Obstructive Sleep Apnea Patients: A Challenge for Anesthesiologists

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INTRODUCTION

Upper airway patency is essential for normal respiratory function. The maintenance of a patent airway is dependent primarily on the pharyngeal structures. In some individuals, there is a loss of this airway patency from collapse of pharyngeal soft tissue, and interruption of airflow occurs during sleep. Obstructive sleep apnea (OSA) is caused by repetitive partial or complete obstruction of the upper airway, characterised by episodes of breathing cessation during sleep, which lasts <u>10 or more seconds</u>.

From the anesthesiologists' standpoint, OSA patients pose significant problems in the perioperative period – ranging from difficult airways, sensitivity to anesthetic agents, and postoperative adverse events. OSA has been associated with an increase in postoperative complications,¹⁻³ and is an independent risk factor for increased morbidity and mortality.^{4,5}

A recent retrospective matched cohort study in elective surgical patients with OSA showed that OSA patients had an increased incidence of postoperative oxygen desaturation with a hazard ratio of 2.² In addition, there is a growing body of literature showing that OSA patients undergoing upper airway surgery,^{6,7} joint replacement surgery,⁸ and cardiac surgery⁹ have an increased risk of postoperative complications.

Optimal patient care begins with a tailored preoperative assessment, to facilitate patient risk stratification and optimization, followed by formulation of an individualized perioperative management plan.

PREVALENCE

OSA is the most prevalent breathing disturbance during sleep,¹⁰ with an incidence in the general population estimated in the range of 1 in 4 males and 1 in 10 females.¹¹ Moderately severe OSA was present in twice as many more men (11.4%) than women (4.7%).^{12,13} A significant proportion of OSA patients are undiagnosed prior to surgery.¹⁴ It is therefore increasingly being recognized as a significant perioperative problem.

DIAGNOSIS OF OSA

The diagnosis of OSA is established by an overnight sleep study or polysomnography. The apnea hypopnea index (AHI) is the number of abnormal respiratory events per hour of sleep.

AHI cutoffs have been frequently used to describe the severity of OSA. The American Academy of Sleep

Medicine defines mild OSA as AHI > 5 - 15, moderate OSA as AHI > 15 - 30, and severe OSA as AHI > 30!⁵ Clinicians should be cognizant that different published standards of hypopnea definitions might lead to differences in AHI.¹⁶

Some other factors used in the evaluation of OSA severity include duration of oxygen desaturation, rate of desaturation, adequacy of ventilation recovery, and level/stability of arousal threshold.

PRACTICAL SCREENING OF SUSPECTED OSA PATIENTS IN THE PREOPERATIVE CLINIC

A large number of surgical patients with OSA are undiagnosed when they present for surgery and anesthesia. Polysomnographic diagnosis of OSA is prohibitive as it is costly and resource-intensive. Therefore, anesthesiologists are in need of a practical preoperative screening tool to identify patients more likely to have true OSA. For safety reasons, the screening tool should have a high degree of sensitivity, at the expense of lower specificity.

In a preoperative survey of elective surgeries, 24% of patients were identified as having a high risk of OSA using the Berlin questionnaire.¹⁴ In another study screening over 2000 patient, 27.5% of them were classified as being at high risk of OSA when the STOP questionnaire was utilised.¹⁷ In the preoperative anesthesia assessment, a high index of suspicion for OSA is important.

Snoring is the premier symptom of OSA, and is 100% sensitive. However, it is not specific and its positive predictive value is low. Several questionnairebased screening tools have been successfully developed. The Berlin Questionnaire is a 10-item selfreport instrument validated initially in the primary care setting.¹⁸ It consists of 5 questions on snoring, 3 questions on excessive daytime sleepiness, 1 question on sleepiness while driving, and 1 question inquiring about a history of hypertension. Details pertaining to age, gender, weight, height, and neck circumference are also recorded. A study screening preoperative patients using the Berlin questionnaire determined that it had a sensitivity of 69% and a specificity of 56% in surgical patients.¹⁹ The drawback of the Berlin Ouestionnaire is the complicated scoring system and the large number of questions.

