Considerations for patients with obstructive sleep apnea undergoing ambulatory surgery

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Current Opinion in Anesthesiology 2011, 24:605–611

Purpose of review

The purpose of this article is to discuss the anesthetic considerations of obstructive sleep apnea (OSA) patients undergoing ambulatory surgery and the current recommendations based on recent evidence.

Recent findings

It is documented that 75% of patients with high propensity for OSA were not diagnosed prior to ambulatory surgery. An OSA screening questionnaire, the STOP-Bang questionnaire, may be useful to identify patients who have high risk of OSA. Patients with mild-to-moderate OSA with optimized comorbid condition should be able to safely undergo ambulatory surgery. However, severe OSA patients without optimized comorbid conditions are not ideal candidates for ambulatory surgery. Recently, transient oxygen desaturation in postanesthetic care unit has been described in OSA patients with no further increase in unanticipated hospital admission after ambulatory surgery. However, OSA patients undergoing ambulatory upper airway surgery often have lower threshold for hospitalization. A majority of OSA patients are undergoing ambulatory surgery safely. Careful choice of OSA patients, the use of short-acting anesthetic agents with increased perioperative vigilance helps to reduce the adverse cardiopulmonary events in the ambulatory anesthetic settings. Facilities for inpatient admission of OSA patients when necessary should be available. It may not be safe to discharge severe OSA patients who require narcotic analgesics in the postoperative period.

Summary

The recent publications indicated that the majority of OSA patients may be done as ambulatory surgical patients with few adverse events. However, it may not be safe to do patients with severe OSA requiring postoperative narcotics as ambulatory surgical patients.

Keywords

ambulatory surgery, obstructive sleep apnea, screening, STOP-Bang questionnaire, unanticipated admission

Curr Opin Anesthesiol 24:605–611

0952-7907

Introduction

Obstructive sleep apnea (OSA) is the most prevalent breathing disorder during sleep. It is characterized by five or more episodes of apnea, each lasting more than 10 s or causing a drop in oxyhemoglobin saturation of 4% or more from baseline [1,2]. Recently, there has been an increase in the number of patients who have undergone ambulatory surgical procedures in the USA, reaching 35 million in 2009 [3]. Unfortunately, only 10–20% of these patients are diagnosed with OSA preoperatively and optimized. The remaining 80–90% of patients are not diagnosed and, therefore, untreated [4]. These untreated patients may have increased risk of morbidity and mortality due to the lack of preoperative diagnosis [5].

The advantages of ambulatory surgery include convenience to patients and a high level of patient satisfaction. From an economic standpoint, a rapid patient turnover is beneficial [6]. However, the anesthetic care of patients with OSA in ambulatory settings may pose a challenge. OSA patients may exhibit difficult airway and have increased sensitivity to the anesthetic drugs. Also, they may have associated comorbid conditions, which need to be optimized prior to their scheduled surgery.

In a recent prospective study involving 2139 patients undergoing ambulatory surgery, only 4.8% of patients were found to be high risk of OSA and about 75% of patients with high propensity for OSA were not diagnosed prior to ambulatory surgery [7••]. Similarly, patients at high risk of OSA were found to have a higher

incidence of difficult intubation, requirement of medications to control intraoperative hemodynamics when compared with those who were not at risk of OSA.

In this review, we discuss the anesthetic considerations of OSA patients undergoing ambulatory surgery and the current recommendations based on recent evidence.

Prevalence of obstructive sleep apnea

The prevalence of OSA is 9% in women and 24% in men [8]. In a prospective, observational study involving 2877 adult surgical patients, 23.7% of patients were screened high-risk for OSA [9]. Screening of patients prior to surgery using the Berlin and STOP questionnaires detected 24 and 27.5% of patients are at risk of having OSA, respectively [5].

Does obesity alone predispose to obstructive sleep apnea?

