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Society for Ambulatory Anesthesia Consensus Statement on Preoperative Selection of Adult Patients with Obstructive Sleep Apnea Scheduled for Ambulatory Surgery

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The suitability of ambulatory surgery for a patient with obstructive sleep apnea (OSA) remains controversial because of concerns of increased perioperative complications including postdischarge death. Therefore, a Society for Ambulatory Anesthesia task force on practice guidelines developed a consensus statement for the selection of patients with OSA scheduled for ambulatory surgery. A systematic review of the literature was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. Although the studies evaluating perioperative outcome in OSA patients undergoing ambulatory surgery are sparse and of limited quality, they do provide useful information that can guide clinical practice. Patients with a known diagnosis of OSA and optimized comorbid medical conditions can be considered for ambulatory surgery, if they are able to use a continuous positive airway pressure device in the postoperative period. Patients with a presumed diagnosis of OSA, based on screening tools such as the STOP–Bang questionnaire, and with optimized comorbid conditions, can be considered for ambulatory surgery, if postoperative pain can be managed predominantly with nonopioid analgesic techniques. On the other hand, OSA patients with nonoptimized comorbid medical conditions may not be good candidates for ambulatory surgery. What other guidelines are available on this topic? The American Society of Anesthesiologists (ASA) practice guidelines for management of surgical patients with OSA published in 2006. Why was this guideline developed? The ASA guidelines are outdated because several recent studies provide new information such as validated screening tools for clinical diagnosis of OSA and safety of ambulatory laparoscopic bariatric surgery in OSA patients. Therefore, an update on the selection of patients with OSA undergoing ambulatory surgery is warranted. How does this guideline differ from existing guidelines? Unlike the ASA guidelines, this consensus statement recommends the use of the STOP–Bang criteria for preoperative OSA screening and considers patients' comorbid conditions in the patient selection process. Also, current literature does not support the ASA recommendations that upper abdominal procedures are not appropriate for ambulatory surgery. Why does this guideline differ from existing guidelines? This consensus statement differs from existing ASA guidelines because of the availability of new evidence. (Anesth Analg 2012;115:1060–8)

Obstructive sleep apnea (OSA) is a relatively common sleep-related breathing disorder that is associated with significant consequences such as daytime sleepiness, neurocognitive dysfunction, cardiovascular disorders (e.g., hypertension, ischemic heart disease, arrhythmia, pulmonary hypertension, and congestive heart failure), metabolic dysfunction, and impaired quality of life.[1–5] The prevalence of OSA is increasing[6] and is reported to be higher in the surgical population than in the general population.[7] With the increase in prevalence of OSA as well as the increase in surgical procedures performed on an outpatient basis, anesthesiologists will increasingly encounter patients with OSA in the ambulatory setting. However, the suitability of ambulatory surgery in patients with OSA remains controversial because of the concerns of increased perioperative complications (Table 1). Therefore, members of the Society for Ambulatory Anesthesia requested the Task Force on Clinical Practice Guidelines to develop a consensus statement for the optimal selection of OSA patients undergoing ambulatory surgery (Appendix 1).

WHAT GUIDELINE OR STATEMENTS ARE AVAILABLE ON THIS TOPIC?

In 2006, the American Society of Anesthesiologists (ASA) published practice guidelines for management of surgical

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Table 1. Concerns with Obstructive Sleep Apnea Patients Undergoing Ambulatory Surgery

Intraoperative	Difficult/failed mask ventilation and/or tracheal intubation.
	Difficulty maintaining adequate oxygen saturation.
Immediate postoperative	Delayed extubation.
	Obstruction and/or desaturation after extubation.
	Postobstructive pulmonary edema.
	Need for tracheal reintubation.
	Exacerbation of cardiac comorbidities: hypertension, arrhythmias, myocardial ischemia and infarction, pulmonary hypertension, heart failure.
	Cerebrovascular disorders (e.g., stroke).
	Prolonged postanesthesia care unit stay.
	Delayed discharge home.
	Unanticipated hospital admission.
Postdischarge	Readmission after discharge.
	Hypoxic brain death and death.

patients with OSA, including patient selection for ambulatory surgery.[4] These guidelines recommended preoperative assessment for presence of OSA and proposed a checklist consisting of 12 items as a routine screening tool.[4] In addition, the guidelines proposed a scoring system based upon the severity of OSA, the invasiveness of the surgery, the type of anesthetic technique, and the need for postoperative opioids.[4] This scoring system has not yet been validated. Furthermore, the guidelines recommended that upper abdominal procedures and airway procedures are not suitable for ambulatory setting.

WHY WAS THIS STATEMENT DEVELOPED?

