# Perioperative Management of an Adult Obese Patient for Ambulatory Surgery: An Update

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**LESSON OBJECTIVES**

**Upon completion of this lesson, the reader should be able to:**

1. **Identify the perioperative challenges in obese patients scheduled for ambulatory surgery.**
2. **List the comorbid conditions associated with obesity.**
3. **Describe the preoperative evaluation and preparation of the obese, including identification of obstructive sleep apnea.**
4. **Explain management of these patients in the immediate postoperative period.**
5. **Identify criteria for discharge home of these outpatients.**
6. **Discuss appropriate selection of these patients for ambulatory surgical procedures, including patients with obstructive sleep apnea.**
7. **Plan an anesthetic that will minimize the perioperative risks in these patients.**
8. **Discuss optimal management of these patients after discharge home.**
9. **Describe approaches to educate patients and their caregivers regarding perioperative concerns and post-discharge management.**
10. **Develop clinical pathways to improve patient safety and perioperative outcomes.**

Current Reviews for Nurse Anesthetists® designates this lesson for 1 CE contact hour in pharmacology/therapeutics.

## Introduction

The prevalence of obesity is increasing exponentially worldwide. In clinical practice, body mass index (BMI) is used to define the severity of obesity. A BMI of 25.0-29.9 kg/m$^2$ is defined as overweight, while a BMI > 40 kg/m$^2$ is classified as morbid obesity. A BMI > 50 kg/m$^2$ is considered super obese. However, recent literature suggests that BMI may not be a good predictor of distribution of excess body fat. It is suggested that the excess adipose tissue in the visceral compartment (i.e., abdominal girth) may be a better predictor of consequences of obesity, as it contributes to a chronic inflammatory process and metabolic disease.

The pathophysiological changes associated with obesity influences organ function, resulting in the increased incidence of comorbidities (Table 1), which can adversely influence perioperative outcome (Table 2). Therefore, the suitability of ambulatory surgery in this patient population remains controversial. This lesson discusses the current literature related to the perioperative care of adult obese patients scheduled for ambulatory surgery with emphasis on patients with obstructive sleep apnea (OSA).

## Selection for Ambulatory Surgery

Suitability for ambulatory surgery in the obese with or without OSA remains controversial because there is limited scientific literature assessing safety in this patient population. Recently, several large observational trials reveal that BMI alone is not an independent risk factor for perioperative complications. However, the majority of the patients included in these studies had mild-to-moderate obesity (i.e., BMI <40 kg/m$^2$) with minimal or no comorbid conditions.

**Drugs Mentioned in Lesson**

| Generic Name | Trade Name |
|---|---|
| Propofol | Diprivan |
| Midazolam | Versed |
| Dexmedetomidine | Precedex |
| Ketamine | Ketlar, Ketanest, Ketaset |
| Remifentanil | Altiva |
| Sevoflurane | Ultane |
| Desflurane | Suprane |
| Acetaminophen | Tylenol/Ofirmev |
| Dexamethasone | Decadron |
| Ondansetron | Zofran |
| Droperidol | Inapsine |
| Aprepitant | Emend |
| Transdermal scopolamine | Transderm Scop |
| Promethazine | Phernargan |
| Dimenhydrinate | Dramamine |

**Several studies suggest that super obesity (i.e., BMI >50kg/m$^2$) may be associated with a higher risk of postoperative complications, particularly if these patients have significant comorbidities such as OSA, obesity-related hypoventilation syndrome, pulmonary hypertension, resistant hypertension, significant coronary artery disease, and resistant cardiac failure.**

Interestingly, a lower mortality has been observed in the overweight and moderately obese patients compared with patients with normal body weight. The reasons for this "obesity paradox" are not yet known. Overall, it is recommended that **BMI or weight should not be used as a sole determinant of suitability for ambulatory surgery.** However, the super obese population may require greater attention with respect to preoperative evaluation and optimization as well as perioperative care.

One of the major comorbidities associated with obesity is OSA. The risks of respiratory complications, particularly the concerns of post-discharge death (i.e., "found dead in bed") have led to suggestions that OSA patients should not undergo ambulatory surgery. The American Society of Anesthesiologists (ASA)-OSA practice guidelines propose a scoring system that may be used to estimate the perioperative risk of complications and to determine suitability for ambulatory surgery. However, this scoring system is not yet validated. These guidelines also recommend that patients undergoing intra-abdominal and upper airway procedures are not suitable for ambulatory surgery. However, recent evidence suggests that outpatient bariatric surgery can be safely performed on an outpatient basis.