In 2006, the American Society of Anesthesiologists (ASA) taskforce on OSA developed a tool to assist anesthesiologist in identifying patients with OSA. It comprises a 14-item checklist categorised into physical characteristics, history of apparent airway obstruction during sleep, and complaints of

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somnolence (20). The sensitivity of the ASA checklist was 79% and 87% at AHI cutoff level of > 15 and > 30.¹⁹

Subsequently, a more concise and easy-touse clinical screening tool for anesthesiologists was developed (Table 1) – the STOP questionnaire

STOP Questionnaire

- 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
- Observed: 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

High risk of OSA: answering yes to 2 or more questions

Low risk of OSA: answering yes to less than 2 question

STOP-Bang Scoring Model

- 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
- Observed: Has anyone observed you stop breathing during your sleep? Yes No
- Blood pressure: Do you have or are you being treated for high blood pressure? Yes No
- 5. BMI: BMI more than 35 kg/m2? Yes No
- 6. Age: Age over 50 years old? Yes No
- 7. Neck circumference: Neck circumference greater than 40 cm? Yes No
- 8. Gender: Male? Yes No

High risk of OSA: answering yes to <u>3 or more</u> items

Low risk of OSA: answering yes to less than 3 items

Adapted from Chung F, Yegneswaran B, Liao P et al. STOP Questionnaire: A tool to screen patients for obstructive sleep apnea. Anesthesiology 2008;108:812-21.

Table 2: Screening Questionnaires for Obstructive Sleep Apnea

(S: Snore loudly, T: daytime Tiredness, O: Observed to stop breathing during sleep, P: high blood Pressure). The sensitivity of the STOP questionnaire with AHI > 15 and > 30 as cut-offs were 74% and 80% respectively, and the specificity 53% and 49% respectively.¹⁷ When incorporating 4 additional variables with the acronym Bang, (B: BMI > 35kg/m2, A: Age > 50 years, N: Neck circumference > 40cm, G: male Gender), the STOP-Bang questionnaire (Table 1) improved the sensitivity to 93%, and 100% at AHI cut-offs of >15 and >30 respectively.¹⁷ The specificity of the STOP-Bang was 43% and 37% respectively.

There was no significant difference in the predictive parameters of the Berlin questionnaire, the ASA check-list, and the STOP questionnaire. All the questionnaires demonstrated a moderately high level of sensitivity for OSA screening (Table 2). The

Berlin	ASA Checklist	STOP	STOP-Bang
Questionnaire		Questionnaire	Questionnaire
0 Netzer 2003 (31)	Gross 2006 (33)	Chung 2008 (30)	Chung 2008 (30)
Clinician-admin-	Clinician-	Self-administered	Clinician-
istered	administered		administered
Validated in pri- mary care setting and perioperative setting	Validated in perioperative setting	Validated in perioperative setting	Validated in perioperative setting
10-item	14-item	4-item	8-item
3 categories: Snoring, daytime sleepiness, driving	3 categories: predisposing characteristics, symptoms of OSA, complaints	No categories	No categories
High risk if 2 or	High risk if 2 or	High risk if 2 or	High risk if 3 or
more categories	more categories	more items score	more items score
score positive	score positive	positive	positive
For AHI >30	For AHI >30	For AHI >30	For AHI >30
Sensitivity 87%	Sensitivity 87%	Sensitivity 80%	Sensitivity 100%
Specificity 46%	Specificity 36%	Specificity 49%	Specificity 37%
PPV 32%	PPV 28%	PPV 30%	PPV 31%
NPV 93%	NPV 91%	NPV 90%	NPV 100%
For AHI >15	For AHI >15	For AHI >15	For AHI >15
Sensitivity 79%	Sensitivity 79%	Sensitivity 74%	Sensitivity 93%
Specificity 51%	Specificity 37%	Specificity 53%	Specificity 43%
PPV 51%	PPV 45%	PPV 51%	PPV 52%
NPV 78%	NPV 73%	NPV 76%	NPV 90%
Complicated scoring procedure	Clinician required to com- plete checklist	Concise, easy- to-use	Improve sensitiv- ity compared with the STOP questionnaire