Since the publication of the ASA guidelines, several studies have been published that provide validated screening tools for OSA surgical patients that identify patients who are likely to develop postoperative complications.[8–11] In addition, studies assessing perioperative complications after ambulatory surgery in OSA patients, including those undergoing laparoscopic bariatric surgery and upper airway surgery, have been published.[12–18] Therefore, a systematic review of published literature evaluating the perioperative complications in OSA patients undergoing ambulatory surgery was performed. The preoperative factors that may influence the perioperative outcome (e.g., severity of OSA, coexisting medical conditions, and invasiveness of the surgical procedure) were assessed. On the basis of the systematic review, it was determined that the ASA guidelines were outdated and required updating.

The purpose of this consensus statement was to provide guidance for the appropriate selection of OSA patients scheduled for ambulatory surgery, with the aim of reducing perioperative complications. Of note, other sleep disorders were not evaluated. Also, intraoperative and postoperative care in OSA patients was not evaluated. In approving this consensus statement a similar process was used as previously approved by the Society for Ambulatory Anesthesia Board of Directors.[19,20]

METHODS

A systematic review of the literature addressing the selection of adult patients with OSA scheduled for ambulatory surgery was conducted. The literature search was performed according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines using the Cochrane CENTRAL Register of Controlled Trials (first quarter 2011), Cochrane Database of Systematic Reviews (2005 through January 2011), MEDLINE (R) (1948 through February 2011), and EMBASE (1980 through February 2011).[21] A reference librarian familiar with literature search protocol of the Cochrane Collaboration conducted the electronic search strategy with input from members of the consensus panel. The key words used for the literature search included "ambulatory surgery," "ambulatory anesthesia," "patient selection," "obstructive sleep apnea," "sleep apnea," and "postoperative complications." The medical subject heading index terms on Medline were "ambulatory surgery," "patient selection," "preoperative assessment," and "postoperative complications." We also used "obstructive sleep apnea," "screening," "patient selection," "ambulatory anesthesia," "perioperative management," and "anesthetics" as index terms to capture data relating to themes of "ambulatory surgery or anesthesia," "patient selection," "obstructive sleep apnea," "hospital admission," and "postoperative complications." We hand-searched reference lists from the retrieved articles to identify further trials. The search was limited to English language and human trials in adults. Finally, duplicate records were deleted.

The search results were screened in a stepwise manner to identify eligible studies. Two reviewers independently assessed titles, abstracts, and full-text papers retrieved from the electronic database and manual searches for possible inclusion according to the predefined selection criteria. Other authors resolved any disagreements between the reviewers. In the first phase of the review, irrelevant articles were excluded by reviewing the title of the search results. In the next phase, the abstracts and full-text articles were evaluated to determine whether the eligibility criteria were met. The number and reason of excluded studies in this step were recorded.

All randomized controlled trials, prospective observational trials, and retrospective trials were eligible for inclusion if they reported intraoperative adverse events, postoperative complications, hospital admission, and mortality rates in adult OSA patients undergoing ambulatory surgery. Studies not reporting at least one of these outcomes were excluded. All included studies were graded for strength of evidence according to the Scottish Intercollegiate Guideline Network[a] (Table 2). Data extracted from these studies included type of study, level of evidence, demographic data, associated comorbid conditions, method of OSA diagnosis, type of procedure, type of anesthetic technique, intraoperative and postoperative events, unanticipated hospital admission, and mortality after ambulatory surgery in OSA patients.

The ensuing recommendations were formulated by a working group using the Delphi method to collate rounds

[a] Scottish Intercollegiate Guidelines Network. SIGN 50: a guideline developer's handbook. Available at: www.sign.ac.uk/methodology/index.html. Accessed August 4, 2011.

Table 2. Levels of Evidence Used to Rate Individual Studies

I++	High-quality meta-analyses, systematic reviews of RCTs, or RCTs with a very low risk of bias.
I+	Well-conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias.
I–	Meta-analyses, systematic reviews of RCTs, or RCTs with a high risk of bias.
II++	High-quality systematic reviews of case-control or cohort studies. High-quality case-control or cohort studies with a very low risk of confounding or bias and a moderate probability that the relationship is causal.
II+	Well-conducted case-control or cohort studies with a low risk of confounding or bias and a high probability that the relationship is causal.
II–	Case-control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal.
III	Nonanalytic studies (e.g., case reports, case series).

From Scottish Intercollegiate Guidelines Network. SIGN 50: a guideline developer's handbook. Available at: www.sign.ac.uk/methodology/index.html. Accessed August 4, 2011. RCT = randomized controlled trials.

