Practice Guidelines for the Perioperative Management of Patients with Obstructive Sleep Apnea

An Updated Report by the American Society of Anesthesiologists Task Force on Perioperative Management of Patients with Obstructive Sleep Apnea

PRACTICE guidelines are systematically developed recommendations that assist the practitioner and patient in making decisions about health care. These recommendations may be adopted, modified, or rejected according to clinical needs and constraints, and are not intended to replace local institutional policies. In addition, practice guidelines developed by the American Society of Anesthesiologists (ASA) are not intended as standards or absolute requirements, and their use cannot guarantee any specific outcome. Practice guidelines are subject to revision as warranted by the evolution of medical knowledge, technology, and practice. They provide basic recommendations that are supported by a synthesis and analysis of the current literature, expert and practitioner opinion, open-forum commentary, and clinical feasibility data.

This document updates the "Practice Guidelines for the Perioperative Management of Obstructive Sleep Apnea: a Report by the American Society of Anesthesiologists Task Force on Perioperative Management of Obstructive Sleep Apnea," adopted by the ASA in 2005 and published in 2006.*

- What other guideline statements are available on this topic?
  - o These Practice Guidelines update "Practice Guidelines for the Perioperative Management of Obstructive Sleep Apnea: A Report by the American Society of Anesthesiologists Task Force on Perioperative Management of Obstructive Sleep Apnea," adopted by the American Society of Anesthesiologists (ASA) in 2005 and published in 2006.[1]
  - o Other guidelines on this topic include those published by the Society for Ambulatory Anesthesia,[2] the American College of Chest Physicians,[3] and the Canadian Anesthesiologists' Society.[4]
- Why was this Guideline developed?
  - o In October 2012, the ASA Committee on Standards and Practice Parameters elected to collect new evidence to determine if recommendations in the 2006 version of the ASA Practice Guidelines were supported by current evidence.
- How does this statement differ from existing guidelines?
  - o New evidence presented includes an updated evaluation of scientific literature and findings from surveys of experts and randomly selected ASA members. The new findings did not necessitate a change in recommendations.
  - o The updated ASA practice guidelines differ from those published by other organizations in that:
    - They include critical analysis of data from a large-scale survey of practicing anesthesiologists rather than a consensus opinion of a few individuals.
    - They apply to both inpatients and outpatients.
    - They apply to both pediatric and adult patients.
- Why does this statement differ from existing guidelines?
  - o The ASA Guidelines differ from the existing guidelines because it provides new evidence obtained from recent scientific literature as well as findings from new surveys of expert consultants and randomly selected ASA members. Footnotes are added to clarify some recommendations.

Methodology

A. Definition of Obstructive Sleep Apnea

Obstructive sleep apnea (OSA) is a syndrome characterized by periodic, partial, or complete obstruction in the upper airway during sleep. This, in turn, causes repetitive arousal from sleep to restore airway patency, which may result in daytime hypersomnolence or other daytime manifestations of disrupted sleep such as aggressive or distractible behavior in children. The airway obstruction may also cause episodic sleep-associated oxygen desaturation, episodic hypercarbia, and cardiovascular dysfunction. In the perioperative period, both pediatric and adult patients with OSA, even if asymptomatic, present special challenges that must be addressed to minimize the risk of perioperative morbidity or mortality.

This article is featured in "This Month in Anesthesiology," page 1A. Supplemental Digital Content is available for this article. Direct URL citations appear in the printed text and are available in both the HTML and PDF versions of this article. Links to the digital files are provided in the HTML text of this article on the Journal's Web site (www.anesthesiology.org). A complete bibliography used to develop these updated Guidelines, arranged alphabetically by author, is available as Supplemental Digital Content 1, http://links.lww.com/ALN/B6.

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* American Society of Anesthesiologists: 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; 120:268–86.

 Anesthesiology 2014; 120:268–86

Because procedures differ among laboratories, it is not possible to use specific values of indices such as the apnea–hypopnea index to define the severity of sleep apnea. Therefore, for the purposes of these Guidelines, patients will be stratified using the terms *mild*, *moderate*, and *severe* as defined by the laboratory where the sleep study was performed.

B. Purposes of the Guidelines

The purposes of these Guidelines are to improve the perioperative care and reduce the risk of adverse outcomes in patients with confirmed or suspected OSA who receive sedation, analgesia, or anesthesia for diagnostic or therapeutic procedures under the care of an anesthesiologist.

C. Focus

These Guidelines focus on the perioperative management of patients with confirmed or suspected OSA who may be at increased risk of perioperative morbidity and mortality because of potential difficulty in maintaining a patent airway. This population includes but is not limited to patients who have sleep apnea resulting from obesity, pregnancy, and other skeletal, cartilaginous, or soft tissue abnormalities causing upper airway obstruction. These Guidelines do not focus on patients with the following conditions: (1) pure central sleep apnea, (2) abnormalities of the upper or lower airway not associated with sleep apnea (*e.g.*, deviated nasal septum), (3) daytime hypersomnolence from other causes, (4) patients younger than 1 yr, and (5) obesity in the absence of sleep apnea.

D. Application

These Guidelines apply to both inpatient and outpatient settings and to procedures performed in an operating room as well as in other locations where sedation or anesthesia is administered. They are directly applicable to care administered by anesthesiologists and individuals who deliver care under the medical direction or supervision of an anesthesiologist. They are also intended to serve as a resource for other physicians and patient care personnel who are involved in the care of these patients. In addition, these Guidelines may serve as a resource to provide an environment for safe patient care.

E. Task Force Members and Consultants

The original Guidelines were developed by an ASA-appointed Task Force of 12 members, consisting of anesthesiologists in both private and academic practices from various geographic areas of the United States, a bariatric surgeon, an otolaryngologist, and two methodologists from the ASA Committee on Standards and Practice Parameters.

The original Task Force developed the Guidelines by means of a six-step process. First, they reached consensus on the criteria for evidence of effective perioperative management of patients with OSA. Second, original published research studies from peer-reviewed journals relevant to the perioperative management of patients with OSA were evaluated. Third, the panel of expert consultants was asked to (1) participate in opinion surveys on the effectiveness of various perioperative management strategies for patients with OSA and (2) review and comment on a draft of the Guidelines developed by the Task Force. Fourth, the Task Force held open forums at two major national meetings to solicit input on its draft recommendations. National organizations representing most of the specialties whose members typically care for patients with OSA were invited to participate in the open forums. Fifth, the consultants were surveyed to assess their opinions on the feasibility and financial implications of implementing the Guidelines. Sixth, all available information was used to build consensus within the Task Force to finalize the Guidelines.

In 2012, the ASA Committee on Standards and Practice Parameters requested that the updated Guidelines published in 2006 be re-evaluated. This update consists of an evaluation of literature published since completion of the original Guidelines and an evaluation of new survey findings of expert consultants and ASA members. A summary of recommendations is found in appendix 1.

F. Availability and Strength of Evidence

Preparation of these updated Guidelines followed a rigorous methodological process. Evidence was obtained from two principal sources: scientific evidence and opinion-based evidence (appendix 2).

Scientific Evidence

Scientific evidence used in the development of these Guidelines is based on findings from literature published in peer-reviewed journals. Literature citations are obtained from PubMed and other healthcare databases, direct internet searches, task force members, liaisons with other organizations, and from hand searches of references located in reviewed articles.

Findings from the aggregated literature are reported in the text of the Guidelines by evidence category, level, and direction. Evidence categories refer specifically to the strength and quality of the *research design* of the studies. Category A evidence represents results obtained from randomized controlled trials (RCTs), and Category B evidence represents observational results obtained from nonrandomized study designs or RCTs without pertinent controls. When available, Category A evidence is given precedence over Category B evidence in the reporting of results. These evidence categories are further divided into evidence levels. Evidence levels refer specifically to the strength and quality of the summarized study *findings* (*i.e.*, statistical findings, type of data, and the number of studies reporting/replicating the findings) within the two evidence categories. For this document, only the highest level of evidence is included in the summary report for each intervention, including a directional designation of benefit, harm, or equivocality for each outcome.

