TITLE: Pre-Operative Screening and Post-Operative Monitoring in Adult Patients with Obstructive Sleep Apnea: Clinical Effectiveness and Guidelines

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CONTEXT AND POLICY ISSUES:

Obstructive sleep apnea (OSA) is a common condition that affects patients’ breath when they sleep. It is characterized by periodic, partial, or complete obstruction of the upper airway during sleep. The prevalence of OSA is high (2-26% in the general population), especially in obese patients, older patients, and smokers. The commonly used clinical diagnostic criteria for OSA is an apnea hypopnea index (AHI) of greater than 10, in addition to the symptoms of excessive daytime sleepiness; AHI is the number of episodes of apnea or hypopnea per hour during sleep.

Patients with OSA may be more vulnerable than those without OSA during the perioperative period, particularly if they receive general anesthesia or opioids/sedative medications, because of the potential difficulty in maintaining a patent airway and the negative impact of medications on respiratory function. Moreover, clinical studies have shown that patients with OSA have a higher risk of postoperative complications such as unplanned ICU admissions, longer hospital stay, and postoperative encephalopathy compared to those without OSA. Anesthesiologists are interested in finding an accurate clinical test with high sensitivity to rule out OSA in the pre-surgery population.

It is important to screen all surgical patients to provide more appropriate perioperative care and prevent post-operative complications. However, OSA is usually undiagnosed. Studies estimated that about 80% to 90% of the patients with OSA are not diagnosed.

Several diagnostic tests (the Epworth Sleepiness Scale [ESS], the Multiple Sleep Latency Test [MSLT], polysomnography [PSG], and oximetry) are available to subjectively or objectively assess sleepiness from the likelihood of falling asleep in various situations, the time to fall asleep in different occasions across the day, the sleep and breathing patterns, or the oxygen saturation of the arterial blood. Questionnaires are also used in initial assessment in the potential patients. PSG acts as the gold standard for diagnosing sleep apnea, yet it is time-
consuming, costly, and complicated in interpretation, which make it impractical for quick screening of all patients who will undergo surgery.3-5,9

This HTIS report examines the evidence on clinical effectiveness of screening tools in pre-surgical adult patients with potential OSA, and the evidence for postoperative monitoring and discharge after the surgery.

RESEARCH QUESTIONS:

1. What is the clinical effectiveness of tools used to screen pre-surgical adult patients for obstructive sleep apnea?
2. What are the evidence-based guidelines for post-surgical monitoring of adult patients with suspected obstructive sleep apnea?
3. What are the evidence-based guidelines for discharging post-surgical adult patients with suspected obstructive sleep apnea?
4. What evidence exists regarding the risk factors that must be considered for discharge instructions for post-surgical adult patients with obstructive sleep apnea?

METHODS:

A limited literature search was conducted on key health technology assessment resources, including OVID Medline, The Cochrane Library (Issue 2, 2010), University of York Centre for Reviews and Dissemination (CRD) databases, ECRI (Health Devices Gold), EuroScan, international health technology agencies, and a focused Internet search. The search was limited to English language articles published between 2005 and March 2010. Filters were applied to limit the retrieval to health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, controlled clinical trials, observational studies, and guidelines.

HTIS reports are organized so that the higher quality evidence is presented first. Therefore, systematic reviews and meta-analyses are presented first, followed by observational studies and evidence-based guidelines.

SUMMARY OF FINDINGS:

From the limited literature search, we identified one systematic review,4 one meta-analysis,7 one observational study,10 and two evidence-based clinical practice guidelines2,11 that address the research questions. No relevant health technology assessments, randomized controlled trials, or controlled clinical trials were identified about the evidence on preoperative screening, postoperative monitoring in patients with suspected OSA, and discharging OSA patients after the surgery.
Systematic reviews and meta-analyses

Pre-surgery screening

Chung and colleague performed a systematic review on the evidence of perioperative management for surgical patients with OSA. The review included 18 articles; all were nonrandomized controlled studies, cohort studies, case-control studies, and case-series reports. Randomized controlled trials were not identified. In one section of this review, the authors examined three tools for OSA screening in pre-surgical patients. The Berlin Questionnaire, a 10-item self-reported questionnaire that has been validated in atrial fibrillation patients, was deemed to be a valuable tool for OSA screening in primary care; yet its usefulness in detecting surgical patients who are at higher risk of OSA has not been established. Since the Berlin Questionnaire is a complex tool, a shorter tool was developed by the authors. The second tool was a shorter 4-item OSA screening questionnaire (STOP) developed by Chung and colleagues. It was validated by the same investigators in surgical patients with sensitivity of 65.6%, 74.3%, and 79.5% at AHI >5, >15, and >30 cutoff levels, respectively. When the factors of body mass index (BMI), age, neck size, and gender (BANG) were considered along with STOP, the advanced questionnaire of STOP-BANG had higher sensitivity, of 83.6%, 92.9%, and 100% for the same AHIs as mentioned, which were higher than just STOP alone. A third screening tool (ASA checklist) is a 16-item checklist to be completed by clinicians. The validity of the three tools was examined in this review using PSG as a reference. The sensitivity of the Berlin Questionnaire, the STOP questionnaire, and the ASA checklist is presented in Table 1. There was no significant difference between the three screening tools with respect to their sensitivity. The authors indicated the equivalence between the three tools, and highly recommended the use of a practical screening tool in the preoperative clinic.