Table 3. Level of Evidence Used to Provide Recommendations

Category 1	High-level evidence (i.e., high-powered randomized clinical trials or meta-analyses), and the panel has reached uniform (near unanimous) consensus.
Category 2A	Lower-level evidence (phase II or large-cohort studies), but despite the absence of higher-level studies, there is uniform consensus that the recommendation is appropriate. It is assumed that these recommendations may be modified as higher-level evidence becomes available.
Category 2B	Lower-level evidence, and there is nonuniform consensus that the recommendation should be made. This suggests to the practitioner that there could be more than one approach to the question in statement.
Category 3	A major disagreement among the panel members. The level of evidence is not pertinent in this category, because experts can disagree about the significance of high-level trials. This category directs the practitioners that there is a major interpretation issue in the data and directs them to the manuscript for an explanation of the controversy.

of individual comments on the evidence.[22] The recommendations were based on data obtained from the outpatient surgical population as well as the application of general principles of safe perioperative care. The benefits and risks of interventions and clinical practice information were considered to ensure that the recommendations preserved patient safety, clinical validity, and usefulness. We used the Grading of Recommendations, Assessment, Development, and Evaluation system for grading the recommendations.[23] The strength of recommendations was graded either as "strong" or "weak." A strong recommendation was offered when the desirable effects of an intervention either clearly did or did not outweigh the undesirable effects. A weak recommendation was offered if the overall effects were less certain, because the evidence was of low quality, or the evidence suggested that desirable and undesirable effects were closely balanced. The categories of evidence were based upon the level of evidence and agreement among the members of the consensus panel (Table 3).

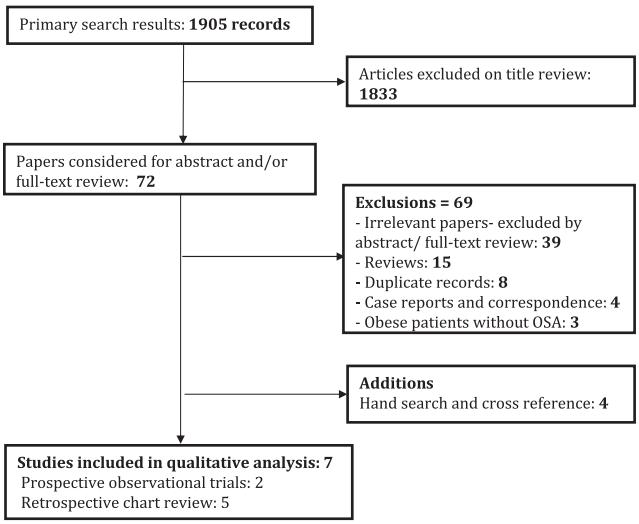


Figure 1. Flowchart of the literature search and study selection. Numbers in boldface type are to be added up; other numbers may overlap. RCT = randomized controlled trials; CCTR = Cochrane Controlled Trials Register; OSA = obstructive sleep apnea.

RESULTS

The Quality of Reporting of Meta-Analysis (PRISMA) guidelines were followed for the description of this study. Our search strategy yielded 1905 articles. However, 1833 irrelevant studies were excluded after title review, leaving 72 studies for consideration. Subsequently, 69 studies were excluded for reasons given in Figure 1. In addition to the 3 studies identified through literature search, 4 articles were added after hand-searching and cross-referencing. Of the 7 studies included,[12–18] 2 were prospective cohorts[13,16] and 5 were retrospective chart reviews.[12,14,15,17,18] Three of the 7 studies did not have a non-OSA group for comparison.[14,15,17] A total of 1491 OSA patients, 2036 low-risk OSA patients, and 2095 non-OSA patients were included in the selected studies. Data from the included studies are summarized in Tables 4 and 5.

A wide variety of ambulatory surgical procedures such as general surgery, orthopedic surgery, laparoscopic bariatric surgery, and upper airway surgery were included in the assessed trials. In comparison with non-OSA patients, OSA patients had a higher body mass index and more comorbidities, including diabetes, hypertension, stroke, myocardial infarction, and congestive heart failure ($P < 0.05$) (Table 4).