Category A

Randomized controlled trials report comparative findings between clinical interventions for specified outcomes.

Statistically significant ($P < 0.01$) outcomes are designated as either beneficial (B) or harmful (H) for the patient; statistically nonsignificant findings are designated as equivocal (E).

Level 1: The literature contains a sufficient number of RCTs to conduct meta-analysis,† and meta-analytic findings from these aggregated studies are reported as evidence.
Level 2: The literature contains multiple RCTs, but the number of RCTs is not sufficient to conduct a viable meta-analysis for the purpose of these Guidelines. Findings from these RCTs are reported as evidence.
Level 3: The literature contains a single RCT, and findings from this study are reported as evidence.

Category B

Observational studies or RCTs without pertinent comparison groups may permit *inference* of beneficial or harmful relationships among clinical interventions and outcomes. Inferred findings are given a directional designation of beneficial (B), harmful (H), or equivocal (E). For studies that report statistical findings, the threshold for significance is *P* value less than 0.01.

Level 1: The literature contains observational comparisons (*e.g.*, cohort and case-control research designs) between clinical interventions for a specified outcome.
Level 2: The literature contains observational studies with associative statistics (*e.g.*, relative risk, correlation, and sensitivity/specificity).
Level 3: The literature contains noncomparative observational studies with descriptive statistics (*e.g.*, frequencies and percentages).
Level 4: The literature contains case reports.

Insufficient Evidence

The *lack* of sufficient scientific evidence in the literature may occur when the evidence is either unavailable (*i.e.*, no pertinent studies found) or inadequate. Inadequate literature cannot be used to assess relationships among clinical interventions and outcomes, because such literature does not permit a clear interpretation of findings due to methodological concerns (*e.g.*, confounding in study design or implementation) or does not meet the criteria for content as defined in the "Focus" of the Guidelines.

Opinion-based Evidence

All opinion-based evidence (*e.g.*, survey data, open-forum testimony, internet-based comments, letters, and editorials) relevant to each topic was considered in the development of these updated Guidelines. However, only the findings obtained from formal surveys are reported.

Opinion surveys were developed for this update by the Task Force to address each clinical intervention identified in the document. Identical surveys were distributed to expert consultants and a random sample of ASA members.

Category A: Expert Opinion

Survey responses from Task Force–appointed expert consultants are reported in summary form in the text, with a complete listing of consultant survey responses reported in appendix 2.

Category B: Membership Opinion

Survey responses from active ASA members are reported in summary form in the text, with a complete listing of ASA member survey responses reported in appendix 2.

Survey responses from expert and membership sources are recorded by using a 5-point scale and summarized based on median values.‡

Strongly Agree: Median score of 5 (at least 50% of the responses are 5)
Agree: Median score of 4 (at least 50% of the responses are 4 or 4 and 5)
Equivocal: Median score of 3 (at least 50% of the responses are 3, or no other response category or combination of similar categories contains at least 50% of the responses)
Disagree: Median score of 2 (at least 50% of responses are 2 or 1 and 2)
Strongly Disagree: Median score of 1 (at least 50% of responses are 1)

Category C: Informal Opinion

Open-forum testimony obtained during development of the original Guidelines, Internet-based comments, letters, and editorials are all informally evaluated and discussed during the formulation of Guideline recommendations. When warranted, the Task Force may add educational information or cautionary notes based on this information.

Guidelines

I. Preoperative Evaluation

Preoperative evaluation of a patient for potential identification of OSA includes (1) medical record review, (2) patient/family interview and screening protocol, and (3) physical examination.

Medical Record Review. The literature is insufficient to evaluate the efficacy of conducting a directed medical history or reviewing previous medical records to identify the presence of OSA. Observational studies comparing OSA with non-OSA patients report higher body mass index values for OSA patients[5–15]; similarly, when obese patients are compared with nonobese patients, higher frequencies of OSA are reported[16–18] (*Category B1-H evidence*). Comparative observational studies

† All meta-analyses are conducted by the ASA methodology group. Meta-analyses from other sources are reviewed but not included as evidence in this document.

‡ When an equal number of categorically distinct responses are obtained, the median value is determined by calculating the arithmetic mean of the two middle values. Ties are calculated by a predetermined formula.

report other pertinent patient characteristics associated with OSA that may be available in medical records, such as hypertension,[19–23] history of stroke,[24,25] history of myocardial infarction,[26] diabetes mellitus,[23] or abnormal cephalometric measurements.[27–53] (*Category B1-H evidence*). Noncomparative observational studies and case reports indicate that certain congenital conditions (*e.g.*, Down syndrome, acromegaly)[54–56] and disease states (*e.g.*, neuromuscular disease, cerebral palsy)[57] may also be associated with OSA (*Category B3-H evidence*).

Patient/Family Interview and Screening Protocol. The literature is insufficient to evaluate the efficacy of conducting a patient or family interview to identify the presence of OSA. Observational studies evaluating screening protocols or questionnaires to identify adult OSA patients report sensitivity values ranging from 36 to 86%, specificity values ranging from 31 to 95%, positive predictive values ranging from 72 to 96%, and negative predictive values ranging from 30 to 82%, based on apnea–hypopnea index or respiratory disturbance index scores of 5 or more (*Category B2-B evidence*).[58–65]

Physical Examination. The literature is insufficient to evaluate the efficacy of conducting a directed physical or airway examination to identify the presence of OSA. Comparative observational studies report differences in neck circumference,[66–68] tongue size,[69] and nasal and oropharyngeal airway structures[69–71] when comparing OSA with non-OSA patients (*Category B1-H evidence*). Observational studies also report associations between tonsil size and apnea–hypopnea index or respiratory disturbance index scores in adult OSA patients (*Category B2-H evidence*).[72–74]

The consultants and ASA members strongly agree that anesthesiologists should work with surgeons to develop a protocol whereby patients in whom the possibility of OSA is suspected on clinical grounds are evaluated long enough before the day of surgery to allow preparation of a perioperative management plan. They also both strongly agree that preoperative evaluation should include (1) a comprehensive review of previous medical records (if available), (2) an interview with the patient and/or family, *and* (3) conducting a physical examination. The consultants and ASA members both agree that if any characteristics noted during the preoperative evaluation suggest that the patient has OSA, the anesthesiologist and surgeon should *jointly* decide whether to (1) manage the patient perioperatively based on clinical criteria alone, or (2) obtain sleep studies, conduct a more extensive airway examination, and initiate indicated OSA treatment in advance of surgery. The consultants agree and the ASA members strongly agree that if the preoperative evaluation does not occur until the day of surgery, the surgeon and anesthesiologist together may elect for presumptive management based on clinical criteria or a last-minute delay of surgery. Both the consultants and ASA members strongly agree that the severity of the patient's OSA, the invasiveness of the diagnostic or therapeutic procedure, and the requirement for postoperative analgesics should be taken into account in determining whether a patient is at an increased perioperative risk from OSA. Finally, both the consultants and ASA members strongly agree that the patient and his or her family as well as the surgeon should be informed of the potential implications of OSA on the patient's perioperative course.

§ Screening protocols or questionnaires may be useful for indentifying these clinical characteristics.

