Obesity and Obstructive Sleep Apnea in the Ambulatory Patient

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KEYWORDS

• Obesity • Obstructive sleep apnea • Ambulatory surgery • Patient selection
• Perioperative outcomes • Patient safety

KEY POINTS

- Appropriate preoperative evaluation in selecting obese and obstructive sleep apnea (OSA) patients scheduled for ambulatory surgery includes the identification and optimization of comorbidities.
- Preoperative screening for OSA is essential in minimizing perioperative risk in undiagnosed patients.
- Obese and OSA patients may be at increased risk for difficult airway management.
- Anesthetic management strategies to reduce perioperative risk in obese and OSA patients presenting for ambulatory surgery include an emphasis on regional anesthesia, use of short-acting agents, and minimizing use of muscle relaxants and opioids.
- Two key discharge criteria for obese and OSA patients are the ability to maintain baseline oxygen saturations on room air and the management of pain with minimal opioids.

INTRODUCTION

Obesity is often associated with increased perioperative risks, particularly at extremes (ie, body mass index [BMI] >40 kg/m^2). However, BMI alone is a poor predictor of perioperative risk because obesity is a heterogeneous condition.[1,2] Morbid obesity has a strong association with obstructive sleep apnea (OSA), a common form of sleep-disordered breathing, which frequently remains undiagnosed.[2] OSA has been linked not only to adverse long-term health outcomes but also to increased perioperative

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risk, particularly respiratory complications.[3] Over recent years, there has been an increase in the rate of ambulatory surgery,[4] which coupled with the increasing prevalence of obesity and OSA, means that this patient population is increasingly presenting for ambulatory surgery. This article discusses the current controversies surrounding perioperative care of morbidly obese patients with or without OSA scheduled for ambulatory surgery, particularly in a free-standing ambulatory center.

PREOPERATIVE CONSIDERATIONS

Obese patients should be screened for comorbidities, including cardiovascular disease, respiratory disease (particularly OSA), and endocrine disorders (particularly diabetes mellitus).[5] Although ambulatory surgeries typically carry a low risk of perioperative cardiac complications (cardiac risk <1%), morbid obesity (BMI >40 kg/m^2) itself can lead to cardiomyopathy in the absence of coronary artery disease.[6] The American Heart Association and the American College of Cardiology have developed guidelines regarding the preoperative evaluation of severely obese patients.[6,7] The initial step should be a thorough history and physical examination, including an evaluation of functional status. However, in the severely obese, functional capacity may be difficult to assess and may be impaired due to reasons other than cardiac compromise. Therefore, an electrocardiogram should be obtained in patients with limited functional capacity and at least one risk factor for perioperative cardiovascular morbidity (ie, history of heart disease, history of congestive heart failure, history of cerebrovascular disease, preoperative insulin treatment, and preoperative serum creatinine >2 mg/dL).[5,6] The presence of left bundle branch block is unusual in uncomplicated obesity and may indicate underlying heart disease. The presence of right heart hypertrophy suggests pulmonary hypertension. A chest radiograph can reveal cardiac chamber enlargement suggestive of heart failure or abnormal pulmonary vascularity suggestive of pulmonary hypertension, and it is reasonable to have this information as a baseline in the event of postoperative respiratory compromise.[6] Further cardiovascular testing, such as stress test or echocardiography, may be indicated in patients with 3 or more risk factors for perioperative cardiovascular morbidity, but routine testing is not indicated.[5]

Approximately 70% of patients with a BMI greater than 40 kg/m^2 may have OSA.[2] Because a significant portion of OSA patients presenting for surgery do not have a formal diagnosis of OSA, identifying patients at risk for OSA has been recommended.[8,9] The Society for Ambulatory Anesthesia and the Society of Anesthesia and Sleep Medicine (SASM) recommend the use of the STOP-BANG questionnaire to screen patients for OSA, because it is the most validated tool.[8,9] A cutoff of $\geq$5 is suggested because scores of 5 to 8 identify patients with a high probability of moderate to severe OSA.[10,11]