Table 1: Obstructive Sleep Apnea Screening Tools

sensitivities of the Berlin questionnaire, the ASA checklist, and STOP questionnaire were similar, 69-87%, 72-87%, and 66-80% at different AHI cutoffs.^{17,19}

A recent meta-analysis of clinical screening tests for OSA identified 26 different clinical prediction tests with 8 in the form of questionnaires, and 18 algorithms, regression models or neural networks.²¹ As a preoperative screening test, the summary recommendation based on ease of use, false negative rate, and test accuracy stated that the STOP-Bang questionnaire was as a user-friendly and excellent method to predict severe OSA (AHI >30) with a diagnostic odds ratio of 142.²¹ The linear scale and the simple acronym make the STOP-Bang practical and easy-to-use in the preoperative setting.

Several other simple screening modalities have been described and may add value to predicting the OSA patient in the preoperative period. The modified Mallampati score assesses the relative tongue size in the oral cavity. A class 3 or 4 modified Mallampati score suggests possible anatomical obstruction and the presence of OSA²² Waist circumference of 102 cm (40 inches) or more also correlated well with increased AHI^{23}

NOCTURNAL OXIMETRY AND HOME SLEEP TESTING

<u>Nocturnal oximetry</u> may be a sensitive and specific tool to detect OSA in surgical patients. Our recent research found that there was a strong correlation between oxygen desaturation index (ODI) from nocturnal oximetry and the AHI from polysomnography.²⁴ ODI > 5, ODI > 15, and ODI > 30 were sensitive and specific predictors for surgical patients with AHI > 5, AHI > 15, or AHI > 30 respectively. The sensitivity was found to be 75–95% and the specificity 67-97%.²⁴

Multichannel home sleep testing is another modality which is easy-to-use and may be accurately performed. It improves access and may be an excellent diagnostic tool for OSA.²⁵

EVALUATION OF SUSPECTED OSA PATIENTS IN THE PREOPERATIVE CLINIC (FIGURE 1)

A patient is at high risk of OSA if ≥ 2 items score positive on the STOP questionnaire, or ≥ 3 items score positive on the STOP-Bang questionnaire (Table 1). Urgent or emergent surgery should not be delayed for the detailed evaluation of suspected OSA. Based on recent research, expert opinion and the collation of various departmental protocols on OSA, a flow diagram for the suggested preoperative evaluation of a suspected OSA patient is outlined in Figure 1.

If the high risk patient is presenting for major elective surgery and has comorbidities suggestive of long-standing severe OSA, the anesthesiologist could consider a preoperative referral to the sleep physician. Subsequently, a formal polysomnography or a multichannel home sleep test may be performed if resources permit. These comorbidities include uncontrolled hypertension, heart failure, arrhythmias, cerebro-vascular disease, morbid obesity and metabolic syndrome. A timely and early consult would be helpful so that the sleep physician may have adequate time to prepare a perioperative management plan, which may include positive airway pressure (PAP) treatment.²⁰ Major elective surgery may have to be deferred in patients with a high clinical suspicion of severe OSA with systemic complications.

It has to be noted that the specificity of these screening tests are in the range of 37-53% for severe OSA. Therefore a fairly high false positive rate exists. Ultimately, the decision for further preoperative testing (e.g. polysomnography) should depend on the clinical judgement and expertise of the attending physician; taking into account the patient-specific and logistical considerations in its totality.

On the other hand, there may be patients who are at high risk on the OSA screening questionnaires, but who are otherwise without significant comorbidities. These patients may be scheduled to undergo minor surgery. In addition, some of them may have had