Recommendations for Preoperative Evaluation

Anesthesiologists should work with surgeons to develop a protocol whereby patients in whom the possibility of OSA is suspected on clinical grounds are evaluated long enough before the day of surgery to allow preparation of a perioperative management plan. This evaluation may be initiated in a preanesthesia clinic (if available) or by direct consultation from the operating surgeon to the anesthesiologist. A preoperative evaluation should include a comprehensive review of previous medical records (if available), an interview with the patient and/or family, and conducting a physical examination. Medical records review should include (but not be limited to) checking for a history of airway difficulty with previous anesthetics, hypertension or other cardiovascular problems, and other congenital or acquired medical conditions. Review of sleep studies is encouraged. The patient and family interview should include focused questions related to snoring, apneic episodes, frequent arousals during sleep (*e.g.*, vocalization, shifting position, and extremity movements), morning headaches, and daytime somnolence.§ A physical examination should include an evaluation of the airway, nasopharyngeal characteristics, neck circumference, tonsil size, and tongue volume. If any characteristics noted during the preoperative evaluation suggest that the patient has OSA, the anesthesiologist and surgeon should jointly decide whether to (1) manage the patient perioperatively based on clinical criteria alone or (2) obtain sleep studies, conduct a more extensive airway examination, and initiate indicated OSA treatment in advance of surgery. If this evaluation does not occur until the day of surgery, the surgeon and anesthesiologist together may elect for presumptive management based on clinical criteria or a last-minute delay of surgery. For safety, clinical criteria (table 1) should be designed to have a high degree of sensitivity (despite the resulting low specificity), meaning that some patients may be treated more aggressively than would be necessary if a sleep study was available.

The severity of the patient's OSA, the invasiveness of the diagnostic or therapeutic procedure, and the requirement for postoperative analgesics should be taken into account in determining whether a patient is at increased perioperative risk from OSA (table 2). The patient and his or her family as well as the surgeon should be informed of the potential implications of OSA on the patient's perioperative course.

II. Preoperative Determination of Inpatient versus *Outpatient Management*

The literature is insufficient to offer guidance regarding which patients with OSA can be safely managed on an inpatient *versus* on an outpatient basis.

The consultants and ASA members strongly agree that before patients at increased perioperative risk from OSA are scheduled to undergo surgery, a determination should be made regarding whether a surgical procedure is most appropriately performed on an inpatient or outpatient basis.

Recommendations for Preoperative Determination of Inpatient versus *Outpatient Management*

Before patients at increased perioperative risk from OSA are scheduled to undergo surgery, a determination should be made regarding whether a surgical procedure is most appropriately performed on an inpatient or outpatient basis. Factors to be considered in determining whether outpatient care is appropriate include (1) sleep apnea status, (2) anatomical and physiologic abnormalities, (3) status of coexisting diseases, (4) nature of surgery, (5) type of anesthesia, (6) need for postoperative opioids, (7) patient age, (8) adequacy of postdischarge observation, and (9) capabilities of the outpatient facility. The availability of emergency difficult airway equipment, respiratory care equipment, radiology facilities, clinical laboratory facilities, and a transfer agreement with an inpatient facility should be considered in making this determination.

III. Preoperative Preparation

Preoperative preparation is intended to improve or optimize an OSA patient's perioperative physical status and includes (1) preoperative continuous positive airway pressure (CPAP) or noninvasive positive pressure ventilation (NIPPV), (2) preoperative use of mandibular advancement or oral appliances, and (3) preoperative weight loss.

CPAP or NIPPV. An observational study reports lower frequencies of serious postoperative complications *(i.e.*, cardiac events, complications needing intensive care unit transfer or urgent respiratory support) when preoperative at-home CPAP is compared with no preoperative CPAP (*Category B1-B evidence*).[75] The literature is insufficient to evaluate the impact of the preoperative use of NIPPV.‖

Mandibular Advancement or Oral Appliances. The literature is insufficient to evaluate the efficacy of preoperative mandibular advancement devices on perioperative outcomes.#

Preoperative Weight Loss. There is insufficient literature to evaluate the efficacy of preoperative weight loss.

The consultants agree and the ASA members strongly agree that preoperative initiation of CPAP should be considered, particularly if OSA is severe. The ASA members agree and the consultants are equivocal that for patients who do not respond adequately to CPAP, NIPPV should be considered. In addition, the ASA members agree and the consultants are equivocal that the preoperative use of mandibular advancement devices or oral appliances and preoperative weight loss should be considered when feasible. Finally, both the consultants and ASA members agree that patients with known or suspected OSA may have difficult airways and therefore should be managed according to the "Practice Guidelines for Management of the Difficult Airway: An Updated Report."**

Recommendations for Preoperative Preparation

Preoperative initiation of CPAP should be considered, particularly if OSA is severe. For patients who do not respond adequately to CPAP, NIPPV should be considered. In addition, the preoperative use of mandibular advancement devices or oral appliances and preoperative weight loss should be considered when feasible. A patient who has had corrective airway surgery (*e.g.*, uvulopalatopharyngoplasty, surgical mandibular advancement) should be assumed to remain at risk of OSA complications unless a normal sleep study has been obtained and symptoms have not returned. Patients with known or suspected OSA may have difficult airways and therefore should be managed according to the "Practice Guidelines for Management of the Difficult Airway: An Updated Report."**

IV. Intraoperative Management

Intraoperative concerns in patients at increased perioperative risk from OSA include (1) choice of anesthesia technique, (2) airway management, and (3) patient monitoring. The literature is insufficient to evaluate the effects of various anesthesia techniques as they specifically apply to patients with OSA. Similarly, the literature is insufficient to evaluate the impact of intraoperative airway management (*e.g.*, awake extubation) or patient monitoring techniques as they specifically apply to patients with OSA.

The consultants and ASA members strongly agree that the potential for postoperative respiratory compromise should be considered in selecting intraoperative medications. They also strongly agree that for superficial procedures consider the use of local anesthesia or peripheral nerve blocks, with or without moderate sedation. The consultants and ASA members agree that, for patients previously treated with CPAP or an oral appliance, consider using these modalities during sedation.

The consultants and ASA members strongly agree that general anesthesia with a secure airway is preferable to deep sedation without a secure airway, particularly for procedures that may mechanically compromise the airway. The consultants and ASA members agree that major conduction anesthesia (spinal/epidural) should be considered for peripheral procedures. They both strongly agree that, unless there is a medical or surgical contraindication, patients at increased perioperative risk from OSA should be extubated while awake. They also both strongly agree that full reversal of neuromuscular block should be verified before extubation. Finally, the ASA members agree and the consultants strongly agree that when

‖ Observational studies of NIPPV in nonperioperative settings report reduced apnea–hypopnea index scores.

RCTs of mandibular advancement devices in nonperioperative settings indicate the efficacy of these devices in reducing apnea–hypopnea index scores.

** Practice guidelines for management of the difficult airway: An updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Anesthesiology 2013; 118:251–70.

possible, extubation and recovery should be carried out in the lateral, semiupright, or other nonsupine positions.

Recommendations for Intraoperative Management

Because of their propensity for airway collapse and sleep deprivation, patients at increased perioperative risk from OSA are especially susceptible to the respiratory depressant and airway effects of sedatives, opioids, and inhaled anesthetics; therefore, the potential for postoperative respiratory compromise should be considered in selecting intraoperative medications. For superficial procedures, consider the use of local anesthesia or peripheral nerve blocks, with or without moderate sedation. If moderate sedation is used, ventilation should be continuously monitored by capnography or another automated method if feasible because of the increased risk of undetected airway obstruction in these patients.†† Consider administering CPAP or using an oral appliance during sedation to patients previously treated with these modalities. General anesthesia with a secure airway is preferable to deep sedation without a secure airway, particularly for procedures that may mechanically compromise the airway. Major conduction anesthesia (spinal/epidural) should be considered for peripheral procedures. Unless there is a medical or surgical contraindication, patients at increased perioperative risk from OSA should be extubated while awake. Full reversal of neuromuscular block should be verified before extubation. When possible, extubation and recovery should be carried out in the lateral, semiupright, or other nonsupine positions.

V. Postoperative Management

Risk factors for postoperative respiratory depression may include the underlying severity of the sleep apnea, systemic administration of opioids, use of sedatives, site and invasiveness of surgical procedure, and the potential for apnea during rapid eye movement (REM) sleep on the third or fourth postoperative day (*i.e.*, "REM rebound"), as sleep patterns are reestablished. Postoperative interventions to manage OSA patients who may be susceptible to the above risks include the topics of (1) postoperative analgesia, (2) oxygenation, (3) patient positioning, and (4) monitoring.