Besides obesity, advanced age, and male preponderance, there is a growing body of evidence supporting a higher incidence of OSA with smoking, increased alcohol consumption, craniofacial abnormalities, positive family history and genetic predisposition. In the Wisconsin Sleep cohort study, the current smokers had a greater risk of moderate or higher degree of OSA [odds ratio (OR) 4.44] compared with nonsmokers [10]. Alcohol intake has been shown to prolong apnea duration, suppress arousals, increases frequency of airway obstruction, and worsens the severity of hypoxemia [11]. Cephalometric analysis of 92 participants with a normal-to-severe apnea hypopnea index (AHI) showed that retrognathia and inferiorly positioned hyoid bone contributed to a greater degree of sleep-disordered breathing vs. controls [12]. Finally, genetic studies in OSA patients have estimated a 1.5–2 times risk of OSA in the first-degree relatives of patients with OSA. The latter also highlights the fact that susceptibility to OSA increases directly with the number of affected relatives [13,14].

Key points

- Majority of OSA patients are not diagnosed preoperatively in ambulatory surgical settings.
- The use of STOP-Bang questionnaire may identify the patients at risk of OSA.
- Mild-moderate OSA patients with optimized comorbid conditions not requiring postoperative opioids probably can safely undergo ambulatory surgery.
- Severe OSA patients requiring postoperative opioids are not safe to undergo ambulatory surgery.

Diagnosis and screening of obstructive sleep apnea

Snoring is a primary symptom of OSA and is almost 100% sensitive for the diagnosis. However, when taken alone, it has low specificity and positive-predictive value. Though polysomnography (PSG) is a gold standard in the diagnosis of OSA, it is not practical to perform PSG in all patients as it is expensive, time-consuming and requires trained personnel. Instead, screening tools help in the diagnosis of OSA when a high index of clinical suspicion is present. However, the currently available screening tools have limited specificity despite a high sensitivity in the diagnosis of OSA. A few currently available screening techniques are described in Table 1 [15–18]. It is interesting to note that the highest sensitivity of detecting OSA is seen with STOP-Bang model with nocturnal oximeter technique having the highest specificity among the available screening techniques [17,18].

A recent systematic review of screening questionnaires for OSA evaluated the utility of eight patient-based questionnaires [19••]. The Wisconsin and Berlin questionnaires were found to have the highest sensitivity and specificity, respectively, in predicting the existence of mild OSA (AHI ≥ 5). The STOP-Bang and the Berlin questionnaires were found to have the highest sensitivity and specificity, respectively, in predicting moderate or

Table 1 Screening techniques of obstructive sleep apnea

Variables	Berlin questionnaire	ASA checklist	STOP questionnaire	STOP-Bang questionnaire	Nocturnal oximetry
Authors	Netzer *et al.* [15]	Gross *et al.* [16]	Chung *et al.* [17]	Chung *et al.* [17]	Chung *et al.* [18]
Validation	Primary care and perioperative setting	Perioperative setting	Perioperative setting	Perioperative setting	Perioperative setting
Number of items	10	14	4	8	
High risk of OSA	Positive score of ≥ 2 categories	Positive score of ≥ 2 categories	Positive score ≥ 2	Positive score ≥ 3	ODI >5
AHI ≥ 15					
Sensitivity	79%	79%	74%	93%	76%
Specificity	51%	37%	53%	43%	93%
AHI ≥ 30					
Sensitivity	87%	87%	80%	100%	75%
Specificity	46%	36%	49%	37%	97%

AHI, apnea hypopnea index; ASA, American Society of Anesthesiologists; ODI, Oxygen Desaturation Index; OSA, obstructive sleep apnea.