Selection of Obese and Obstructive Sleep Apnea Patients for Ambulatory Surgery

It is well accepted that obesity alone is not a contradiction for ambulatory surgery.[12] Because of weight limitations on equipment, such as stretchers and operating tables, there are limits as to the total body weight (TBW) of a patient that can be taken care of at any given ambulatory center. Studies investigating perioperative outcomes in obese patients are of limited quantity, but seem to indicate that obese patients with BMI $\leq$40 kg/m^2 can undergo ambulatory surgery if comorbidities are optimized before surgery.[12] Patients with BMI greater than 50 kg/m^2 appear to be at increased risk for postdischarge readmission, and caution should be used when selecting these patients for ambulatory surgery, particularly those requiring general anesthesia.[12] For

patients with BMI of 41 to 50 kg/m^2, the presence of OSA should be taken into consideration.[8] A recent study in patients undergoing elective ambulatory hernia repairs found that the readmission rates increased with increasing BMI.[13] Adjusting for age and comorbidities, the BMI threshold associated with increased readmission risk was 45.7 kg/m^2. However, the modest discriminating ability of the model indicates that in addition to BMI, patient comorbidity and surgical factors should also be taken into account.[13]

Patients with known OSA scheduled for ambulatory surgery should have other comorbidities optimized and be able to use continuous positive airway pressure (CPAP) after discharge.[8] If a patient is deemed to be at high risk for moderate to severe OSA based on a screening tool, the surgery or procedure should proceed with the assumption that the patient has OSA. Of note, there is no clear evidence to suggest that delaying a procedure to obtain a sleep study and initiate positive airway pressure therapy (eg, CPAP) would improve perioperative outcome.[8,9] Therefore, delaying surgery to obtain a sleep study is not recommended.

INTRAOPERATIVE CONSIDERATIONS

Sedation and Analgesia

Many ambulatory procedures can be performed with sedation/analgesia, avoiding some of the risks of general anesthesia. Benzodiazepines, most commonly midazolam, are frequently used for sedation; however, these agents may cause respiratory depression and decrease the arousal response to airway occlusion. Therefore, benzodiazepines should be used with caution.[14]

Propofol, a commonly used agent for sedation during gastrointestinal (GI) endoscopy procedures and drug-induced sleep endoscopy (DISE), is also associated with increased respiratory events and desaturation in OSA patients.[14] Studies examining propofol sedation during DISE procedures have found OSA and increasing BMI to be risk factors for airway obstruction and collapse.[14] Several studies have found that OSA, increased BMI, male gender, American Society of Anesthesiologists (ASA) physical status >3, and increased age to be independent risk factors for hypoxic events during procedural sedation with propofol.[14] In addition, in obese patients, there is uncertainty regarding the appropriate dosing,[14] with some studies supporting lean body weight (LBW)[15] and others supporting a scalar between LBW and TBW.[16] Therefore, careful titration is recommended when using propofol for sedation in patients with obesity or OSA.

Another common agent for procedural sedation is ketamine. Ketamine does not decrease upper airway muscle activity,[17] which may be a beneficial property for OSA patients. Studies in the general adult population have shown that when ketamine supplements propofol in procedural sedation, there are fewer adverse respiratory events.[18] Thus, it is reasonable to assume that obese and OSA patients could also benefit from ketamine, although there is no strong evidence in these populations.

Dexmedetomidine has a favorable respiratory profile, making it desirable in obese or OSA patients. However, there is limited evidence linking dexmedetomidine to improved outcomes in these patient populations. A systematic review of dexmedetomidine compared with propofol in patients undergoing DISE found that dexmedetomidine resulted in less airway obstruction and a more stable cardiopulmonary profile. However, propofol resulted in a quicker onset and shorter duration.[19] A prospective case series of patients at high risk for OSA undergoing sedation for upper endoscopy found that compared with propofol alone, a dexmedetomidine-propofol

combination resulted in prolonged induction and recovery times.[20] The combination of dexmedetomidine and ketamine may provide adequate sedation/analgesia while maintaining airway patency. However, it has not been adequately studied in the obese and OSA populations.

Regardless of the anesthetic agents chosen for procedural sedation, it is important to use capnography to monitor respiratory status, because it allows early detection of apnea and decreases hypoxemic events.[21] The use of CPAP or an oral appliance during sedation in patients with OSA can be considered,[22] but there is limited evidence to support improved outcomes.

Regional Anesthesia

There are several reasons that regional anesthesia may be advantageous over general anesthesia in obese and OSA patients. With regional anesthesia, airway manipulation and airway difficulties are avoided. In addition, the effects of intraoperative anesthetic agents, neuromuscular blockade, and opioids are avoided. Regional anesthesia also offers pain relief, thereby reducing postoperative opioid requirements.[8,14,22] Therefore, regional anesthesia has been recommended as a safer alternative to general anesthesia in obese and OSA patients.[14,22] A systematic review of literature revealed 6 observational trials suggesting that regional anesthesia resulted in improved postoperative outcomes.[14] However, several studies included in this review were performed in hospitalized patients. A review of studies involving peripheral nerve blocks in obese and nonobese patients found a higher block failure rate in obese patients, although the overall rate of success was still high.[23] Overall, the superiority of regional anesthesia over general anesthesia in the ambulatory surgical population remains controversial, particularly with the use of "fast-track" general anesthesia techniques that include using shorter-acting anesthetics at the lowest possible doses.