Postoperative Analgesia. The literature is insufficient to evaluate outcomes associated with postoperative peripheral regional *versus* systemic analgesic techniques on patients with OSA; similarly, the literature is insufficient to evaluate outcomes associated with postoperative central regional (*i.e.*, neuraxial) *versus* systemic techniques.‡‡ The literature is insufficient to evaluate the effect of adding a basal infusion to systemic patient-controlled opioids on the oxygenation of patients with OSA.

Oxygenation. The literature is insufficient to evaluate the effects of postoperative supplemental oxygen administration in patients with OSA.§§ An RCT indicates improved ventilatory function for OSA patients when postoperative CPAP is compared with no postoperative CPAP (*Category A3-B evidence*).[76]

Patient Positioning. Comparative observational studies indicate an improvement in apnea–hypopnea index scores when adult nonsurgical OSA patients sleep in the lateral, prone, or sitting positions rather than the supine (*Category B1-B evidence*)[77–82]; the literature is insufficient to evaluate the effects of positioning adult or pediatric OSA patients in the postoperative setting.

Monitoring. Observational studies and case reports indicate that continuous postoperative monitoring with pulse oximetry is effective in detecting hypoxemic events (*Category B3-B evidence*).[83–87] The literature is insufficient to examine the impact of monitored postoperative settings (*e.g.*, stepdown or intensive care unit) *versus* routine hospital wards for patients with known or suspected OSA. However, an observational study reports lower frequencies of rescue events and transfers to the intensive care unit when a continuous pulse oximetry surveillance system was introduced into the postoperative care setting for a general patient population.[88] The literature is insufficient to offer guidance regarding the appropriate duration of postoperative respiratory monitoring in patients with OSA.

The consultants and ASA members strongly agree that regional analgesic techniques should be considered to reduce or eliminate the requirement for systemic opioids in patients at increased perioperative risk from OSA. They both agree that if neuraxial analgesia is planned, the benefits (improved analgesia, decreased need for systemic opioids) and risks (respiratory depression from rostral spread) of using an opioid or opioid–local anesthetic mixture rather than a local anesthetic alone should be weighed. The consultants and ASA members strongly agree that if patient-controlled systemic opioids are used, continuous background infusions should be avoided or used with extreme caution. In addition, they both strongly agree that to reduce opioid requirements, nonsteroidal antiinflammatory agents and other modalities (*e.g.*, ice, transcutaneous electrical nerve stimulation) should be considered if appropriate. The consultants agree and the ASA members strongly agree that supplemental oxygen should be administered continuously to all patients who are at increased perioperative risk from OSA until they are able to maintain their baseline oxygen saturation while breathing room air. They both strongly agree that when

†† ASA Standards now state "During moderate or deep sedation, the adequacy of ventilation shall be evaluated by continual observation of qualitative clinical signs and monitoring for the presence of exhaled carbon dioxide unless precluded or invalidated by the nature of the patient, procedure, or equipment." American Society of Anesthesiologists: Standards for Basic Anesthetic Monitoring, effective July, 2011.

‡‡ For unselected surgical patients, RCTs indicate that neuraxial opioids are associated with lower frequencies of respiratory depression, somnolence and sedation compared to systemic opioids. (See Practice guidelines for the prevention, detection, and management of respiratory depression associated with neuraxial opioid administration. Anesthesiology 2009; 110:218–30.)

§§ For unselected surgical patients, RCTs indicate that postoperative supplemental oxygen is associated with lower frequencies of hypoxemia. (See Practice guidelines for management of the difficult airway: An updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Anesthesiology 2013; 118:251–70.)

feasible, CPAP or NIPPV (with or without supplemental oxygen) should be continuously administered postoperatively to patients who were using these modalities preoperatively, unless contraindicated by the surgical procedure. The consultants and ASA members agree that if possible, patients at increased perioperative risk from OSA should be placed in nonsupine positions throughout the recovery process. The ASA members agree and the consultants strongly agree that hospitalized patients who are at increased risk of respiratory compromise from OSA should have continuous pulse oximetry monitoring after discharge from the recovery room. In addition, the ASA members agree and the consultants strongly agree that continuous monitoring should be maintained as long as patients remain at increased risk. Finally, both the consultants and ASA members strongly agree that if frequent or severe airway obstruction or hypoxemia occurs during postoperative monitoring, initiation of nasal CPAP or NIPPV should be considered. For children undergoing tonsillectomy for OSA, the Task Force cautions that repeated hypoxemia may alter μ-opioid receptors, making these children sensitive to opioids and therefore requiring a reduced opioid dose (*i.e.*, approximately half the usual dose).‖‖

Recommendations for Postoperative Management

Regional analgesic techniques should be considered to reduce or eliminate the requirement for systemic opioids in patients at increased perioperative risk from OSA. If neuraxial analgesia is planned, weigh the benefits (improved analgesia, decreased need for systemic opioids) and risks (respiratory depression from rostral spread) of using an opioid or opioid–local anesthetic mixture rather than a local anesthetic alone. If patient-controlled systemic opioids are used, continuous background infusions should be avoided or used with extreme caution. To reduce opioid requirements, nonsteroidal antiinflammatory agents and other modalities (*e.g.*, ice, transcutaneous electrical nerve stimulation) should be considered if appropriate. Clinicians are cautioned that the concurrent administration of sedative agents (*e.g.*, benzodiazepines, barbiturates) increases the risk of respiratory depression and airway obstruction.

Supplemental oxygen should be administered continuously to all patients who are at increased perioperative risk from OSA until they are able to maintain their baseline oxygen saturation while breathing room air.## When feasible, CPAP or NIPPV (with or without supplemental oxygen) should be continuously administered to patients who were using these modalities preoperatively, unless contraindicated by the surgical procedure. Compliance with CPAP or NIPPV may be improved if patients bring their own equipment to the hospital.

If possible, patients at increased perioperative risk from OSA should be placed in nonsupine positions throughout the recovery process. Hospitalized patients who are at increased risk of respiratory compromise from OSA should have continuous pulse oximetry monitoring after discharge from the recovery room. Continuous monitoring may be provided in a critical care or stepdown unit, by telemetry on a hospital ward, or by a dedicated, appropriately trained professional observer in the patient's room. Continuous monitoring should be maintained as long as patients remain at increased risk.*** If frequent or severe airway obstruction or hypoxemia occurs during postoperative monitoring, initiation of nasal CPAP or NIPPV should be considered.

VI. Criteria for Discharge to Unmonitored Settings

The literature is insufficient to offer guidance regarding the appropriate time for discharge of patients at increased perioperative risk from OSA from the surgical facility.

The consultants and ASA members strongly agree that patients at increased perioperative risk from OSA should not be discharged from the recovery area to an unmonitored setting (*i.e.*, home or unmonitored hospital bed) until they are no longer at risk of postoperative respiratory depression. Moreover, they both agree that to establish that patients are able to maintain adequate oxygen saturation levels while breathing room air, respiratory function may be determined by observing patients in an unstimulated environment, preferably while asleep.

Recommendations for Criteria for Discharge to Unmonitored Settings

Patients at increased perioperative risk from OSA should not be discharged from the recovery area to an unmonitored setting (*i.e.*, home or unmonitored hospital bed) until they are no longer at risk of postoperative respiratory depression.††† To establish that patients are able to maintain adequate oxygen saturation levels while breathing room air, respiratory function may be determined by observing patients in an unstimulated environment, preferably while asleep.

Appendix 1. Summary of Recommendations

I. Preoperative Evaluation

- Anesthesiologists should work with surgeons to develop a protocol whereby patients in whom the possibility

‖‖ Reduction or avoidance of systemic opioids is of particular concern for some high-risk OSA patient populations. In October, 2012, the U.S. Food and Drug Administration posted a Box Warning to be added to the drug labels of codeine-containing products about the risk of codeine in postoperative pain management in children after tonsillectomy and/or adenoidectomy. They note that "Health care professionals should prescribe an alternate analgesic for postoperative pain control in children who are undergoing tonsillectomy and/or adenoidectomy. Codeine should not be used for pain in children after these procedures. For management of other types of pain in children, codeine should only be used if the benefits are anticipated to outweigh the risks." (Updated February 20, 2013). For more information, go to the following web address: http://www.fda.gov/Safety/MedWatch/SafetyInformation/SafetyAlertsforHumanMedicalProducts/ucm315627.htm.