Table 2 STOP questionnaire

S	Snoring: Do you snore loudly (louder than talking or loud enough to be heard through closed doors?	Y	N
T	Tired: Do you often feel tired, fatigued, or sleepy during the daytime?	Y	N
O	Observed: Has anyone observed you stop breathing during your sleep?	Y	N
P	Blood pressure: Do you have or are you being treated for high blood pressure?	Y	N

High risk of obstructive sleep apnea (OSA): yes to at least two questions; low risk of OSA: yes to less than two questions. Adapted with permission from Ref [17].

severe OSA [15,17]. The STOP questionnaire (Table 2) and STOP-Bang questionnaires (Table 3) were found to have the highest methodological validity, reasonable accuracy, and easy-to-use features [17,19••]. Patients who screen positive on the STOP-Bang questionnaire are more likely to have multiple postoperative complications when compared with those who do not (19.3 vs. 1.3%) [20•]. The STOP-Bang questionnaire with a cutoff of at least 3 is highly sensitive but moderately specific (Table 1) [17]. This means that some patients may be falsely identified to be at risk of OSA. The specificity for AHI more than 30 was more than 88% for STOP-Bang score of at least 6. The OR for AHI more than 15 was 6.29 [95% confidence interval (CI): 3.29–11.66] and more than 30 was 11.55 (95% CI: 4.64–28.71) for a score of 6 vs. a score of 0–2 [17]. Using a higher cutoff of STOP-Bang at least 6 will help to identify the patients truly at risk of moderate-severe OSA [21].

A recent meta-analysis of clinical screening tests for the diagnosis of OSA indicated that a significant proportion of patients with OSA might be missed by the screening questionnaires due to a high degree of heterogeneity and greater likelihood of false-negative results [22]. The use of nocturnal oximeter is an alternate tool in the diagnosis of OSA when PSG is not available. The association between Oxygen Desaturation Index (ODI) from nocturnal oximeter and AHI from PSG in surgical patients has been described. The sensitivity and specificity to predict ODI more than 5 and AHI more than 5 was 95 and 67% respectively. Similarly, the sensitivity for ODI more than 15 to predict moderate–severe OSA (AHI >15) was 76% with a specificity of 93% (Table 1). The specificity to detect severe OSA was 97% [18,23].

Though a wide range of screening techniques are available for the prediction of OSA, the combination of STOP-Bang questionnaire and the nocturnal oximeter may provide the higher sensitivity and specificity required in the diagnosis of OSA [17,18].

Perioperative care of obstructive sleep apnea patients in ambulatory anesthetic setting

There is limited data on the safety of OSA patients undergoing ambulatory surgery. In 2006, the American Society of Anesthesiologists developed guidelines on the perioperative management of OSA patients. This is based mainly on the consensus opinion of the experts, rather than evidence based [16]. A scoring system is proposed to estimate whether an OSA patient would be at increased perioperative risk of complications, and to determine the suitability for ambulatory surgery. It is based on the severity of OSA, the invasiveness of surgery, the type of anesthesia and the need of postoperative opioids. The score range from 0–9 with a score of 3 or less can safely undergo ambulatory surgery.

It is recommended that patients who are at significantly increased risk of perioperative complications (score ≥ 4) are not good candidates for ambulatory surgery. Similarly, patients with mild OSA undergoing superficial or minor surgical procedures under local, regional or general anesthesia, and expected to have minimal postoperative opioid requirement may undergo ambulatory surgery. On the contrary, ambulatory surgery is not recommended in patients undergoing airway surgery or upper abdominal laparoscopic surgery. However, clinical judgment should be used to assess the risk in individual patients [16].

Recently, a functional algorithm describing the management of OSA patients presenting for elective surgery was published [24••,25,26]. Mild-to-moderate OSA patients with optimized comorbid conditions may be able to safely undergo ambulatory surgery. However, severe OSA patients without optimized comorbid conditions are

Table 3 STOP-Bang scoring model

S	Snoring: Do you snore loudly (louder than talking or loud enough to be heard through closed doors?	Y	N
T	Tired: Do you often feel tired, fatigued, or sleepy during the daytime?	Y	N
O	Observed: Has anyone observed you stop breathing during your sleep?	Y	N
P	Blood pressure: Do you have or are you being treated for high blood pressure?	Y	N
B	BMI: BMI more than 35 kg/m^2	Y	N
A	Age: Age over 50 years	Y	N
N	Neck circumference: Neck circumference greater than 40 cm	Y	N
G	Gender: Male	Y	N

High risk of OSA: yes to at least three questions; low risk of OSA: yes to less than three questions. Adapted with permission from [17].