<table>
<thead>
<tr>
<th>AHI Cutoff Level</th>
<th>The Berlin Questionnaire</th>
<th>The STOP Questionnaire</th>
<th>ASA Checklist</th>
</tr>
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<tbody>
<tr>
<td>&gt;5</td>
<td>68.9%</td>
<td>65.6%</td>
<td>72.1%</td>
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<tr>
<td>&gt;15</td>
<td>78.6%</td>
<td>74.3%</td>
<td>78.6%</td>
</tr>
<tr>
<td>&gt;30</td>
<td>87.2%</td>
<td>79.5%</td>
<td>87.2%</td>
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Ramachandran and colleague conducted a meta-analysis to compare the diagnostic accuracy of the currently validated clinical screening tests for preoperative use in patients with OSA. The investigated screening tests included questionnaires (a set of questions with no additional physical measurement involved) and clinical prediction models (combined elements of medical history and physical examination, with or without additional radiologic, oximetry, or laboratory measurements). The standard overnight PSG was used as a reference. In total, 26 articles including 8 questionnaires and 18 clinical prediction models were accepted for final analysis. The study did not identify any single questionnaire or clinical model as an ideal preoperative screening test, which was defined as a test with a diagnostic odds ratio (DOR) greater than 81 and a false-negative (FN) rate of 0%. The screening tests were compared for accuracy of prediction of both diagnosis and severity of OSA. The study found that questionnaires and clinical models could predict severe OSA with a high degree of accuracy (pooled DOR = 12.09 for questionnaires; pooled DOR = 14.69 for clinical models), compared to their capabilities to predict the diagnosis of OSA (pooled DOR = 5.50 for questionnaires; pooled DOR = 9.74 for clinical models). The Berlin questionnaire, the Sleep Disorders Questionnaire, morphometry
(Kushida index), and the combined clinical-cephalometry model were found to be the most accurate questionnaires and clinical models. Yet, due to the high degree of heterogeneity and FN rate with all questionnaires and most clinical prediction models, a significant proportion of patients with OSA may not be identified by all questionnaires and most of the clinical models. The limitations of this study are threshold variability (variable AHI threshold used by the reference test for the validation process of the included individual studies), study heterogeneity, verification bias, and spectrum bias.

Risk factors that must be considered for discharge instructions

No studies were identified that examined the risk factors to be considered when discharging patients with OSA. The systematic review by Chung and colleagues indicated that cases of respiratory depression occurred in patients who received opioid analgesics for postoperative pain control. Non-opioid analgesics such as nonsteroidal anti-inflammatory analgesics, acetaminophen, and tramadol were recommended. These statements were primarily derived from the evidence from case reports, thus the strength of evidence was low.

Observational studies

Gali and colleagues conducted a prospective observational study to identify surgical patients at high or low risk for OSA using a two-step approach: a preoperative screening tool for OSA combined with a postanesthesia care unit assessment for specific respiratory events. Before the surgery, all eligible patients (those without a known diagnosis of OSA and scheduled to undergo inpatient surgery) were evaluated with the Flemons criteria. The Flemons criteria is also known as sleep apnea clinical score (SACS), which is a screening tool based on snoring, witnessed episodes of apnea, neck circumference, and systemic hypertension. Higher score is correlated to higher risk of sleep apnea. A score of 15 or greater indicates moderate to severe sleep apnea. After the surgery, all patients were monitored continuously for recurrent postanesthesia events of apnea, bradypnea, oxygen desaturation, and pain-sedation mismatch. A total of 693 patients were included in data analysis, and 472 were identified as low risk of OSA and 221 were identified as high risk of OSA based on the results of SACS. Compared to the low SACS group, patients in the high SACS group were more likely to be male, with higher BMI, to be hypertensive, and with greater neck circumference. Significantly more postanesthesia care unit events were associated with a high SACS (p = 0.043) compared with the low SACS group. The likelihood of a postoperative oxygen desaturation increased with a high SACS (p <0.001) and there were more respiratory events reported in the high SACS group (p <0.001) compared with the low SACS group. The authors concluded that a combination of preoperative SACS and postanesthesia care unit monitoring can be used to identify patients at risk for postoperative respiratory and other complications, in addition to desaturations. One limitation of this study was that PSG was not performed; therefore the study could not directly compare the SACS results for OSA with those from a PSG.