None of the included studies reported anesthesia-related mortality, as adjudicated by the research groups. There appears to be no correlation between the occurrence of these "surrogate" adverse events (e.g., desaturation, need for supplemental oxygen, need for additional monitoring, and atelectasis) and clinically significant adverse outcomes such as the need for a surgical airway, incidence of anoxic brain injury, delayed discharge, unanticipated hospital admission, and death. Although

Table 4. Demographic Data of Obstructive Sleep Apnea (OSA) Patients Undergoing Ambulatory Surgery

Study	Design	LOE	Diagnosis of OSA	Number of patients	Age (years)	Male gender	BMI (kg/m²)	Comorbid conditions
Kurrek 2011[12]	Retrospective chart review	II–	Preoperative OSA diagnosis on CPAP or STOP–Bang questionnaire	746 OSA vs. 1624 non-OSA	53 ± 9 (OSA) vs. 46 ± 11 (all)	38% (OSA) vs. 18% (all)	45 ± 8 (OSA) vs. 43 ± 8 (all)	HTN (71% in OSA vs. 31% in all), DM (30% in OSA vs.14% in all)
Stierer 2010[13]	Prospective cohort	II+	Screening questionnaire using frequency of sleep-related symptoms (e.g., snoring, witness apneas) recorded on a 6-point Likert scale (never, rarely, sometimes, often, usually, and always)	103 high risk of OSA vs. 2036 low risk of OSA	59 ± 15 (high risk of OSA) vs. 48 ± 16 (low risk of OSA), $P < 0.05$	10% (high risk of OSA)	40 ± 8 (high risk of OSA) vs. 27 ± 6 (low risk of OSA), $P < 0.05$	History of MI, stroke, and CHF was higher in high-risk OSA group, $P < 0.05$
Liu 2010[14]	Retrospective chart review	II–	ICD-9 codes for diagnosis of OSA (codes 327.23 and 780.57)	206 OSA	56 (mean, all)	78% (all)	34 ± 6 (all)	NA
Hathaway 2006[15]	Retrospective chart review	II–	PSG	110 OSA	44 (19–71)	89%	32 (20–61)	NA
Watkins 2005[16]	Prospective cohort	II+	Screening questionnaire included witnessed apnea, neck circumference [mt]43 cm, males with diabetes	106 OSA vs. 237 non-OSA	44 ± 10 (All) vs. OSA–NA	11% (all) vs. NA (OSA)	45 ± 6 vs. NA (OSA)	DM 15% in all (NA in OSA)
Kieff 2004[17]	Retrospective chart review	II–	PSG	86 OSA; 27% outpatients (i.e., overnight stay). No difference in OSA severity between outpatients and inpatients	46 (18–64, outpatients) vs. 48 (range 26–83, inpatients)	21% (outpatient) vs. 64% (inpatient)	29 (25–35, outpatients) vs. 33 (range 28–35, inpatients)	CAD, COPD, DM; details not available
Sabers 2003[18]	Retrospective chart review	II–	PSG	234 OSA vs. 234 Controls	57 ± 13 (OSA) vs. 57 ± 13 (control)	73% (OSA) vs. 73% (control)	36 ± 7 (OSA) vs. 34 ± 7 (control), $P < 0.001$	DM 12% (OSA) vs. 5% (control) ($P = 0.01$) and HTN 43% (OSA) vs. 26% (control) ($P < 0.001$)

Values are mean ± standard deviation or mean (range). A total of 1491 OSA patients, 2036 low-risk OSA patients, and 2095 non-OSA patients were included the selected studies. NA = not available; CPAP = continuous positive airway pressure; LOE = level of evidence; PSG = polysomnography; BMI = body mass index; DM = diabetes mellitus; HTN = hypertension; CAD = coronary artery disease; MI = myocardial infarction; CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease.

Table 5. Perioperative Outcome in Obstructive Sleep Apnea (OSA) Patients Undergoing Ambulatory Surgery