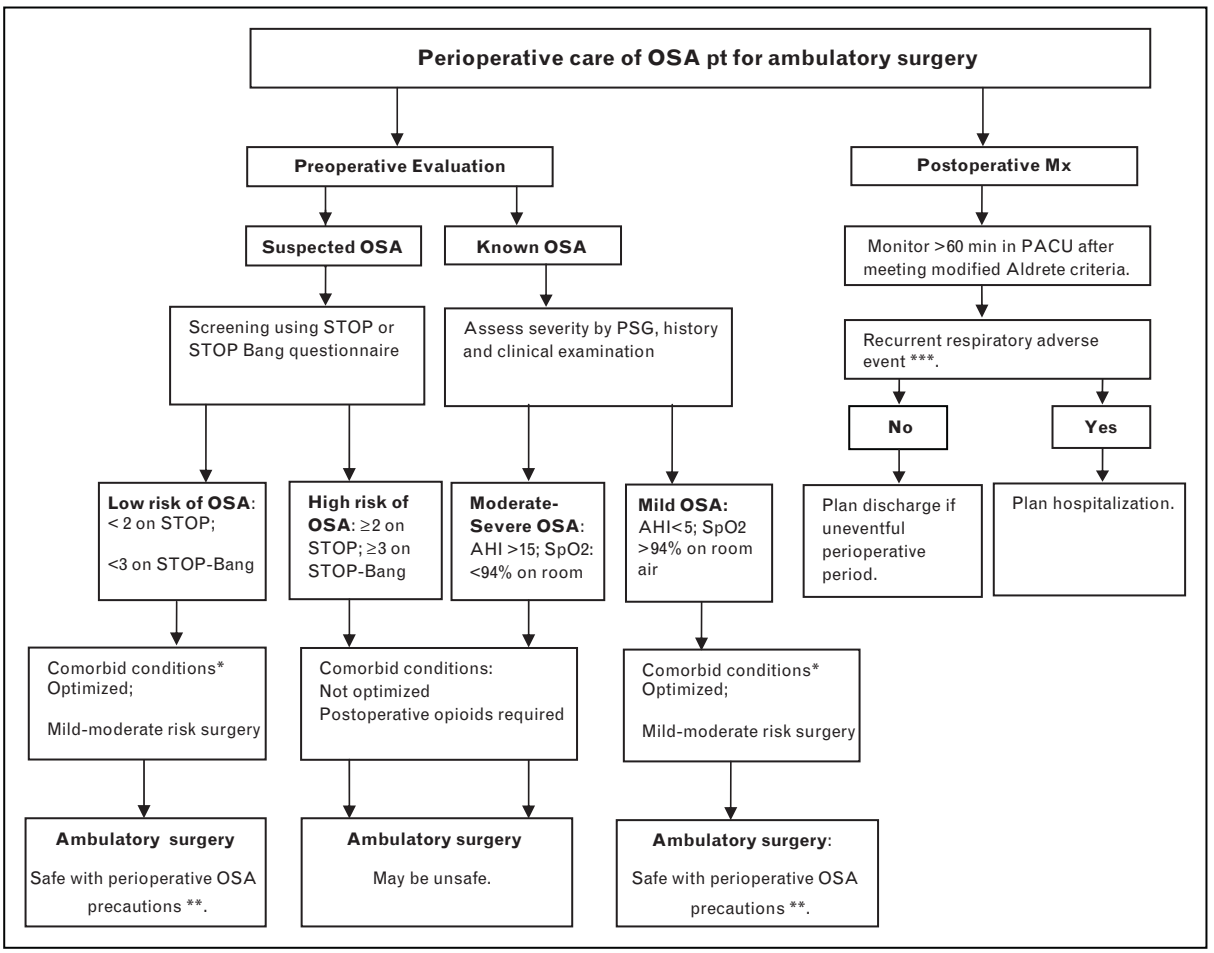
not ideal candidates for ambulatory surgery (Fig. 1) [25,27].