Guidelines and recommendations

Pre-surgery screening

The guidelines by the American Society of Anesthesiologists (ASA) Task Force provide recommendations on perioperative management of patients with OSA. Before the surgery,
Preoperative evaluation is urged to include 1) a comprehensive review of patient’s previous medical records for information of history of airway difficulty with previous anesthetics, hypertension or other cardiovascular problems, and other medical conditions; 2) an interview with the patient and/or family for information related to snoring, apneic episodes, frequent arousals during sleep, morning headaches, and daytime somnolence; 3) a physical examination to evaluate the airway, nasopharyngeal characteristics, neck circumference, tonsil size, and tongue volume; and 4) sleep studies. Specific sleep studies were not indicated in these guidelines. The ASA guidelines indicate that the literature lacked sufficient evidence-based findings to enable clinicians to formulate strategies for preoperative evaluation, even though the literature was searched systematically, and the guidelines were developed through a six-step process including consensus on selection criteria, evaluating published studies from peer-reviewed journals, obtaining expert’s opinions from surveys and open forums, and using all available information to build consensus to finalize the guidelines. The recommendations were primarily based on the consensus of consultants’ opinions.

**Post-surgical monitoring**

In the ASA guidelines, it is suggested that after the surgery, continuous pulse oximetry monitoring is recommended for hospitalized patients with increased risk of respiratory compromise from OSA, in a critical care or stepdown unit, by telemetry on a hospital ward, or by a dedicated, appropriately trained professional observer in the patient’s room. The authors also mentioned that there was not sufficient literature to evaluate the efficacy of telemetry monitoring systems, to examine the impact of monitored postoperative settings, and to determine the proper duration of postoperative respiratory monitoring. The recommendations were mainly based on the consensus of consultants’ opinions due to a lack of sufficient evidence-based findings, even though a comprehensive literature search was conducted.

An evidence-based guideline developed by Canadian Thoracic Society suggests that all patients at risk of respiratory complications from OSA should be monitored with oximetry after the surgery, based on the evidence from case series, case reports, or expert opinion. It is unclear if a systematic search was performed. Details about the postoperative monitoring such as the length of monitoring were not provided in the guideline.

**Discharging the post-surgical adult patient with suspected OSA**

In the ASA guidelines which were developed rigorously, the recommendations for patient discharging are that, in addition to standard outpatient discharge criteria, patients with OSA should not be discharged from the recovery area to an unmonitored setting, such as home or unmonitored hospital bed until they are no longer at risk for postoperative respiratory depression. Patients may require a longer stay compared with those undergoing similar procedures but without OSA.

**Limitations**

- There were no health technology assessments or randomized controlled trials evaluating the performance of OSA screening tools in the pre-surgical patients identified from 2005 to date.
- There were a limited number of systematic reviews, meta-analyses, observational studies, and evidence-based clinical practice guidelines available.
Recommendations from the clinical practice guidelines were primarily based on expert opinions. Study quality of the individual studies included in the meta-analysis was low due to various biases (i.e. verification bias and spectrum bias). Clinically relevant health outcomes, such as symptom control, quality of life, survival, and adverse events were rarely reported in the literature.

CONCLUSIONS AND IMPLICATIONS FOR DECISION OR POLICY MAKING:

PSG is the gold standard to evaluate patients with suspected OSA in the current practice; however, its use is restricted due to the time commitment, resource availability, and complex results interpretation. In addition, a previous study suggested a discordance between PSG indexes and quality of life, symptoms, or reaction time in patients with mild to moderate OSA

Evidence of the performance of several validated screening tools (STOP, the Berlin questionnaire, the Sleep Disorders Questionnaire, Kushida index, the combined clinical-cephalometry model, SACS) was identified. The studies suggested that all tools showed acceptable diagnostic accuracy in screening pre-surgical patients with suspected OSA, and the 4-item STOP questionnaire is a shorter questionnaire so may be easier to use compared to the others (10-item Berlin questionnaire and 16-item ASA checklist). The relatively high false negative rates of some screening tools may result in a significant proportion of the patients missed in the screening process.

According to two clinical practice guidelines, oximetry can be used in patient monitoring after surgery. Opioid analgesics are not recommended to be prescribed to postoperative patients with OSA; non-opioid analgesics such as nonsteroidal anti-inflammatory analgesics are an option for postoperative pain management. Limited information about guidelines for discharging post-operative OSA patients and risk factors was identified. One guideline stated that patients with OSA may require a longer hospital or critical care unit stay compared with those undergoing similar procedures but without OSA.

The data was sparse and there is limited evidence to support the use of screening tools before the surgery, the continuous patient monitoring after the surgery, and the discharge instructions for the study population. It remains unclear whether the perioperative risks could be reduced by appropriate screening to detect undiagnosed OSA and implementation of a perioperative management plan for patients with OSA. Further well-designed clinical studies would provide more rigorous evidence to fill the gap.

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