Study	Surgical procedure	Anesthetic techniques	Intraoperative complications	Postoperative complications (in facility and postdischarge)	Hospital admission
Kurrek 2011[12]	Laparoscopic gastric banding	GA	NA	Transient desaturation (SaO_2 < 93%): 39.5% (OSA) vs. 29.8% (all patients), *P* = NA No respiratory failure or reintubation, no difference in duration of PACU stay	One unplanned admission due to severe nausea from gastric obstruction, 0.5% readmission within 30 days all due to surgical causes
Stierer 2010[13]	General surgery	GA = 24%, RA = 50%, MAC = 26%, *P* < 0.001	↑ laryngoscopy attempts (*P* = 0.001)	↑ in O_2 requirement (*P* < 0.02)	24% (high risk of OSA) vs.17% (low risk of OSA), *P* = NS
			↑ difficult laryngoscopic view grade (P < 0.001)	Tachycardia (P < 0.03)	
			↑ use of FOB (*P* = 0.01)	No difference in need for ventilatory assistance (*P* = NS) or reintubation (*P* = NS)	
			↑ ephedrine (*P* < 0.001) ↑ metoprolol (*P* = 0.003) ↑ labetalol (*P* < 0.001)		
Liu 2010[14]	Orthopedic surgery	GA = 5%	NA	No serious complications. All patients stayed overnight and received supplemental nasal O_2 at 2 L/min	14% admitted after overnight stay (no difference in patients with or without hypoxemia). No anesthesia-related reasons. No readmissions
		GA + RA = 3%		↑ hypoxemia (SaO_2 ≤ 95%) in patients with COPD (OR: 3.64 [95% CI = 1.03–12.88]) and those undergoing upper extremity procedure under regional anesthesia (OR: 2.53 [95% CI = 1.36–4.68])	
		RA = 92%		Hypoxemia group required supplemental O_2 (37% vs.16%) (*P* < 0.05), No difference in hypoxemia with or without CPAP use No correlation between postoperative hypoxemia and adverse events, Postdischarge complications = NA	
Hathaway 2006[15]	Uvulopalatopharyngoplasty ± tonsillectomy, septoplasty, supraglottoplasty	GA	NA	10% patients had minor complications postdischarge, all surgical related	18% admitted [3% because of desaturation, 7% for limited oral intake, 3% for nausea, 0.1% for anticoagulation, and 5% for lack of escort] Higher hospital admission after nasal surgery (P < 0.02). No correlation between OSA severity and admission rate
Watkins 2005[16]	Laparoscopic gastric banding	GA	NA	No anesthesia-related complications; 2.8% surgical complications. No postdischarge complications	3 patients hospitalized because of postoperative nausea, blood in nasogastric tube, and stoma occlusion
Kieff 2004[17]	Uvulopalatopharyngoplasty	GA	NA	Lowest SaO_2 85% (range 75%–94% outpatient) vs. 82% range 74%–88% (inpatient), *P* = 0.007 No airway compromise, no cardiopulmonary events in immediate postoperative period or postdischarge	None in outpatients; 4.8% surgical complications in inpatients
Sabers 2003[18]	General surgery	GA = 86%, RA = 14%	No differences in intraoperative variables	Postoperative complications: 2.1% (OSA) vs. 1.3% (control), OR = 1.7; 95% CI: 0.4–7.0, *P* = NS Postdischarge complications = NA	23.9% (OSA) vs 18.8% (control), OR = 1.4; 95% CI: 0.8–2.5, *P* = NS

A total of 1491 OSA patients, 2036 low-risk OSA patients, and 2095 non-OSA patients were included the selected studies. NA = not available; NS = not significant; OR = odds ratio; CI = confidence interval; GA = general anesthesia; RA = regional anesthesia; MAC = monitored anesthesia care; PACU = postanesthesia care unit; SaO_2 = oxygen saturation; O_2 = oxygen; COPD = chronic obstructive pulmonary disease; FOB = fiberoptic intubation; CPAP = continuous positive airway pressure.

Table 6. STOP–Bang Questionnaire Used to Screen Patients to Determine the Risk of Obstructive Sleep Apnea (OSA)[8]

S = Snoring. Do you snore loudly (louder than talking or loud enough to be heard through closed doors)?
T = Tiredness. Do you often feel tired, fatigued, or sleepy during daytime?
O = Observed apnea. Has anyone observed you stop breathing during your sleep?
P = Pressure. Do you have or are you being treated for high blood pressure?
B = BMI > 35 kg/m^2
A = Age > 50 years
N = Neck circumference > 40 cm
G = Male gender

From Hathaway, 2006.[15] Fewer than 3 questions positive = low risk of OSA; 3 or more questions positive: high risk of OSA; 5 to 8 questions positive: high probability of moderate-to-severe OSA.[11]

several studies reported a higher incidence of postoperative hypoxemia in the OSA population, none of the studies observed differences in the need for ventilatory assistance or reintubation.

The limitations of the trials include use of varying approaches to diagnose OSA such as polysomnography, validated screening questionnaires, presence of symptoms suggestive of OSA, and administrative data (i.e., ICD-9 codes for diagnosis of OSA). Also, the control group, when included, had not undergone a polysomnography or a validated screening questionnaire to exclude OSA. Instead the authors used the absence of clinical symptoms such as daytime hypersomnolence to assume the absence of OSA. In addition, there were significant variations in the definition of complications (e.g., hypoxemia was defined as oxygen saturation [SaO_2] ≤95% or ≤90% or need for supplemental oxygen, which was provided at varying levels of desaturation). Similarly, varying definitions of difficult tracheal intubation were used (e.g., increased laryngoscopy attempts and difficult tracheal view). Despite several limitations, the included studies provide useful information that can guide clinical care.