Phase	Anesthetic Concern	Principles of Management		
PREOPE	RATIVE PERIOD			
	Cardiac arrhythmias and unstable hemo- dynamic profile	Indirect evidence advocating the usefulness of PAP to reduce cardiac arrhythmias, sta- bilize variable blood pressure, and decrease myocardial oxygen consumption.		
	Multisystemic comorbidities	Preoperative risk stratification and patient optimization. Individualized intraoperative anesthetic management tailored to comor- bidities.		
	Sedative premedication	Alpha-2 adrenergic agonist (clonidine, dex- medetomidine) premedication may reduce intraoperative anesthetic requirements and have an opioid-sparing effect.		
	OSA risk stratifica- tion, evaluation and optimization	Preoperative anesthesia consults for symptom evaluation, airway assessment, polysomnography if indicated, and formula- tion of anesthesia management.		
INTRAOPERATIVE PERIOD				
	Difficult intubation (8X more prevalent)	"Sniffing" position. Ramp from scapula to head. Adequate preoxygenation. ASA Difficult Airway Algorithm.		
	Opioid-related respi- ratory depression	Opioid avoidance or minimization. Use of short-acting agents. Regional and multimodal analgesia (NSAIDs, acetaminophen, tramadol, ketamine, gabap- entin, pregabalin, dexamethasone.		
	Carry-over sedation effects from longer- acting intravenous sedatives and inhaled anesthetic agents	Use of propofol for maintenance of anesthesia. Use of insoluble potent anesthetic agents (desflurane).		
	Excessive sedation in monitored anesthetic care	Use of capnography for intraoperative monitoring.		
REVERSAL OF ANESTHESIA				
	Post-extubation airway obstruction and desaturations	Verification of full reversal of neuromuscular blockade. Ensure patient fully conscious and coopera- tive prior to extubation. Semi-upright posture for recovery.		
IMMEDIATE POSTERATIVE PERIOD				
	Suitability for day- case surgery	Lithotripsy, superficial or minor orthopedic surgeries using local or regional techniques may be considered for day surgery. No requirement for high dose postoperative opioids. Transfer arrangement to inpatient facility should be available.		
	Postoperative respiratory event in known and sus- pected high risk OSA patients	Longer monitoring in the PACU. Continuous oximetry monitoring and PAP therapy may be necessary if recurrent PACU respiratory events occur (desaturation, apnea, bradypnea, pain-sedation mismatch).		

Table 3: Perioperative Anesthetic Management of the Patient with Obstructive Sleep Apnea

uneventful general anesthesia in the past. These at riskpatientsmayrepresentfalsepositivesonscreening, or represent patients with mild OSA with AHI < 15. Screening positive on the OSA questionnaires would raise the awareness of the anesthesia healthcare team so that perioperative precautions for possible OSA may be undertaken (Table 3). These patients

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can be assumed as possibly having mild / moderate OSA. If subsequent intraoperative (difficult airway) or postoperative events (postanesthesia care unit recurrent respiratory events) suggest a higher probability of OSA, a polysomnography and a sleep physician referral after surgery may be indicated. More research needs to be done to define the optimal clinical pathways for these surgical patients with increased OSA risk.

Because of the high sensitivity and negative predictive value of the OSA screening tools, the incidence of false negatives would be low. Therefore patients who are at low risk of OSA (<2 on STOP or <3 on STOP-Bang) would not likely have OSA. These patients may be managed with routine perioperative care (Figure 1).

EVALUATION OF KNOWN OSA PATIENTS IN THE PREOPERATIVE CLINIC (FIGURE 1)

In patients who are known to have OSA, the severity of the sleep disorder may be assessed from the patient history or from previous polysomnography



results. Long-standing OSA may have systemic complications, which should be ascertained. These include hypoxemia, hypercarbia, polycythaemia, and cor pulmonale. A simple screening tool in the preoperative clinic may be the pulse oximetry. In our opinion, an oxygen saturation value of < 94% on room air in the absence of other causes should be a red flag for severe long-standing OSA. The presence of comorbidities such as uncontrolled hypertension, arrhythmias, cerebro-vascular disease, heart failure, metabolic syndrome, and obesity should be determined. The use of continuous positive airway pressure or other PAP devices and the compliance to PAP therapy should be assessed for the subgroup of patients who have been prescribed with PAP therapy.

Patients with a known diagnosis of OSA, who have been lost to sleep medicine follow up, have had recent exacerbation of OSA symptoms, have undergone OSA-related airway surgery, or have been non-compliant with PAP treatment, may have to be referred to the sleep physician for reassessment preoperatively. Due consideration should be given for the re-initiation of preoperative PAP in the noncompliant patient, although evidence is lacking in this preoperative context.