The administration of general anesthesia in OSA patients is often challenging as the administration of sedatives, anesthetics and analgesics could further worsen pharyngeal obstruction in a pre-existing dysfunctional airway. While planning general anesthesia, anticipation of difficult intubation, use of short-acting opioids, propofol and desflurane or sevoflurane will minimize airway related complications [24••]. During emergence, extubating awake with adequate reversal of neuromuscular blockade in a semiupright posture minimizes the incidences of oxygen desaturation in the immediate postoperative period.

In practice, a lot of patients with OSA or at risk of OSA are being done on an ambulatory surgical basis. Patients may be discharged on the same day provided that there is no untreated moderate–severe OSA, no recurrent respiratory adverse events in PACU and minimal requirement of postoperative opioids (Fig. 1). Similarly, it may not be safe for untreated-severe OSA patients requiring postoperative opioids to undergo ambulatory surgery [27]. OSA patients that have recurrent PACU events such as apnea, bradypnea and desaturation are more likely to suffer from postoperative respiratory complications and these patients may require admission to hospital [28].

In a prospective follow-up of 221 OSA patients undergoing noncardiac surgery, higher risk of postoperative complications (OR: 2.7; $P < 0.004$) and respiratory event (OR: 3.5; $P < 0.001$) were described in OSA patients [28]. It is essential that ambulatory surgical settings are equipped to handle the potential problems that may arise while anesthetising the OSA patients. Facilities

Figure 1 Flowchart showing perioperative management of obstructive sleep apnea patient undergoing ambulatory surgery



*, Comorbid conditions: obesity (BMI >35 kg/m^2), metabolic syndrome, cerebrovascular disease, uncontrolled hypertension, arrythmias, and heart failure. **, Perioperative obstructive sleep apnea (OSA) precautions: anticipate possible difficult airway, short acting anesthetic medications, ensure adequate reversal of neuromuscular blockade, extubate in head-up position. ***, recurrent respiratory adverse event: any event occurring more than once in each 30-min evaluation period. It includes one of the following events: oxygen saturation less than 90% on nasal cannula (three episodes), hypopnoea less than 8/min (three episodes), apnea more than 10 s (one episode), pain sedation mismatches (high pain and sedation scores concurrently) [25]. AHI, apnea hypopnea index; Mx, management; PACU, post anaesthetic care unit; PSG, polysomnography.

for inpatient admission when necessary should be available. The final decision as to whether the patient requires postoperative monitoring and hospitalization after ambulatory surgery should be based on the judgement and discretion of the attending anesthesiologist.

Outcome of obstructive sleep apnea patients undergoing ambulatory surgery

There are a few studies in the literature regarding postoperative complications in OSA patients undergoing ambulatory surgery. In a prospective cohort study of 103 patients for ambulatory surgery, those patients with greater propensity to OSA had increase in numbers of laryngoscopy attempts, difficult laryngoscopic grade view and the use of fibreoptic intubation. The use of intraoperative ephedrine, metoprolol and labetalol were greater in OSA patients than those with fewer propensities to OSA. Postoperatively, the oxygen requirement was greater in patients with propensity to OSA. However, there was no difference in unanticipated hospital admission between the two groups [7••].

In a prospective cohort of 131 patients undergoing ambulatory colonoscopic procedure, 18.3% patients were retrospectively diagnosed as having moderate–severe OSA. These patients had a significant history of snoring, apnea at night and higher BMI vs. patients without snoring [29]. In another retrospective chart review involving 234 OSA patients undergoing ambulatory surgery, there was no difference in the incidence of postoperative complications and unanticipated hospital admission [30].

In a retrospective chart review of 206 OSA patients undergoing ambulatory orthopedic surgery, 34% of OSA patients had oxygen desaturation less than 95% in postanesthesia care unit [31•]. The authors emphasised that a higher incidence was noticed with associated chronic obstructive pulmonary disease (OR: 3.64; 95% CI: 1.03–12.88) and upper extremity procedures (OR: 2.53; 95% CI 1.36–4.68).