Airway Management

Although several retrospective and prospective studies have supported that OSA is an independent risk factor for difficult airway management,[14] obesity itself has not consistently been shown to be an independent risk factor. Studies examining incidence of difficulty with tracheal intubation have found mixed results, with some studies associating obesity with difficult intubation and other studies finding no correlation with BMI, but finding correlation with high Mallampati score and neck circumference (characteristics associated with OSA).[24] These studies reiterate the importance of screening for OSA, especially in obese patients.

Because of the increased potential for difficult airway management, optimal preoxygenation is essential. There is a negative correlation between BMI and time to desaturation when apneic. Maneuvers to improve preoxygenation include head-up position and application of CPAP. In addition, appropriate positioning (ramping or stacking) reduces difficulty in tracheal intubation.[25] There is some debate as to the appropriateness of video laryngoscopy as a first-line intubation method in the obese. A meta-analysis found that video laryngoscopy in obese patients was superior to direct laryngoscopy in glottic visualization, success rate, and intubation time, but intubation time was only improved if the video laryngoscope had a tracheal tube guide channel.[26] Nevertheless, the investigators of this meta-analysis did not yet recommend routine use of video laryngoscopy in obese patients because of the limitations in studies analyzed. Because of decreased time to desaturation and possible difficult mask ventilation, there is argument for using succinylcholine for its rapid onset and short duration of action. However, it may be disadvantageous if difficulty intubating occurs, because fasciculations can decrease safe apnea time.[27] With the introduction of

sugammadex, the use of large doses of rocuronium in patients with suspected difficult mask ventilation has been considered because spontaneous respirations may occur more quickly with rocuronium-sugammadex than with succinylcholine.[28] Unfortunately, pharmacologic simulation shows that in a significant portion of morbidly obese and obese patients, rocuronium-sugammadex will not result in return of spontaneous ventilation before significant desaturation occurs.[29]

Choice of General Anesthetic Technique

There is lack of scientific literature regarding the choice of anesthetic technique in the OSA population. The SASM analyzed studies in the obese population, because there is a strong association between obesity and OSA.[14] Studies in the obese population indicate that desflurane and sevoflurane have a superior recovery profile compared with isoflurane and propofol.[14] Studies comparing desflurane and sevoflurane have shown conflicting results, with some finding that desflurane results in quicker emergence, whereas other studies show no difference between the 2 inhalational agents.[14] A systematic review of randomized controlled trials in obese patients undergoing abdominal surgery found that desflurane is superior to sevoflurane, isoflurane, and propofol in providing a quicker recovery, but that there were no differences in postoperative nausea and vomiting (PONV) or postoperative pain scores.[15] Two randomized trials in bariatric surgery patients did show that total intravenous anesthesia (propofol and dexmedetomidine) resulted in less PONV.[30,31] Intraoperative monitoring of hypnosis (eg, bispectral index monitoring) may be particularly helpful in patients with obesity and/or OSA, especially in titrating anesthetic agents. However, good evidence is lacking.

Neuromuscular Blockade

Residual neuromuscular blockade is a common problem, with studies showing that approximately 20% of patients in the postanesthesia care unit (PACU) have a train-of-4 ratio less than 0.9.[32] Residual neuromuscular blockade is associated with impaired pharyngeal function, airway obstruction, attenuation of hypoxic ventilatory response, and increased risk of postoperative pulmonary complications.[32] It is, therefore, important to take measures to reduce residual neuromuscular blockade. If possible, the use of neuromuscular blockade should be avoided or minimized, neuromuscular function monitored, and neuromuscular blockade reversed appropriately.[14] A Cochrane Review found that in the general adult surgical population receiving neuromuscular blocking drugs, sugammadex resulted in quicker recovery of twitches and decreased bradycardia and PONV when compared with neostigmine.[33] The studies included in this review did not report on OSA status, but 6 of the studies did include morbidly obese patients, which found that sugammadex resulted in faster recovery and decreased incidence of residual postoperative neuromuscular blockade.[33] Because of the paucity of evidence in the OSA population, the SASM has not recommended routine use of sugammadex over neostigmine at this time.[14] The recommended manufacturer dosing for sugammadex is based on TBW, but being a water-soluble drug, sugammadex may better dosed based on ideal body weight (IBW) or LBW. So far, studies show that in morbidly obese patients, ideal dose may be IBW + 40%.[34–36]