Patients with moderate and severe OSA who have been on PAP therapy should continue PAP therapy in the preoperative period.20 Perioperative OSA precautions should be taken (Table 3). Some of these measures would include anticipating possible difficult airways, the use of short-acting anesthetic agents, opioid-avoidance or minimization if possible, full reversal prior to endotracheal extubation, and extubation in a non-supine position. It is unclear from the current literature if mild OSA (AHI >5 – 15) is a significant disease entity. In our opinion, patients with mild OSA would not require preoperative PAP therapy. Mild OSA patients, without respiratory events in the postanesthesia care unit (PACU), may be managed with routine perioperative care.

For all patients with known OSA, there should also be a focus on airway assessment, Mallampati scoring²² and formulation of a perioperative management plan. Patient-specific comorbidities should be assessed and optimized. The anesthesiologist should engage the patient to explore the various anesthetics options and discuss patient-specific risks pertaining to OSA. Sedative premedication should be avoided.

PREOPERATIVE POSITIVE AIRWAY PRESSURE THERAPY

Conventional PAP therapy acts as an airway stent and is the primary treatment for patients with OSA. There are several kinds of PAP devices: continuous positive airway pressure, auto-titrating positive airway pressure, and bi-level positive airway pressure. PAP therapy has been shown to alleviate undesirable symptoms of OSA²⁶ PAP has the potential of reducing cardiac rhythm abnormalities,²⁷ stabilizing variability of blood pressure,²⁸ and improving the hemodynamic profile^{.29} One week of PAP treatment has been shown to improve pharyngeal collapsibility and increase pharyngeal cross-sectional area^{.30} In an 18-year follow-up cohort study, PAP was found to be protective against cardiovascular death and improved survival.⁴

However, high level of evidence is lacking in the perioperative context. It is still unclear if the use of PAP therapy will reduce adverse events attributed to OSA in rigorous randomized controlled trials. Only one study of 53 severe OSA patients undergoing uvulopalatopharyngoplasty with preoperative PAP therapy showed reduction in the surgical risk and perioperative complications.³¹

Taking into account the low level of invasiveness of PAP therapy, its short-term use immediately preoperatively may be considered, particularly in patients with severe OSA²⁰ Based on consensus opinion, patients already on treatment with PAP should be advised to continue the treatment perioperatively, and to bring the PAP device to the hospital on admission. Further research in this area is warranted.

Anesthesiologists should be aware that asymptomatic patients might not easily accept PAP therapy. Appropriate timing for surgery should be a joint decision made by the anesthesiologist, the surgeon, and the patient, weighing the risks of delaying the surgery and the benefits of preoperative OSA investigation and PAP treatment.

OSA AND DIFFICULT AIRWAYS

Upper airway abnormalities, which predispose to OSA, share a similar etiological pathway with difficult airways - mask ventilation and tracheal intubation. Snoring and OSA were found to be independent risk factors for difficult or impossible mask ventilation.³² In a retrospective matched case-control study of 253 patients, difficult intubations was found to occur 8 times as often in the OSA patient versus the control group (21.9% versus 2.6%, p < 0.05). OSA therefore is a risk factor for difficult endotracheal intubation.³³ In another study of more than 1500 patients, OSA, but not the magnitude of the body mass index, was associated with a higher incidence of difficult laryngoscopy.³⁴ In patients undergoing uvulopalatopharyngoplasty, an AHI greater than 40 was a predictor for difficult intubation.35

In support of the strong association between OSA and a difficult airway, the corollary is also true that patients with difficult intubations have a higher risk of being diagnosed with OSA³⁶ In a prospective study looking at the correlation between OSA and difficult intubations, we found that 66% of patients with unexpected difficult intubation were later diagnosed with OSA by polysomnography. Patients with difficult intubation are at high risk for OSA and should be screened for signs and symptoms of sleep apnea and may have to be referred for sleep studies.³⁷

There are several clinical features that the anesthesiologist associates with difficult intubations, which are likewise linked with the propensity for obstruction in the unsupported upper airway during sleep and anesthesia. These include obesity, increased neck circumference,38 limited neck extension, nasal obstruction, a crowded oropharynx (including decreased pharyngeal width, a high Mallampati score, decreased retrolingual airway size,³⁹ an enlarged tongue or tonsils), dental abnormalities, limited mouth opening, hypoplasia of the maxilla or mandible, decreased thyromental distance, and increased mandibular angle. A detailed airway assessment should be performed in the preoperative clinic in anticipation of possible difficult airways.