Transient oxygen desaturation less than 93% was described in 39.5% OSA patients undergoing outpatient laparoscopic gastric banding surgeries [32•]. However, there was no respiratory failure requiring reintubation or unanticipated hospital admission in these patients postoperatively.

All these studies indicated that patients with OSA are undergoing ambulatory surgery with a very good safety record. Careful choice of OSA patients, the use of short-acting anesthetic agents, with increased perioperative vigilance will minimize the adverse cardiopulmonary events in the ambulatory anesthetic settings.

Unanticipated admissions in obstructive sleep apnea patients

The incidence of unanticipated hospital admission in ambulatory surgery is 1–2% [33]. However, there is limited data on the incidence of unanticipated hospital admission in OSA patients undergoing ambulatory surgery.

In OSA patients undergoing outpatient upper airway surgery, a greater incidence of unanticipated hospital admission in the postoperative period has been described. In a prospective cohort involving 110 OSA patients undergoing ambulatory uvulopalatopharyngoplasty, desaturation requiring hospital admission was seen in 3% of patients [34].

In a recent prospective cohort involving 2139 patients with 103 OSA patients, there was no relationship between unplanned hospital admission and patients with increased risk of OSA [7••]. Similarly, a retrospective analysis of 234 OSA patients undergoing outpatient surgical procedures in a tertiary referral centre, the preoperative diagnosis of OSA was not a risk factor for unanticipated hospital admission or other adverse events [30]. Although no significant increase in unanticipated hospital admission was shown in these studies, the number of OSA patients studied was small. Also there may be undiagnosed OSA patients in the control group. Further studies are needed.

Outcomes of obstructive sleep apnea patients undergoing inpatient surgery

A number of studies showed that higher postoperative complications occurred in OSA patients vs. non-OSA patients having inpatient surgeries. A recent large retrospective cohort study involving 65 774 OSA patients undergoing orthopedic procedures and 51 509 OSA patients undergoing general surgical procedures described that OSA patients had significantly higher pulmonary complications including aspiration pneumonia, acute respiratory distress syndrome, and difficult intubation and/or mechanical ventilation [35••]. In a prospective cohort study of 147 OSA patients, higher oxygen desaturation vs. control was documented [5].

A retrospective matched cohort study involving 240 OSA undergoing elective surgery, patients showed a higher incidence of postoperative complications (44 vs. 28%) [36]. In another retrospective chart review involving 37 OSA patients undergoing cardiac surgery, a higher incidence of encephalopathy, postoperative infection and prolonged ICU stay was documented in OSA patients when compared with non-OSA patients [37].

In a case control study involving 101 OSA patients undergoing knee or hip replacement surgeries, serious complications occurred in OSA group (24 vs.9%) [38]. Hence, OSA patients undergoing inpatient surgeries had higher postoperative complications in hospital when compared with non-OSA patients.

Conclusion

In the ambulatory anesthetic setting, OSA patients may present a challenge for anesthesiologists. At present, most patients with OSA are undergoing ambulatory surgery safely. Although patients with OSA are at risk for a multitude of increased perioperative complications, the use of the STOP-Bang questionnaire may identify the patients at risk of OSA and help us to be on a higher alert to deliver well tolerated anesthesia in ambulatory settings. Careful choice of OSA patients, the use of short-acting anesthetic agents with increased perioperative vigilance helps to reduce the adverse cardiopulmonary events in the ambulatory anesthetic settings. Facilities for inpatient admission of OSA patients when necessary should be available. It may not be safe to undergo patients with severe OSA requiring postoperative narcotic as ambulatory surgical patients.

Acknowledgement

Funding was received from the Department of Anesthesia, Toronto Western Hospital, University Health Network, University of Toronto, Toronto, Ontario, Canada.

Conflicts of interest

There are no conflicts of interest.

References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:

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Additional references related to this topic can also be found in the Current World Literature section in this issue (pp. 705–707).

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