Perioperative Pain Management

It is recommended that perioperative opioid use must be limited because of adverse effects, particularly respiratory depressant effects.[37] Unfortunately, the intermittent hypoxia and sleep fragmentation seen in OSA can lead to hyperalgesia and increased analgesic requirements.[38] Studies examining if OSA patients are more likely to have adverse respiratory events in the setting of opioids have shown mixed results.[14] In

fact, there is no high-quality evidence to support a direct link between OSA and opioid-induced ventilatory impairment.[14] Despite this, it is important to note that some studies, which found no increased respiratory impairment in OSA patients receiving opioids, did find increased GI impairment.[14] High-quality evidence regarding opioid risks in the obese population is also lacking. Opioid-free anesthesia has been increasingly used in recent years.[39] Several studies have used lidocaine, dexmedetomidine, ketamine, and magnesium, either alone or in combination.[40] However, the available evidence is limited. Furthermore, the adverse effects of these drugs and their combinations have not been adequately assessed. Thus, the risks and benefits of each agent need to be considered before administration.

Available studies do support superior outcomes with a multimodal, opioid-sparing approach.[40] Adequate postoperative pain management is necessary for enhanced recovery after surgery. Procedure- and patient-specific pain management strategies should be developed so that they can be incorporated in enhanced recovery protocols.[41] The aim of an analgesic technique should be to optimize pain relief and facilitate early ambulation and physical therapy. The choice of analgesic combinations should depend not only on analgesic efficacy but also on the overall side-effect profiles of these combinations. Regional/local analgesic techniques should form the basis of any optimal multimodal analgesic approach and should be supplemented with a combination of acetaminophen, traditional nonsteroidal anti-inflammatory drugs or cyclo-oxygenase-2–specific inhibitors, and dexamethasone, assuming there are no contraindications. Opioids should used as "rescue" analgesics on an "as-needed" basis rather than on a scheduled basis.[41]

POSTOPERATIVE CONSIDERATIONS

Postanesthesia Care Unit Care

Postoperatively, patients with OSA and/or obesity should be carefully monitored, particularly for respiratory compromise. In the PACU, the patient should be positioned in a semiupright position to decrease airway obstruction; continuous pulse oximetry should be used, and the patient should be observed for apneic events.[22]

If needed, supplemental oxygen should be used until the patient can maintain baseline saturations on room air. There has been some concern that supplemental oxygen can result in delayed detection of hypercapnia from respiratory depression. Although supplemental oxygen improves oxygen saturations, it can also increase the length of apneic episodes, because hypoxia is a trigger for arousal.[42] This potential for increased length of apneic episodes with supplemental oxygen has led to concerns that supplemental oxygen can actually increase respiratory depression[43] and impair detection of hypoventilation.[44] A recent study randomized untreated OSA patients to supplemental oxygen postoperatively and showed no difference in apnea-hypopnea event duration or incidence of hypercarbia.[45]

In addition to supplemental oxygen, CPAP therapy may be used in the PACU. It is prudent to have a CPAP device available should the need arise. Several studies have shown benefit in initiating CPAP therapy postoperatively in untreated patients,[46] but these studies are often in patients undergoing major surgery, not the type of surgery performed in the ambulatory setting. As an alternative to CPAP, high-flow nasal oxygen therapy is starting to show promise, because it can decrease apnea-hypopnea events and arousals from sleep in patients with OSA.[47]

Discharge

Patients should not be discharged until there is no longer a risk of postoperative respiratory depression. To meet this requirement, patients should be able to maintain

adequate oxygen saturations while in an unstimulated environment, preferably asleep, and while breathing room air.[22] Pain should also be well controlled without opioids. Patients with CPAP therapy should be advised to use CPAP any time they sleep, whether day or night.[8] The use of at-home oxygen saturation monitoring has been considered in OSA patients, but in one study, severe postoperative desaturation at home occurred in one-quarter of patients, but did not result in any complications or required interventions.[48]

SUMMARY

Patients with morbid obesity and OSA can be at increased perioperative risk, and there is a large overlap between the 2 pathologic conditions. However, these patients can and do safely undergo ambulatory surgery provided appropriate precautions are taken. First, appropriate preoperative workup can ensure appropriate patient selection, excluding patients with nonoptimized comorbidities. Intraoperatively, precautions include appropriate management of a potentially difficult airway and careful selection of anesthetic techniques with an emphasis on using shorter-acting anesthetics, muscle relaxants, and opioids at lowest possible doses. Postoperatively, careful monitoring is essential in determining an appropriate discharge. With these concepts in mind, obese and OSA patients can do well in the ambulatory setting.

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