The Task Force cautions that supplemental oxygen may increase the duration of apneic episodes and may hinder detection of atelectasis, transient apnea, and hypoventilation by pulse oximetry.

*** Intermittent pulse oximetry or continuous bedside oximetry without continuous observation does not provide the same level of safety.

††† Because of their propensity to develop airway obstruction or central respiratory depression, this may require a longer stay as compared with non-OSA patients undergoing similar procedures.

of obstructive sleep apnea (OSA) is suspected on clinical grounds are evaluated long enough before the day of surgery to allow preparation of a perioperative management plan.
  - This evaluation may be initiated in a preanesthesia clinic (if available) or by direct consultation from the operating surgeon to the anesthesiologist.

- A preoperative evaluation should include a comprehensive review of previous medical records (if available), an interview with the patient and/or family, and conducting a physical examination.
  - Medical records review should include (but not be limited to) checking for a history of airway difficulty with previous anesthetics, hypertension, or other cardiovascular problems, and other congenital or acquired medical conditions.

- Review of sleep studies is encouraged.
  - The patient and family interview should include focused questions related to snoring, apneic episodes, frequent arousals during sleep (*e.g.*, vocalization, shifting position, and extremity movements), morning headaches, and daytime somnolence.‡‡‡
  - A physical examination should include an evaluation of the airway, nasopharyngeal characteristics, neck circumference, tonsil size, and tongue volume.

- If any characteristics noted during the preoperative evaluation suggest that the patient has OSA, the anesthesiologist and surgeon should jointly decide whether to (1) manage the patient perioperatively based on clinical criteria alone or (2) obtain sleep studies, conduct a more extensive airway examination, and initiate indicated OSA treatment in advance of surgery.
- If the preoperative evaluation does not occur until the day of surgery, the surgeon and anesthesiologist together may elect for presumptive management based on clinical criteria or a last-minute delay of surgery.
- For safety, clinical criteria should be designed to have a high degree of sensitivity (despite the resulting low specificity), meaning that some patients may be treated more aggressively than would be necessary if a sleep study was available.
- The severity of the patient's OSA, the invasiveness of the diagnostic or therapeutic procedure, and the requirement for postoperative analgesics should be taken into account in determining whether a patient is at increased perioperative risk from OSA.
- The patient and his or her family as well as the surgeon should be informed of the potential implications of OSA on the patient's perioperative course.

‡‡‡ Screening protocols or questionnaires may be useful for indentifying these clinical characteristics.

II. Inpatient versus *Outpatient Surgery*

- Before patients at increased perioperative risk from OSA are scheduled to undergo surgery, a determination should be made regarding whether a surgical procedure is most appropriately performed on an inpatient or outpatient basis.
  - Factors to be considered in determining whether outpatient care is appropriate include (1) sleep apnea status, (2) anatomical and physiologic abnormalities, (3) status of coexisting diseases, (4) nature of surgery, (5) type of anesthesia, (6) need for postoperative opioids, (7) patient age, (8) adequacy of postdischarge observation, and (9) capabilities of the outpatient facility.
  - The availability of emergency difficult airway equipment, respiratory care equipment, radiology facilities, clinical laboratory facilities, and a transfer agreement with an inpatient facility should be considered in making this determination.

III. Preoperative Preparation

- Preoperative initiation of continuous positive airway pressure (CPAP) should be considered, particularly if OSA is severe.
  - For patients who do not respond adequately to CPAP, noninvasive positive pressure ventilation should be considered.

- The preoperative use of mandibular advancement devices or oral appliances and preoperative weight loss should be considered when feasible.
  - A patient who has had corrective airway surgery (*e.g.*, uvulopalatopharyngoplasty, surgical mandibular advancement) should be assumed to remain at risk of OSA complications unless a normal sleep study has been obtained and symptoms have not returned.

- Patients with known or suspected OSA may have difficult airways and therefore should be managed according to the "Practice Guidelines for Management of the Difficult Airway: An Updated Report."**

IV. Intraoperative Management

- Because of their propensity for airway collapse and sleep deprivation, patients at increased perioperative risk from OSA are especially susceptible to the respiratory depressant and airway effects of sedatives, opioids, and inhaled anesthetics; therefore, the potential for postoperative respiratory compromise should be considered in selecting intraoperative medications.
- For superficial procedures, consider the use of local anesthesia or peripheral nerve blocks, with or without moderate sedation.
- If moderate sedation is used, ventilation should be continuously monitored by capnography or another automated method if feasible because of the increased risk of undetected airway obstruction in these patients.
- Consider administering CPAP or using an oral appliance during sedation to patients previously treated with these modalities.

- General anesthesia with a secure airway is preferable to deep sedation without a secure airway, particularly for procedures that may mechanically compromise the airway.
- Major conduction anesthesia (spinal/epidural) should be considered for peripheral procedures.
- Unless there is a medical or surgical contraindication, patients at increased perioperative risk from OSA should be extubated while awake.
- Full reversal of neuromuscular block should be verified before extubation.
- When possible, extubation and recovery should be carried out in the lateral, semiupright, or other nonsupine position.

V. Postoperative Management

- Regional analgesic techniques should be considered to reduce or eliminate the requirement for systemic opioids in patients at increased perioperative risk from OSA.
- If neuraxial analgesia is planned, weigh the benefits (improved analgesia and decreased need for systemic opioids) and risks (respiratory depression from rostral spread) of using an opioid or opioid–local anesthetic mixture rather than a local anesthetic alone.
- If patient-controlled systemic opioids are used, continuous background infusions should be avoided or used with extreme caution.
- To reduce opioid requirements, nonsteroidal antiinflammatory agents and other modalities (*e.g.*, ice, transcutaneous electrical nerve stimulation) should be considered if appropriate.
- Clinicians are cautioned that the concurrent administration of sedative agents (*e.g.*, benzodiazepines and barbiturates) increases the risk of respiratory depression and airway obstruction.
- Supplemental oxygen should be administered continuously to all patients who are at increased perioperative risk from OSA until they are able to maintain their baseline oxygen saturation while breathing room air.
  - The Task Force cautions that supplemental oxygen may increase the duration of apneic episodes and may hinder detection of atelectasis, transient apnea, and hypoventilation by pulse oximetry.
- When feasible, CPAP or noninvasive positive pressure ventilation (with or without supplemental oxygen) should be continuously administered to patients who were using these modalities preoperatively, unless contraindicated by the surgical procedure.
  - Compliance with CPAP or noninvasive positive pressure ventilation may be improved if patients bring their own equipment to the hospital.
- If possible, patients at increased perioperative risk from OSA should be placed in nonsupine positions throughout the recovery process.
- Hospitalized patients who are at increased risk of respiratory compromise from OSA should have continuous pulse oximetry monitoring after discharge from the recovery room.
  - Continuous monitoring may be provided in a critical care or stepdown unit, by telemetry on a hospital ward, or by a dedicated, appropriately trained professional observer in the patient's room.
  - Continuous monitoring should be maintained as long as patients remain at increased risk.§§§
- If frequent or severe airway obstruction or hypoxemia occurs during postoperative monitoring, initiation of nasal CPAP or noninvasive positive pressure ventilation should be considered.

VI. Criteria for Discharge to Unmonitored Settings

- Patients at increased perioperative risk from OSA should not be discharged from the recovery area to an unmonitored setting (*i.e.*, home or unmonitored hospital bed) until they are no longer at risk of postoperative respiratory depression.
  - Because of their propensity to develop airway obstruction or central respiratory depression, this may require a longer stay as compared with non-OSA patients undergoing similar procedures.
- To establish that patients are able to maintain adequate oxygen saturation levels while breathing room air, respiratory function may be determined by observing patients in an unstimulated environment, preferably while asleep.