A variety of airway adjuncts and skilled anesthesia assistance should be made available in advance for dealing with the possible difficult airway. ASA practice guidelines for the management of the difficult airway may be used as a roadmap to assist the anesthesiologist.⁴⁰

PLANNING FOR LOCAL, REGIONAL OR GENERAL ANESTHESIA

The use of local and regional blocks (neuroaxial or peripheral nerve blocks) as a sole anesthetic without sedation may potentially be beneficial to the OSA patient as it circumvents the issue of upper airway patency in the perioperative period. Based on expert opinion and consensus by consultants, ASA guidelines recommend regional anesthesia rather than general anesthesia for peripheral surgery.²⁰ The ASA guidelines however remain equivocal on regarding whether combined regional and general anesthetics techniques are useful.

PLANNING FOR POSTOPERATIVE ANALGESIA

Optimal intraoperative management encompasses knowledge of the problems associated with OSA, and taking measures to minimize the aggravating effects of anesthesia. OSA patients are sensitive to the respiratory depressant effects of anesthetic drugs, in particular opioid analgesic agents. This is largely due to the propensity of airway collapse, sleep deprivation, and blunting of the physiological response to hypercarbia and hypoxia. Therefore avoidance or minimization of the use of longer acting anesthetic drugs should be recommended.

The dangers of opioid use in patients with evidence of a compromised upper airway have been highlighted in several case reports. The use of morphine in OSA patients has been associated with severe respiratory depression and even death.^{41,42} Postoperative oxygen desaturations were 12-14 times more likely to occur in OSA patients receiving oral or parenteral opioids after surgery versus non-opioid analgesic agents.⁴³

A multimodal approach for analgesia is therefore advocated,⁴⁴ where a combination of analgesics

from different classes is used. Medications such as nonsteroidal anti-inflammatory drugs, acetaminophen, tramadol, ketamine, gabapentin, pregabalin, clonidine, and dexamethasone are used to alleviate the opioid-related adverse effects of respiratory depression in susceptible OSA patients. Dexmedetomidine, has been purported in several case reports as having beneficial effects in patients with OSA because of the lack of respiratory depression and opioid-sparing effects in the perioperative period.⁴⁵⁻⁴⁸

The postoperative use of nerve block catheters or epidural catheters with local anesthetics obviates the need for systemic opioid analgesics. This potentially reduces the risk of sedation and upper airway obstruction. However, this is not the case if neuroaxial opioids are administered. The occurrence of sudden postoperative respiratory arrests from epidural opioids has been reported in a case series of three OSA patients.⁴⁹ Likewise, if postoperative systemic strong opioid analgesics are administered after a regional anesthetic, the OSA patient will be at increased risk for respiratory complications.⁵⁰

PLANNING FOR AMBULATORY SURGERY

Controversy exists as to whether OSA patients should be done on an ambulatory basis. ASA guidelines highlighted that superficial surgeries or minor orthopedic surgery using local or regional techniques, and lithotripsy may be done on an ambulatory basis.²⁰ Considerations would include the types of surgeries, the comorbidities, patient age, status (treat versus untreated) and severity of OSA, use of postoperative opioids, type of anesthesia, and the level of home care:²⁰

Based on expert opinion, in the absence of moderate to severe OSA, recurrent postanesthesia care unit respiratory events (apnea, bradypnea, desaturation).51 and the need for strong postoperative opioids for analgesia, patients may be discharged home at the discretion of the attending anesthesiologist (Figure 2). Ambulatory surgical facilities managing OSA patients should have transfer arrangements to an inpatient facility, and be equipped to handle the problems (e.g. difficult airway, postoperative respiratory depression) associated with the OSA patient.