DISCUSSION

This systematic review has resulted in several recommendations that are contradictory to the ASA OSA guidelines.[4] In contrast to the ASA guidelines that recommend the use of a checklist for preoperative screening for OSA,[24] the STOP–Bang screening questionnaire (Table 6) is preferred because it is simple to administer.[8,9] The STOP–Bang tool has high sensitivity, and its low specificity can be improved by using a greater number of positive indicators (e.g., ≥6) rather than a cutoff ≥3 as originally suggested.[10] Recent evidence suggests that the higher the cumulative score of risk factors on the STOP–Bang tool, the greater the probability of severe OSA.[10,11] In addition, the STOP–Bang tool might provide some indication of the severity of OSA.

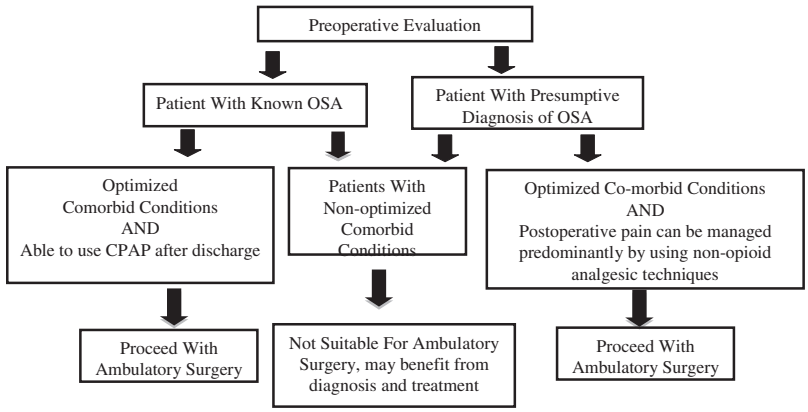
Similar to the ASA guidelines, we recommend that if OSA is suspected during the preoperative evaluation, one could proceed with an assumption that the patient has OSA (i.e., presumptive diagnosis of OSA) because there is no clear evidence to suggest that a sleep study and preoperative continuous positive airway pressure (CPAP) or bilevel positive airway pressure (BiPAP) use would improve the perioperative outcome.[b] Also, the optimal duration of CPAP or bilevel positive airway pressure (BiPAP) therapy before proceeding with elective surgical procedures is unknown.

In outpatients with an established diagnosis of OSA (either by a sleep study or presumptive diagnosis), an adverse perioperative outcome is associated with a complex interplay of factors, particularly coexisting medical conditions and the use of opioids (Fig. 2). Patients with nonoptimized comorbid medical conditions may not be good candidates for ambulatory surgery. We agree with the ASA guidelines that opioids have a significant propensity to exacerbate OSA and prevent arousal.[25] Therefore, painful ambulatory surgery may not be suitable if postoperative pain relief cannot be predominantly provided with nonopioid analgesic techniques.[26] Local/regional analgesia, acetaminophen, and nonsteroidal anti-inflammatory drugs or cyclooxygenase-2 specific inhibitors should be used as primary analgesic techniques. Combinations of acetaminophen and nonsteroidal anti-inflammatory drugs or cyclooxygenase-2 specific inhibitors have been reported to offer superior analgesia in comparison with either drug alone.[27,28] Also, dexamethasone has significant analgesic and opioid-sparing efficacy.[29] Preoperative discussion with the surgeons regarding plans for postdischarge pain therapy should assist with this determination.

In the included studies a majority of the OSA patients used CPAP or BiPAP postoperatively, which may have contributed to a safe perioperative course. Thus, patients' ability to follow postdischarge instructions, particularly compliance with CPAP, appears to be critical. Therefore, patients with a known diagnosis of OSA and optimized comorbid conditions can be considered for ambulatory surgery if they are able to use a CPAP device in the postoperative period (Fig. 2). Patients who are unable or unwilling to use CPAP after discharge may not be appropriate for ambulatory surgery. Patients with a presumed diagnosis of OSA and optimized comorbid conditions can be considered for most types of ambulatory surgery, if postoperative pain relief can be provided predominantly with nonopioid analgesic techniques.[4] In contrast to the ASA OSA guidelines, laparoscopic upper abdominal procedures may be safely performed on an outpatient basis provided the perioperative precautions are followed. No guidance can be provided for OSA patients undergoing upper airway surgery because of limited evidence.

It is necessary to educate surgeons, patients, and their family (or caregivers) regarding the need for increased vigilance after discharge home. Patients and their families should be informed of the potential for hospital admission, which may give them an opportunity to plan in advance and make appropriate arrangements if necessary. Patients receiving preoperative CPAP should be instructed to bring their CPAP device to the ambulatory care facility, unless

[b]Centers for Medicare and Medicaid Services. Decision memo for sleep testing for obstructive sleep apnea. Available at: http://www.cms.hhs.gov/mcd/viewdecisionmemo.asp?id=227. Accessed August 2011.