§§§ Intermittent pulse oximetry or continuous bedside oximetry without continuous observation does not provide the same level of safety.

Appendix 2. Methods and Analyses

A. State of the Literature

For these updated Guidelines, a review of studies used in the development of the original Guidelines was combined with studies published subsequent to approval of the original Guidelines in 2005.* The scientific assessment of these Guidelines was based on evidence linkages or statements regarding potential relationships between clinical interventions and outcomes. The interventions listed below were examined to assess their relationship to a variety of outcomes related to the perioperative management of patients with obstructive sleep apnea.

Preoperative Evaluation

Medical records review
Patient/family interview and screening protocol
Focused physical examination
Sleep study

Preoperative Preparation

Preoperative treatment/optimization for obstructive sleep apnea (*e.g.*, continuous positive airway pressure [CPAP], noninvasive positive pressure ventilation, mandibular appliances, and medical treatment)

Consult the American Society of Anesthesiologists "Practice Guidelines for Management of the Difficult Airway"
Limit procedures to facilities with full hospital services

Intraoperative Management

Anesthesia technique
- Local or regional anesthesia *versus* general anesthesia
- Combined regional and general anesthesia *versus* general anesthesia
- Sedation *versus* general anesthesia

Monitoring
- Continuously monitor the respiratory depressant effects of sedatives and/or opioids (*e.g.*, level of consciousness, pulmonary ventilation, oxygenation, and automated apnea monitoring)
- Special intraoperative monitoring techniques (arterial line, pulmonary artery catheter)
- Extubation:
  - Verify the full reversal of neuromuscular block before extubation
  - Extubate patients after they are fully awake (*vs.* asleep or partially awake)
  - Extubate patients in the semiupright, lateral, or prone positions (*vs.* supine)

Postoperative Management

- Analgesic use
  - Regional analgesic techniques without neuraxial opioids *versus* systemic opioids
  - Neuraxial opioids *versus* systemic opioids
  - Oral analgesics *versus* parenteral opioids
  - Patient-controlled analgesia without a background infusion *versus* patient-controlled analgesia with a background infusion
  - Titration or lower dosage levels of systemic opioids
- Oxygenation
  - Supplemental oxygen *versus* no supplemental oxygen
  - CPAP *versus* no CPAP (oxygen or room air)
  - CPAP for patients who had previously been on CPAP *versus* CPAP for patients not previously on CPAP
  - Noninvasive positive pressure ventilation *versus* no noninvasive positive pressure ventilation (CPAP, oxygen, or room air)
- Patient positioning
  - Lateral, prone, or tonsil positions *versus* the supine position
- Monitoring
  - Telemetry monitoring systems *versus* no telemetry monitoring systems
  - Monitored settings *versus* routine hospital wards
- Length of stay
  - Extended stay in postanesthesia care unit *versus* no extended stay in postanesthesia care unit
  - Hospital admission *versus* discharge home

For the literature review, potentially relevant clinical studies were identified *via* electronic and manual searches of the literature. The electronic and manual searches covered a 61 yr period from 1953 to 2013. More than 2,000 citations were initially identified, yielding a total of 835 nonoverlapping articles that addressed topics related to the evidence linkages. After review of the articles, 476 studies did not provide direct evidence and were subsequently eliminated. A total of 359 articles contained direct linkage-related evidence. A complete bibliography used to develop these Guidelines, organized by section, is available as Supplemental Digital Content 2, http://links.lww.com/ALN/B7.

No evidence linkage contained sufficient literature with well-defined experimental designs and statistical information to conduct an analysis of aggregated randomized controlled trials (*i.e.*, meta-analysis). A complete bibliography used to develop these updated Guidelines, organized by section, is available as Supplemental Digital Content 2, http://links.lww.com/ALN/B7.

Interobserver agreement among Task Force members and two methodologists was established by interrater reliability testing. Agreement levels using a kappa (κ) statistic for two-rater agreement pairs were as follows: (1) type of study design, κ = 0.50 to 0.69; (2) type of analysis, κ = 0.43 to 0.60; (3) evidence linkage assignment, κ = 0.88 to 1.00; and (4) literature inclusion for database, κ = 0.44 to 0.87. Three-rater chance-corrected agreement values were (1) study design, Sav = 0.56, Var (Sav) = 0.009; (2) type of analysis, Sav = 0.54, Var (Sav) = 0.011; (3) linkage assignment, Sav = 0.87, Var (Sav) = 0.003; and (4) literature database inclusion, Sav = 0.58, Var (Sav) = 0.030. These values represent moderate to high levels of agreement.

B. Consensus-based Evidence

Consensus was obtained from multiple sources, including (1) updated surveys sent to consultants who were selected based on their knowledge or expertise in perioperative management of patients with obstructive sleep apnea and a random sample of American Society of Anesthesiologists members, (2) testimony from attendees of two publicly held open forums at two national anesthesia meetings,|||||| and (3) Task Force opinion and interpretation. An updated opinion survey of consultant and American Society of Anesthesiologists members regarding the management of patients with known or suspected obstructive sleep apnea was conducted. The survey rate of return for the consultants was 53% (N = 54 of 102) and 267 responses were obtained from the random sample of American Society of Anesthesiologists members. Summary results of these surveys are reported in the text of these updated Guidelines, with a complete and full reporting of all questionnaire item responses in tables 3 and 4.

|||| Postgraduate Assembly in Anesthesiology; 58th Annual Meeting, December 11, 2004 in New York, NY, and Society of Ambulatory Anesthesia, 20th Annual Meeting, May 12, 2005 in Scottsdale, Arizona.

Table 1. Identification and Assessment of OSA: Example

A. Clinical signs and symptoms suggesting the possibility of OSA
1. Predisposing physical characteristics
   - Adult patients: BMI 35 kg/m^2
   - Pediatric patients: 95th percentile for age and sex
   - Neck circumference 17 inches (men) or 16 inches (women)
   - Craniofacial abnormalities affecting the airway
   - Anatomical nasal obstruction
   - Tonsils nearly touching or touching in the midline
2. History of apparent airway obstruction during sleep
   Two or more of the following are present: (if patient lives alone or sleep is not observed by another person then only one condition needs to be present)
   - Loud snoring (loud enough to be heard through closed door)
   - Frequent snoring
   - Observed pauses in breathing during sleep
   - Awakens from sleep with choking sensation
   - Frequent arousals from sleep
   - Pediatric patients:
     - Intermittent vocalization during sleep
     - Parental report of restless sleep, difficulty breathing, or struggling respiratory efforts during sleep
     - Child with night terrors
     - Child sleeps in unusual positions
     - Child with new onset enuresis
3. Somnolence (one or more of the following is present)
   - Frequent daytime somnolence or fatigue despite adequate "sleep"
   - Falls asleep easily in a nonstimulating environment (*e.g.*, watching television, reading, riding in, or driving a car) despite adequate "sleep"
   - Pediatric patients: parent or teacher comments that child appears sleepy during the day, is easily distracted, is overly aggressive, is irritable, or has difficulty concentrating
   - Pediatric patients: child often difficult to arouse at usual awakening time

If a patient has signs or symptoms in two or more of the above categories, there is a significant probability that he or she has OSA. The severity of OSA may be determined by sleep study (see below). If a sleep study is not available, such patients should be treated as though they have moderate sleep apnea unless one or more of the signs or symptoms above is severely abnormal (*e.g.*, markedly increased BMI or neck circumference, respiratory pauses which are frightening to the observer, patient regularly falls asleep within minutes after being left unstimulated without another explanation) in which case they should be treated as though they have severe sleep apnea.