A recent systematic review assessed the perioperative complications in OSA patients undergoing ambulatory surgery. It was revealed that OSA alone was not a determinant of perioperative complications. Of note, OSA was identified, comorbid conditions were optimized preoperatively, and opioid use was avoided or minimized in the included studies. In addition, patients on preoperative continuous positive airway pressure (CPAP) used it in the postoperative period. The data from these studies suggest that predictors for perioperative complications include age, male gender, coexisting medical conditions, the degree of surgical invasiveness, and postoperative opioid dose. Overall, **adverse perioperative outcome is associated with a complex interplay of factors, such as coexisting medical conditions, the surgical procedure, and the anesthetic technique.**

**BMI or weight should not be used as a sole determinant of suitability for ambulatory surgery.**

A consensus statement from the Society for Ambulatory Anesthesia (SAMBA) that patients with a known diagnosis of OSA (i.e., diagnosis made using a sleep study) and optimized comorbid medical conditions can be considered for ambulatory surgery, if they are able to use CPAP in the postoperative period (Figure 1). Patients with a presumed diagnosis of OSA (i.e., based upon preoperative screening) and optimized comorbid conditions can be considered for most types of ambulatory surgery if postoperative opioid use can be limited. Of note, these recommendations do not include patients undergoing airway surgery.

## Preoperative Considerations

Obese patients can suffer from numerous chronic medical conditions. A focused preoperative evaluation includes assessment of the airway, cardio-

**Table 1**
**Comorbidities Associated with Obesity**

- **Respiratory**—restrictive pulmonary disease, hypoventilation syndrome, obstructive sleep apnea, asthma, pulmonary hypertension
- **Cardiac**—systemic hypertension, coronary artery disease, dysrhythmias, cardiomyopathy, CHF
- **Neurologic**—stroke
- **Renal**—renal dysfunction
- **Metabolic**—metabolic syndrome, type 2 diabetes mellitus, hypothyroidism
- **Abdominal**—hiatal hernia, gastroesophageal reflux, fatty liver infiltration
- **Others**—airway abnormalities, deep vein thrombosis

**Table 2**
**Challenges in the Obese Patients Undergoing Ambulatory Surgery**

**Intraoperative Considerations**
- Difficult/failed mask ventilation and/or tracheal intubation
- Difficulty in ventilation and/or maintaining adequate oxygen saturation
- Difficulty in positioning
- Exacerbation of cardiac co-morbidities (hypertension, arrhythmias, myocardial ischemia and infarction, pulmonary hypertension, heart failure)

**Immediate Postoperative Considerations**
- Delayed extubation
- Obstruction and/or desaturation after extubation
- Post-obstructive pulmonary edema
- Need for tracheal reintubation
- Exacerbation of cardiac comorbidities
- Cerebrovascular disorders (e.g., stroke)
- Postoperative delirium
- Prolonged PACU stay
- Delayed discharge home
- Unanticipated hospital admission

**Post-discharge Considerations**
- Exacerbation of cardiopulmonary comorbid conditions
- Renal dysfunction
- Rhabdomyolysis
- Deep vein thrombosis and pulmonary embolism
- Surgical site infection
- Readmission after discharge
- Hypoxic brain death and death

vascular, respiratory, and endocrine systems. In addition to the assessment of functional status, patients should be questioned to determine symptoms of angina, paroxysmal nocturnal dyspnea, orthopnea, and arrhythmias. Because 60-70% of morbidly obese patients may have OSA and OSA is undiagnosed in an estimated 60-70% of patients, screening for OSA should be part of the routine preoperative evaluation. The STOP-BANG screening tool is a user-friendly questionnaire that can be used to identify unrecognized OSA (Table 3). **Two recent studies suggest that a higher STOP-BANG score (i.e., 5 positive predictors rather than the originally proposed 3 positive predictors) provided superior specificity and identified patients with a high probability of moderate-to-severe OSA.**

### Preoperative Testing

It is well recognized that preanesthesia tests should be based on clinical indications and the invasiveness of the surgical procedure. A patient's functional activity (i.e., exercise tolerance) is commonly used to determine the need for further testing. However, obese patients may have limited functional activity despite the absence of cardiopulmonary dysfunction. Therefore, the American College of Cardiology and the American Heart Association developed recommendations for preoperative testing specifically for the obese population. It is recommended that an electrocardiogram (ECG) be obtained in patients with at least one risk factor for heart disease and/or poor exercise tolerance. Presence of ECG signs of right ventricular hypertrophy, right-axis deviation and right bundle-branch block would suggest pulmonary hypertension, while a left bundle-branch block may suggest occult heart disease. In addition, cardiac chamber enlargement or abnormal pulmonary vascularity on a chest X-ray may suggest undiagnosed heart failure or pulmonary hypertension, respectively. These positive findings warrant further cardiovascular investigation.