PLANNING FOR IN-PATIENT SURGERY (FIGURE 2)

Depending on the severity of the OSA, the extent of the surgery, and the type of anesthetics administered, and postoperative analgesics required, the patient may shift to the higher end of the risk continuum, increasing the need for step-down care. The anesthesiologist should ensure that a postoperative monitored bed is available for a patient with a high AHI, undergoing major surgery or airway surgery. A monitored bed refers to an environment with continuous oximetry with the possibility of



early nursing intervention (e.g. step-down unit, or general surgical ward near the nursing station, or remote continuous oximetry with telemetry).

After general anesthesia, we recommend that all known OSA patients or suspected OSA patients (positive on screening with STOP or STOP-Bang) should be observed in postanesthesia care unit with continuous pulse oximetry for a longer period than a patient without OSA²⁰ Very often, the decision of whether the patient requires postoperative in-patient monitoring is dependent on the judgement and discretion of the attending anesthesiologist. Based on expert opinion and a collation of various departmental protocols on OSA, we suggest a simple algorithm in Figure 2 to guide the anesthesiologist in making the decision regarding the postoperative disposition of the OSA patient. For all known OSA patients or suspected OSA patients (≥ 2 criteria on STOP, or ≥ 3 criteria on STOP-Bang) who have undergone general anesthesia, we propose an extended PACU observation of at least a 30-60 minute period of time in an unstimulated environment after the patients has met the modified Aldrete criteria for discharge.

To determine whether the known OSA patient or suspected OSA patient requires continuous postoperative monitoring, observation of recurrent PACU respiratory events can be used as a second phase approach to guide further management. A single PACU respiratory event occurs when a patient has apnea for ≥ 10 s (1 episode needed for yes), bradypnoea of < 8 breaths per minute (3 episodes needed for yes), pain-sedation mismatch, or desaturation to < 90% with nasal cannula (3 episodes needed for yes). Recurrent PACU respiratory events occur when any one of the PACU respiratory events occurs in two separate 30 minute time blocks (not necessary to be the same event).⁵¹

Patients who are at high risk of OSA on the screening questionnaires, and have recurrent PACU respiratory events are associated with higher postoperative respiratory complication.⁵¹ It may be prudent to place these patients in a monitored bed postoperatively. Depending on the degree of desaturation, these patients may also require postoperative PAP therapy (Figure 2).

Known OSA patients who have been noncompliant with PAP therapy or have severe OSA (AHI > 30) may have to be fitted with postoperative PAP therapy and cared for in a monitored environment with oximetry, especially if there has been a recurrent PACU respiratory event (Figure 2). Moderate OSA patients (AHI 16-30) requiring postoperative parenteral opioids or higher dose oral opioids (> codeine 60 mg every 4 hourly or equivalent), and without recurrent PACU respiratory events can be managed postoperatively on the surgical ward with continued periodical monitoring (Figure 2). It may also be expedient to place patients requiring postoperative parenteral opioids on supplemental oxygen.52 Mild OSA patients who have undergone minor surgery, without recurrent PACU respiratory events, and without the need for higher dose of oral opioids, may be discharged home (Figure 2).

Newer remote pulse oximetry monitoring devices enable data from a bedside monitor to be continuously streamed wirelessly to a central observation station (e.g. Oxinet[®] III telemetry, Nellcor, Colorado, USA) or paging system. This technology may be useful in the context of postoperative monitoring of OSA patients. Studies are however lacking in this area. This technology potentially allows OSA patients to be cared for postoperatively in the surgical ward instead of the step-down unit, thus lessening caregiver burden.

Recently our research found that OSA patients have more profound increases in AHI after surgery, with a peak on night 3 and returned to preoperative level only on night 7⁵³ Therefore monitoring the OSA patient overnight may not safeguard against all respiratory event in the first postoperative week. Further research on the postoperative management of OSA patients is essential.

CONCLUSION

The OSA patient poses special challenges to the anesthesiologist in the perioperative period. Preoperative evaluation through vigilant screening and formulation of an anesthesia management plan may ameliorate the perioperative morbidity associated with OSA patients.

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