B. If a sleep study has been done, the results should be used to determine the perioperative anesthetic management of a patient. However, because sleep laboratories differ in their criteria for detecting episodes of apnea and hypopnea, the Task Force believes that the sleep laboratory's assessment (none, mild, moderate, or severe) should take precedence over the actual AHI. If the overall severity is not indicated, it may be determined by using the table below:

Severity of OSA	**Adult AHI**	**Pediatric AHI**
None	0–5	0
Mild OSA	6–20	1–5
Moderate OSA	21–40	6–10
Severe OSA	>40	>10

AHI = apnea–hypopnea index: the number of episodes of sleep-disordered breathing per hour; BMI = body mass index; OSA = obstructive sleep apnea.

Table 2. Scoring System for Perioperative Risk from OSA: Example*

A. Severity of sleep apnea based on sleep study (or clinical indicators if sleep study is not available)	
Point score: (0–3)†‡	
Severity of OSA (table 1)	Points
None	0
Mild	1
Moderate	2
Severe	3
B. Invasiveness of surgery and anesthesia	
Point score: (0–3)	
Type of surgery and anesthesia	Points
Superficial surgery under local or peripheral nerve block anesthesia without sedation	0
Superficial surgery with moderate sedation or general anesthesia	1
Peripheral surgery with spinal or epidural anesthesia (with no more than moderate sedation)	1
Peripheral surgery with general anesthesia	2
Airway surgery with moderate sedation	2
Major surgery, general anesthesia	3
Airway surgery, general anesthesia	3
C. Requirement for postoperative opioids	
Point score: (0–3)	
Opioid requirement	Points
None	0
Low-dose oral opioids	1
High-dose oral opioids, parenteral or neuraxial opioids	3
D. Estimation of perioperative risk:	
Overall point score: the score for A plus the greater of the score for either B or C: (0–6)§	

* A scoring system similar to the above may be used to estimate whether a patient is at increased perioperative risk of complications from OSA. This example, which has not been clinically validated, is meant only as a guide, and clinical judgment should be used to assess the risk of an individual patient. † One point may be subtracted if a patient has been on CPAP or NIPPV before surgery and will be using his or her appliance consistently during the postoperative period. ‡ One point should be added if a patient with mild or moderate OSA also has a resting $PaCO_2$ >50 mmHg. § Patients with score of 4 may be at increased perioperative risk from OSA; patients with a score of 5 or 6 may be at significantly increased perioperative risk from OSA.

CPAP = continuous positive airway pressure; NIPPV = noninvasive positive pressure ventilation; OSA = obstructive sleep apnea.

Table 3. Consultant Survey Responses

		Percent Responding to Each Item				
	N	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
I. Preoperative evaluation						
1. Anesthesiologists should work with surgeons to develop a protocol whereby patients in whom the possibility of OSA is suspected on clinical grounds are evaluated long enough before the day of surgery to allow preparation of a perioperative management	54	64.8*	27.8	3.7	3.7	0.0
2. A preoperative evaluation should include (1) a comprehensive review of previous medical records (if available), (2) an interview with the patient and/or family, and (3) conducting a physical examination	54	74.1*	20.4	3.7	0.0	1.9
3. If any characteristics noted during the preoperative evaluation suggest that the patient has OSA, the anesthesiologist and surgeon should jointly decide whether to (1) manage the patient perioperatively based on clinical criteria alone, or (2) obtain sleep studies, conduct a more extensive airway examination, and initiate indicated OSA treatment in advance of surgery	54	48.1	35.2*	14.8	1.9	0.0
4. If the preoperative evaluation does not occur until the day of surgery, the surgeon and anesthesiologist together may elect for presumptive management based on clinical criteria or a last-minute delay of surgery	54	29.6	48.1*	13.0	9.3	0.0

(*Continued*)

Table 3. Continued

	Percent Responding to Each Item					
	N	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
5. The severity of the patient's OSA, the invasiveness of the diagnostic or therapeutic procedure, and the requirement for postoperative analgesics should be taken into account in determining whether a patient is at increased perioperative risk from OSA	54	87.0*	13.0	0.0	0.0	0.0
6. The patient and his or her family as well as the surgeon should be informed of the potential implications of OSA on the patient's perioperative course	54	77.8*	16.7	5.6	0.0	0.0
II. Inpatient *vs.* outpatient surgery						
7. Before patients at increased perioperative risk from OSA are scheduled to undergo surgery, a determination should be made regarding whether a surgical procedure is most appropriately performed on an inpatient or outpatient basis	54	59.3*	27.8	9.3	1.9	1.9
III. Preoperative preparation						
8. Preoperative initiation of CPAP should be considered, particularly if OSA is severe	54	40.7	29.6*	24.1	3.7	1.9
9. For patients who do not respond adequately to CPAP, NIPPV should be considered	54	9.3	37.0	44.4*	5.6	3.7
10. The preoperative use of mandibular advancement devices or oral appliances and preoperative weight loss should be considered when feasible	54	9.3	33.3	37.0*	18.5	1.9
11. Patients with known or suspected OSA may have difficult airways and therefore should be managed according to the "Practice Guidelines for Management of the Difficult Airway: An Updated Report, ANESTHESIOLOGY 2013; 118:251–70"	54	35.2	46.3*	13.0	3.7	1.9
IV. Intraoperative management						
12. The potential for postoperative respiratory compromise should be considered in selecting intraoperative medications	54	66.7*	29.6	3.7	0.0	0.0
13. For superficial procedures, consider the use of local anesthesia or peripheral nerve blocks, with or without moderate sedation	54	50.0*	44.4	3.7	1.9	0.0
14. Consider administering CPAP or using an oral appliance during sedation to patients previously treated with these modalities	54	38.9	37.0*	18.5	5.6	0.0
15. General anesthesia with a secure airway is preferable to deep sedation without a secure airway, particularly for procedures that may mechanically compromise the airway	54	68.5*	24.1	5.6	1.9	0.0
16. Major conduction anesthesia (spinal/epidural) should be considered for peripheral procedures	54	42.6	42.6*	11.1	3.7	0.0
17. Unless there is a medical or surgical contraindication, patients at increased perioperative risk from OSA should be extubated while awake	54	55.6*	25.9	16.7	1.9	0.0
18. Full reversal of neuromuscular block should be verified before extubation	54	70.4*	24.1	3.7	1.9	0.0
19. When possible, extubation and recovery should be carried out in the lateral, semiupright, or other nonsupine positions	54	50.0*	33.3	9.3	7.4	0.0
V. Postoperative management						
20. Regional analgesic techniques should be considered to reduce or eliminate the requirement for systemic opioids in patients at increased perioperative risk from OSA	54	50.0*		5.6	3.7	0.0
21. If neuraxial analgesia is planned, weigh the benefits (improved analgesia, decreased need for systemic opioids) and risks (respiratory depression from rostral spread) of using an opioid or opioid–local anesthetic mixture rather than a local anesthetic alone	54	40.7		20.4	1.9	0.0

(*Continued*)

Table 3. Continued

	Percent Responding to Each Item					
	N	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
22. If patient-controlled systemic opioids are used, continuous background infusions should be avoided or used with extreme caution	54	59.3*		5.6	3.7	0.0
23. To reduce opioid requirements, nonsteroidal antiinflammatory agents and other modalities (*e.g.*, ice, transcutaneous electrical nerve stimulation) should be considered if appropriate	54	57.4*		5.6	0.0	0.0
24. Supplemental oxygen should be administered continuously to all patients who are at increased perioperative risk from OSA until they are able to maintain their baseline oxygen saturation while breathing room air	54	31.5		16.7	14.8	3.7
25. When feasible, CPAP or NIPPV (with or without supplemental oxygen) should be continuously administered postoperatively to patients who were using these modalities preoperatively, unless contraindicated by the surgical procedure	54	66.7*		3.7	0.0	0.0
26. If possible, patients at increased perioperative risk from OSA should be placed in nonsupine positions throughout the recovery process	54	44.4		18.5	0.0	0.0
27. Hospitalized patients who are at increased risk of respiratory compromise from OSA should have continuous pulse oximetry monitoring after discharge from the recovery room	54	44.4		18.5	1.9	0.0
28. Continuous monitoring should be maintained as long as patients remain at increased risk	54	40.7		14.8	5.6	0.0
29. If frequent or severe airway obstruction or hypoxemia occurs during postoperative monitoring, initiation of nasal CPAP or NIPPV should be considered	54	55.6*		5.6	1.9	0.0
VI. Criteria for discharge to unmonitored settings						
30. Patients at increased perioperative risk from OSA should not be discharged from the recovery area to an unmonitored setting (*i.e.*, home or unmonitored hospital bed) until they are no longer at risk for postoperative respiratory depression	54			22.2	1.9	0.0
31. To establish that patients are able to maintain adequate oxygen saturation levels while breathing room air, respiratory function may be determined by observing patients in an unstimulated environment, preferably while asleep	54			18.5	5.6	0.0

N is the number of consultants who responded to each item.