Exercise and/or pharmacologic stress echocardiography may be performed in the presence of $\geq 3$ risk factors of coronary artery disease (e.g., history of heart disease, history of congestive heart failure, history of cerebrovascular disease, preoperative treatment with insulin, and preoperative serum creatinine levels >2 mg/dL). Although obesity can influence pulmonary function (e.g., reduced expiratory reserve volume, forced expiratory volume, and functional residual capacity), pulmonary function tests (e.g., spirometry), are of no added benefit unless chronic obstructive pulmonary disease is suspected. In addition, patients should be assessed for obesity-induced hypoventilation syndrome.

**There is no valid reason to routinely avoid $N_2O$.**

If OSA is suspected during preoperative evaluation, one could proceed with a presumptive diagnosis of moderate-to-severe OSA or obtain a sleep study. A sleep study confirms the diagnosis and provides the severity of OSA (based upon the apnea-hypopnea index), as well as allows determination of CPAP requirements. However, it is unclear if routine preoperative sleep studies would influence perioperative outcome. In addition, the optimal duration of CPAP therapy before proceeding with elective surgical procedures is unknown.

### Preoperative Medications

Because obesity can be associated with several comorbidities, these patients may be on multiple medications. These medications should be continued until the day of surgery, except for antidiabetic therapy. Routine use of preoperative prophylaxis against acid aspiration (e.g., $H_2$-receptor antagonists and proton pump inhibitors) is questioned, as the risk of regurgitation of gastric contents for the obese and the non-obese appears to be similar. Obesity is an independent risk factor for venous thrombo-

embolism (VTE). Therefore, the use of mechanical prophylaxis (e.g., sequential compression devices or intermittent pneumatic compression) has been recommended. Because the risk of VTE is cumulative, pharmacologic prophylaxis may be warranted in patients with additional risk factors such as a history of deep vein thrombosis (DVT) and pulmonary embolism (PE).

## Sedation and Analgesia Techniques

Obese patients, particularly those with OSA, are sensitive to sedative-hypnotics and opioids, as they can cause dose-dependent upper airway obstruction, respiratory depression, and reduced respiratory responses to hypoxia and hypercapnia. Therefore, these drugs should be used with caution.

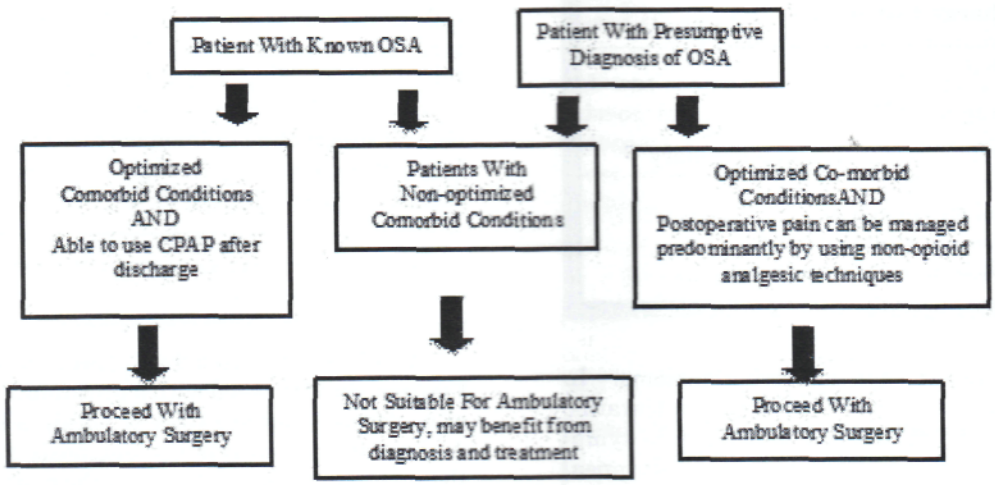
Compared with midazolam, propofol is preferred for sedation because of its rapid and clear-headed recovery. Dexmedetomidine (a highly selective alpha-2 adrenergic agonist with sedative, amnestic, analgesic, and sympatholytic properties with no respiratory depression) can also be used to provide sedation/analgesia. In addition, it reduces salivary secretions through sympatholytic and vagomimetic effects. Ketamine has sedative and analgesia properties with no respiratory depression.

Combining low-dose ketamine with propofol should reduce propofol requirements, as well as provide analgesia. Similarly, addition of low-dose ketamine to dexmedetomidine may potentiate its analgesic effects and reduce the hemodynamic adverse effects without influencing respiration.

Monitoring during sedation/analgesia should include continuous capnography as it allows detection of upper airway obstruction before oxygen desaturation, particularly when supplemental oxygen is administered.

## Intraoperative Considerations

Although the choice of anesthetic technique does not appear to be an important determinant of perioperative outcome in the obese or OSA patient, local or regional anesthesia is preferred, if possible. Local/regional anesthesia obviates the need for airway manipulation as well as avoids the need for hypnotic-sedatives, opioids, and muscle relaxants. In addition, these techniques provide postoperative analgesia and reduce postoperative opioid requirements.