Preoperative Considerations:

- Comorbid conditions include hypertension, arrhythmias, heart failure, cerebrovascular disease, and metabolic syndrome.
- If OSA is suspected during the preoperative evaluation, one could proceed with a presumptive diagnosis of OSA albeit with caution.
- Educate surgeon, patient and family (see the text for details)

Intraoperative Considerations:

- Non-opioid analgesic techniques, when possible.

Postoperative Considerations:

- Exercise caution in OSA patients who develop prolonged and frequent severe respiratory events (e.g., sedation analgesic mismatch, desaturation, and apneic episodes) in the postoperative period.

Figure 2. Decision making in preoperative selection of a patient with obstructive sleep apnea scheduled for ambulatory surgery. OSA = obstructive sleep apnea; CPAP = continuous positive airway pressure.

one is available at the facility. Patients receiving preoperative CPAP should be advised to use their CPAP device for several days postoperatively, because the potential risks can last for several days after surgery. In addition to the usual nocturnal CPAP use, patients should be advised to use CPAP whenever sleeping, even during the daytime. Also, patients should be advised against sleeping in the supine position. Patients who are assumed to have OSA on the basis of the screening questionnaire should be advised to follow up with their primary physician for possible sleep study. Finally, the deleterious effects of opioids must be emphasized, and patients should be asked to limit opioid use.

This review has identified several areas for future research in which current data are insufficient or conflicting. There is a need for large, adequately powered, well-designed prospective trials to assess the suitability of OSA patients for ambulatory surgery. These studies must assess clinically significant outcomes (e.g., need for a surgical airway, incidence of hypoxic/anoxic brain injury, cardiovascular complications such as myocardial infarction and heart failure, delayed discharge, unanticipated hospital admission, readmission after discharge home, and death) rather than "surrogate" outcomes (e.g., desaturation, incidence of hypoxemia, need for supplemental oxygen, difficult mask ventilation or tracheal intubation, and need for additional monitoring). Future studies should assess the influence of opioids on perioperative outcomes. In addition, it is necessary to evaluate the contribution of factors that can influence perioperative outcomes such as preoperative and postoperative CPAP/BiPAP use, type of surgical procedures, anesthetic interventions, and intraoperative and postoperative opioid use. Furthermore, it would be beneficial to compare these complications with those occurring if a surgical intervention did not occur (i.e., baseline risks of OSA). Finally, the impact of the recommendations provided in this consensus statement on perioperative outcome is needed.