* Indicates the median.

CPAP = continuous positive airway pressure; NIPPV = noninvasive positive pressure ventilation; OSA = obstructive sleep apnea.

Table 4. ASA Members Survey Responses

	Percent Responding to Each Item					
	N	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
I. Preoperative evaluation						
1. Anesthesiologists should work with surgeons to develop a protocol whereby patients in whom the possibility of OSA is suspected on clinical grounds are evaluated long enough before the day of surgery to allow preparation of a perioperative management	267	55.4*	27.0	14.6	2.2	0.7
2. A preoperative evaluation should include (1) a comprehensive review of previous medical records (if available), (2) an interview with the patient and/or family, and (3) conducting a physical examination	267	71.2*	22.1	5.6	1.1	0.0

(*Continued*)

Table 4. Continued

	Percent Responding to Each Item					
	N	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
3. If any characteristics noted during the preoperative evaluation suggest that the patient has OSA, the anesthesiologist and surgeon should jointly decide whether to (1) manage the patient perioperatively based on clinical criteria alone, or (2) obtain sleep studies, conduct a more extensive airway examination, and initiate indicated OSA treatment in advance of surgery	267	43.1	33.7*	18.0	4.5	0.7
4. If the preoperative evaluation does not occur until the day of surgery, the surgeon and anesthesiologist together may elect for presumptive management based on clinical criteria or a last-minute delay of surgery	267	50.9*	37.1	9.4	2.6	0.0
5. The severity of the patient's OSA, the invasiveness of the diagnostic or therapeutic procedure, and the requirement for postoperative analgesics should be taken into account in determining whether a patient is at increased perioperative risk from OSA	267	81.3*	18.0	0.7	0.0	0.0
6. The patient and his or her family as well as the surgeon should be informed of the potential implications of OSA on the patient's perioperative course	267	75.3*	22.8	1.9	0.0	0.0
II. Inpatient *vs.* outpatient surgery						
7. Before patients at increased perioperative risk from OSA are scheduled to undergo surgery, a determination should be made regarding whether a surgical procedure is most appropriately performed on an inpatient or outpatient basis	267	67.8*	28.5	3.0	0.7	0.0
III. Preoperative preparation						
8. Preoperative initiation of CPAP should be considered, particularly if OSA is severe	267	50.2*	27.7	18.7	3.0	0.4
9. For patients who do not respond adequately to CPAP, NIPPV should be considered	267	25.5	49.4*	24.0	1.1	0.0
10. The preoperative use of mandibular advancement devices or oral appliances and preoperative weight loss should be considered when feasible	267	25.5	36.7*	31.1	6.0	0.7
11. Patients with known or suspected OSA may have difficult airways and therefore should be managed according to the "Practice Guidelines for Management of the Difficult Airway: an Updated Report, ANESTHESIOLOGY 2013; 118:251–70"	267	48.3	36.7*	12.7	1.1	1.1
IV. Intraoperative management						
12. The potential for postoperative respiratory compromise should be considered in selecting intraoperative medications	267	70.0*	28.1	1.9	0.0	0.0
13. For superficial procedures, consider the use of local anesthesia or peripheral nerve blocks, with or without moderate sedation	267	58.4*	34.8	6.0	0.4	0.4
14. Consider administering CPAP or using an oral appliance during sedation to patients previously treated with these modalities	267	38.2	40.4*	15.0	6.4	0.0
15. General anesthesia with a secure airway is preferable to deep sedation without a secure airway, particularly for procedures that may mechanically compromise the airway	267	67.8*	23.2	6.7	1.5	0.7
16. Major conduction anesthesia (spinal/epidural) should be considered for peripheral procedures	267	37.5	45.7*	14.6	1.9	0.4
17. Unless there is a medical or surgical contraindication, patients at increased perioperative risk from OSA should be extubated while awake	267	53.9*	28.1	13.9	3.7	0.4
18. Full reversal of neuromuscular block should be verified before extubation	267	85.8*	12.4	1.9	0.0	0.0
19. When possible, extubation and recovery should be carried out in the lateral, semiupright, or other nonsupine positions	267	43.4	32.6*	16.9	6.4	0.7

(*Continued*)

Table 4. Continued

	Percent Responding to Each Item					
	N	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
V. Postoperative management						
20. Regional analgesic techniques should be considered to reduce or eliminate the requirement for systemic opioids in patients at increased perioperative risk from OSA	267	56.6*	38.6	4.9	0.0	0.0
21. If neuraxial analgesia is planned, weigh the benefits (improved analgesia, decreased need for systemic opioids) and risks (respiratory depression from rostral spread) of using an opioid or opioid–local anesthetic mixture rather than a local anesthetic alone	267	38.2	51.7*	7.9	1.9	0.4
22. If patient-controlled systemic opioids are used, continuous background infusions should be avoided or used with extreme caution	267	68.9*	24.3	5.6	1.1	0.0
23. To reduce opioid requirements, nonsteroidal antiinflammatory agents and other modalities (*e.g.*, ice, transcutaneous electrical nerve stimulation) should be considered if appropriate	267	68.2*	29.2	2.6	0.0	0.0
24. Supplemental oxygen should be administered continuously to all patients who are at increased perioperative risk from OSA until they are able to maintain their baseline oxygen saturation while breathing room air	267	51.3*	35.6	9.0	3.4	0.7
25. When feasible, CPAP or NIPPV (with or without supplemental oxygen) should be continuously administered postoperatively to patients who were using these modalities preoperatively, unless contraindicated by the surgical procedure	267	54.7*	31.1	10.9	3.4	0.0
26. If possible, patients at increased perioperative risk from OSA should be placed in nonsupine positions throughout the recovery process	267	47.6	39.7*	10.5	2.2	0.0
27. Hospitalized patients who are at increased risk of respiratory compromise from OSA should have continuous pulse oximetry monitoring after discharge from the recovery room	267	56.9*	33.7	7.5	1.1	0.7
28. Continuous monitoring should be maintained as long as patients remain at increased risk	267	64.0*	29.2	4.5	1.9	0.4
29. If frequent or severe airway obstruction or hypoxemia occurs during postoperative monitoring, initiation of nasal CPAP or NIPPV should be considered	267	67.8*	28.8	2.6	0.7	0.0
VI. Criteria for discharge to unmonitored settings						
30. Patients at increased perioperative risk from OSA should not be discharged from the recovery area to an unmonitored setting (*i.e.*, home or unmonitored hospital bed) until they are no longer at risk of postoperative respiratory depression	267	51.7*	33.3	10.9	3.7	0.4
31. To establish that patients are able to maintain adequate oxygen saturation levels while breathing room air, respiratory function may be determined by observing patients in an unstimulated environment, preferably while asleep	267	40.8	44.6*	11.6	3.0	0.0

N is the number of ASA members who responded to each item.

* Indicates the median.

ASA = American Society of Anesthesiologists; CPAP = continuous positive airway pressure; NIPPV = noninvasive positive pressure ventilation; OSA = obstructive sleep apnea.

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Competing Interests

The authors declare no competing interests.

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Address correspondence to the American Society of Anesthesiologists: 520 N. Northwest Highway, Park Ridge, Illinois 60068-2573. These Practice Guidelines, and all ASA Practice Parameters, may be obtained at no cost through the Journal Web site, www.anesthesiology.org.

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