical volume more than 50 cases per year, surgical experience of more than 5 years
- Private practice, surgical volume less than 50 cases per year, surgical experience of less than 5 years
- Private practice, surgical volume less than 50 cases per year, surgical experience of more than 5 years
- Private practice, surgical volume more than 50 cases per year, surgical experience of less than 5 years
- Private practice, surgical volume more than 50 cases per year, surgical experience of more than 5 years

2. Proportion of my ESBS patients that have suspected / confirmed obstructive sleep apnea (OSA)
- Do not know
- Less than 5%
- 5-10%
- 11-25%
- More than 25%

3. Proportion of my ESBS patients with suspected OSA that are advised PREOPERATIVE sleep study
- Do not know
- Less than 20%
- 21%-50%
- 51-80%
- 81-100%

4. Do you have a PRE-OPERATIVE obstructive sleep apnea screening protocol for ESBS patients?
- Yes
- Working towards it
- No

5. For PRE-OPERATIVE OSA screening in my ESBS patients, I currently use
- Body mass index
- History taking (Apnea, snoring etc.)
- Screening instruments (STOP-BANG etc.)
- Sleep study
- Others (Please specify ____________)

6. In ESBS, PREOPERATIVE knowledge about patient’s sleep apnea status and its SEVERITY has an effect on my __________ (Select all that apply)
- Intra-operative decision making on skull base reconstruction
- Postoperative monitoring including need for critical care
- Pulse oximetry monitoring in recovery
- Advice on hospital stay duration
- Level of concern for post-operative complications (cardiac, pulmonary, stroke, venous thrombosis)
- Advice on restarting CPAP
- Advice on non-CPAP treatment devices for OSA in post-operative period (if CPAP is withheld/never used)
- None of the above

7. PREOPERATIVE sleep study should ideally be done in all cases of suspected OSA undergoing ESBS
- Do not know
- Agree

Figure 1. Survey questions.

Figure 2. Respondent demographic information.
patient’s medical history (69% usually use) and body mass index (55% usually use). Screening instruments such as the STOP-BANG questionnaire were used rarely or occasionally in most respondents (69%). Nine respondents (10%) reported additional factors for preoperative screening including: echocardiogram, pulmonary function tests, nasal resistance measurements, sleep medicine/surgeon consultation, drug-induced sleep endoscopy, and neck circumference.

Polysomnograms were used occasionally by 32% and rarely by 34% of respondents as a component of screening. Nearly half (47%) of respondents estimated that less than 20% of their patients with suspected OSA are advised to obtain a preoperative polysomnogram and 35% of respondents did not know. However, 76% of respondents either agreed or somewhat agreed that preoperative sleep studies should ideally be performed preoperatively. Overall responses to this question are shown in Figure 3.

Regression analysis demonstrated no significant differences in responses between the different demographics of respondents who completed the survey.

### Discussion

Obstructive sleep apnea is a highly prevalent condition associated with increased overall mortality.\textsuperscript{2,3} Due to the biology of certain skull base pathologies, patients needing endoscopic skull base surgery may be at higher risk for underlying OSA.\textsuperscript{7,8} Additionally, postoperative care of patients with skull base defects and underlying OSA is complicated by the risks of CPAP delivery to the sinonasal cavity which may lead to epistaxis, graft disruption, or pneumocephalus.\textsuperscript{7,11,14,15}

Practice guidelines for the perioperative management of patients with OSA have been developed by the

| Survey Question                                                                 | Yes (%) | No (%) |
|--------------------------------------------------------------------------------|---------|--------|
| Intra operative decision making on skull base reconstruction                    | 44 (50%)| 44 (50%)|
| Postoperative monitoring including need for critical care                       | 55 (62.5%) | 33 (37.5%)|
| Pulse oximetry monitoring in recovery                                           | 44 (50%) | 44 (50%)|
| Advice on hospital stay duration                                                | 25 (28.4%) | 63 (71.6%)|
| Level of concern for post-operative complications (cardiac, pulmonary, stroke, venous thrombosis) | 48 (54.5%) | 40 (45.5%)|
| Advice on restarting CPAP                                                       | 74 (84.1%) | 14 (15.9%)|
| Advice on non-CPAP treatment devices for OSA in post-operative period (if CPAP is withheld/never used) | 38 (43.2%) | 50 (56.8%)|
| None of the above                                                              | 5 (5.7%) | 83 (94.3%)|
Preoperative screening of surgical patients for OSA has been shown to be beneficial in the perioperative period. In a large study of non-emergent surgical patients, those with a preoperative diagnosis of OSA were shown to have decreased respiratory interventions, hospital use, and 30-day all-cause mortality compared to patients with suspected OSA based on their STOP-BANG score on the day of surgery. These poorer post-operative outcomes could be related to lack of awareness of underlying OSA by hospital caregivers. Thus, with preoperative knowledge of OSA and its severity, postoperative risks can be mitigated by closer monitoring, appropriate positioning, and plans for intervention.

Limitations
We acknowledge the limitations of this study. Overall, only a small proportion of NASBS members responded to the survey request, which may subject our results to sampling bias. However, our total responses were comparable to other similar surveys. By attempting to further clarify the relevant specialties within NASBS (e.g., rhinology, neurosurgery) we attempted to obtain a more accurate assessment of the response rate from relevant specialties, which was estimated at 15%. However, 46 NASBS members did not list a specialty, which could affect our relevant response rate. While most respondents were experienced endoscopic skull base surgeons with high surgical volume, we did not assess for geographic differences or differences in training (i.e., neurosurgery vs otolaryngology). Geographic settings with a high incidence of OSA may be more likely to screen the patient preoperatively and better manage the OSA postoperatively. Additionally, some surgeons may rely on or assume that other medical professionals will have previously screened patients for OSA, and thus their practices may not be captured by this survey. Furthermore, access to polysomnograms and dedicated sleep medicine physicians may be more difficult in rural or community settings.

While severity of OSA (based on AHI) generally correlates with higher levels of CPAP, many other anatomic and physiologic factors may influence the level of CPAP required for optimal management of OSA. Question number 6 in our survey assessed the impact of OSA severity on respondents’ decisions, using severity as a correlate for higher CPAP level and more risk of postoperative complications. Finally, our question set was rather limited with a goal of increasing response rate by decreasing time commitment.

Conclusions
Obstructive sleep apnea is prevalent and likely under-diagnosed in the endoscopic skull base surgery...
population. Respondents to our survey reported that knowledge of OSA and its severity affects intraoperative decision-making and postoperative patient care; however, only a minority of participants have a preoperative OSA screening protocol in place. This survey reveals that additional study is needed to assess and widely implement the most appropriate OSA screening methods, as well as develop perioperative protocols for OSA patients undergoing endoscopic skull base surgery.

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Ethical Approval
This study was approved by our institutional review board.

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Statement of Human and Animal Rights
This article does not contain any studies with human or animal subjects.

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