APPENDIX 1

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REFERENCES

1. Adesanya AO, Lee W, Greilich NB, Joshi GP. Perioperative management of obstructive sleep apnea. Chest 2010;138:1489–98
2. Chung SA, Yuan H, Chung F. A systemic review of obstructive sleep apnea and its implications for anesthesiologists. Anesth Analg 2008;107:1543–63
3. Seet E, Chung F. Management of sleep apnea in adults—functional algorithms for the perioperative period. Can J Anesth 2010;57:849–64
4. Gross JB, Bachenberg KL, Benumof JL, Caplan RA, Connis RT, Coté CJ, Nickinovich DG, Prachand V, Ward DS, Weaver EM, Ydens L, Yu S, American Society of Anesthesiologists Task Force on Perioperative Management. Practice guidelines for the perioperative management of patients with obstructive sleep apnea: a report by the American Society of Anesthesiologists Task Force on Perioperative Management of patients with obstructive sleep apnea. Anesthesiology 2006;104:1081–93
5. Isono S. Obstructive sleep apnea of obese adults, pathophysiology and perioperative airway management. Anesthesiology 2009;110:908–21
6. Kezirian EJ, Maselli J, Vittinghoff E, Goldberg AN, Auerbach AD. Obstructive sleep apnea surgery practice patterns in the United States: 2000 to 2006. Otolaryngol Head Neck Surg 2010;143:441–7
7. Finkel KJ, Searleman AC, Tymkew H, Tanaka CY, Saager L, Safer-Zadeh E, Bottros M, Selvidge JA, Jacobsohn E, Pulley D, Duntley S, Becker C, Avidan MS. Prevalence of undiagnosed obstructive sleep apnea among adult surgical patients in an academic medical center. Sleep Med 2009;10:753–8
8. Chung F, Yegneswaran B, Liao P, Chung SA, Vairavanathan S, Islam S, Khajehdehi A, Shapiro CM. STOP questionnaire: a tool to screen patients for obstructive sleep apnea. Anesthesiology 2008;108:812–21
9. Ramachandran SK, Josephs LA. A meta-analysis of clinical screening tests for obstructive sleep apnea. Anesthesiology 2009;110:928–39
10. Farney RJ, Walker BS, Farney RM, Snow GL, Walker JM. The STOP-Bang equivalent model and prediction of severity of obstructive sleep apnea: relation to polysomnographic measurements of the apnea/hyponea index. J Clin Sleep Med 2011;7:459–65
11. Chung F, Subramanyam R, Liao P, Sasaki E, Shapiro C, Sun Y. High STOP-Bang score indicates a high probability of obstructive sleep apnoea. Br J Anaesth 2012;108:768–75
12. Kurrek MM, Cobourn C, Wojtasik Z, Kiss A, Dain SL. Morbidity in patients with or at high risk for obstructive sleep apnea after ambulatory laparoscopic gastric banding. Obes Surg 2011;21:1494–8
13. Stierer TL, Wright C, George A, Thompson RE, Wu CL, Collop N. Risk assessment of obstructive sleep apnea in a population of patients undergoing ambulatory surgery. J Clin Sleep Med 2010;6:467–72
14. Liu SS, Chisholm MF, John RS, Ngeow J, Ma Y, Memtsoudis SG. Risk of postoperative hypoxemia in ambulatory orthopedic surgery patients with diagnosis of obstructive sleep apnea: a retrospective observational study. Patient Saf Surg 2010;4:9 (Epub doi: 10.1186/1754-9493-4-9)
15. Hathaway B, Johnson JT. Safety of uvulopalatopharyngoplasty as outpatient surgery. Otolaryngol Head Neck Surg 2006;134:542–4
16. Watkins BM, Montgomery KF, Ahroni JH, Erlitz MD, Abrams RE, Scurlock JE. Adjustable gastric banding in an ambulatory surgery center. Obes Surg 2005;15:1045–9
17. Kieff DA, Busaba NY. Same-day discharge for selected patients undergoing combined nasal and palatal surgery for obstructive sleep apnea. Ann Otol Rhinol Laryngol 2004;113:128–31
18. Sabers C, Plevak DJ, Schroeder DR, Warner DO. The diagnosis of obstructive sleep apnea as a risk factor for unanticipated admissions in outpatient surgery. Anesth Analg 2003;96:1328–35
19. Gan TJ, Meyer TA, Apfel CC, Chung F, Davis PJ, Habib AS, Hooper VD, Kovac AL, Kranke P, Myles P, Philip BK, Samsa G, Sessler DI, Temo J, Tramer MR, Vander Kolk C, Watcha M. Society for Ambulatory Anesthesia guidelines for the management of postoperative nausea and vomiting. Anesth Analg 2007;105:1615–28
20. Joshi GP, Chung F, Vann MA, Ahmad S, Gan TJ, Goulson DT, Merrill DG, Twersky R. Society for Ambulatory Anesthesia

consensus statement on perioperative blood glucose management in diabetic patients undergoing ambulatory surgery. Anesth Analg 2010;111:1378–87
21. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. BMJ 2009;339:b2535
22. Dalkey N, Helmer O. An experimental application of the Delphi method to the use of experts. Manage Sci 1963;9:458–67
23. Guyatt GH, Oxman AD, Vist GE, Kunz R, Falck-Ytter Y, Alonso-Coello P, Schünemann HJ and for the GRADE Working group. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. BMJ 2008; 336:924–6
24. Chung F, Yegneswaran B, Liao P, Chung SA, Vairavanathan S, Islam S, Khajehdehi A, Shapiro CM. Validation of the Berlin Questionnaire and American Society of Anesthesiologists checklist as screening tools for obstructive sleep apnea in surgical patients. Anesthesiology 2008;107:915–20
25. Macintyre, PE, Loadsman JA, Scott DA. Opioids, ventilation and acute pain management. Anesth Int Care 2011;39:545–58
26. Joshi GP. Multimodal analgesia techniques and postoperative rehabilitation. Anaesthesiology Clin N Am 2005;23: 185–202
27. Ong CKS, Seymour RA, Lirk P, Merry AF. Combining paracetamol (acetaminophen) with nonsteroidal anti-inflammatory drugs: a qualitative systematic review of analgesic efficacy for acute postoperative pain. Anesth Analg 2010;110:1170–9
28. Maund E, McDaid C, Rice S, Wright K, Jenkins B, Woolacott N. Paracetamol and selective and non-selective non-steroidal anti-inflammatory drugs for the reduction in morphine-related side-effects after major surgery: a systematic review. Br J Anaesth 2011;106:292–7
29. De Oliveira GS, Almeida MD, Benzon HT, McCarthy RJ. Perioperative single dose systemic dexamethasone for postoperative pain: a meta-analysis of randomized controlled trials. Anesthesiology 2011;115:575–88