**Preoperative Considerations:**

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

**Intraoperative Considerations:**

- Use non-opioid analgesic techniques, minimize or avoid opioids

**Postoperative Considerations:**

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

**Figure 1.** Decision making in preoperative selection of a patient with obstructive sleep apnea scheduled for ambulatory surgery (modified from Joshi GP et al *Anesth Analg* 2012).

**Table 3**
**STOP-BANG Scoring System**
(high risk of OSA: 3 or more questions answered yes)

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

### General Anesthesia

The optimal general anesthetic technique allows rapid and clear-headed recovery including early return of the patient's protective airway reflexes, which would allow maintenance of a patent airway. In addition, early recovery should reduce postoperative cardiorespiratory complications caused by residual anesthetic effects.

**The dose of neostigmine should be based upon the degree of blockade at the time of reversal.**

### Pre-induction Considerations

Obese patients are at risk of hypoxemia after induction of anesthesia. Preinduction head-up positioning, achieved by "stacking" with blankets or a specially designed foam pillow, can facilitate mask ventilation, as well as facilitate tracheal intubation (Table 4). Other techniques used to avoid post-induction hypoxemia include use of CPAP (10 cm $H_2O$) during preoxygenation with 100% oxygen until the end-tidal oxygen concentration is at least 90%.

### Airway Management

The excess adipose tissue in the neck, breast, thoracic wall, and abdomen in the obese may impair mask ventilation and tracheal intubation. However, several large observational trials have reported that BMI alone is not a good predictor of a difficult airway. Therefore, BMI or weight alone should not be considered a determinant for "awake" tracheal intubation. Similarly, although OSA has been reported to be a predictor of a difficult airway, it should not be the sole determinant of "awake" intubation. The need for "awake" tracheal intubation should be based upon several predictors of difficult tracheal intubation such as high Mallampati score (III or IV), neck circumference $\geq$40 cm, limited mandibular protrusion, and severe OSA. The availability of videolaryngoscopes has increased the success of tracheal intubation and reduced the need for "awake" intubation. Of note, an"awake" videolaryngoscopy after topical anesthesia (i.e., an "awake" look) may be an alternative to "awake" fiberoptic tracheal intubation. Sedatives and opioids must be utilized judiciously during "awake" tracheal intubation as they may cause airway obstruction before the airway is secured.

### Induction of General Anesthesia

Rapid sequence induction (RSI) is commonly performed in the obese due to concerns of pulmonary aspiration of gastric contents and difficult tracheal intubation. However, the need for RSI in this population is increasingly being questioned. Recent studies have shown that the barrier pressure (lower esophageal pressure-gastric pressure) in the obese patient remains positive throughout the induction of anesthesia. This suggests that the risk of gastric regurgitation in the obese is low.

**Of note, anesthesia drugs, including sedative/hypnotic drugs and opioids, should be dosed according to lean body weight (not actual body weight), while neuromuscular blocking drugs should be dosed according to ideal body weight (IBW).**

### Maintenance of General Anesthesia

There is lack of evidence for superiority of a specific maintenance technique (e.g., inhalation vs. total intravenous anesthesia). Nevertheless, inhaled anesthetics exert some neuromuscular blocking effect, which may reduce the need for muscle relaxants. Although the overall clinical differences between newer inhaled anesthetics (i.e., desflurane and sevoflurane) appear to be small, several studies have reported that desflurane allows earlier emergence and reduced variability in the time to tracheal extubation.

Because of its amnestic and analgesic properties, nitrous oxide ($N_2O$) reduces anesthetic and analgesic requirements and facilitates recovery. Nevertheless, the use of $N_2O$ is questioned due to concerns about the increased incidence of postoperative nausea and vomiting (PONV) and the effects of expansion of closed gas spaces. However, a recent systematic re-

**Table 4**
**Optimal Induction of Anesthesia in the Obese**

- **"Stacking" (chin higher than chest)**
- **Head-up position (decreases airway collapse, increases lung volume)**
- **Preinduction continuous positive airway pressure (improves pharyngeal airway patency)**
- **Recruitment maneuver**
- **Preoxygenation (duration determined by end-tidal oxygen >90%)**

view concluded that use of propofol for induction of anesthesia and antiemetic prophylaxis (current standard of care for ambulatory surgery) negated the emetic effects of $N_2O$. Also, $N_2O$ facilitates emergence from anesthesia by enhancing removal of inhaled anesthetic through the "second gas" effect. Furthermore, $N_2O$ reduces the occurrence of persistent postoperative pain. Thus, there is no valid reason to routinely avoid $N_2O$.

Opioids should be used sparingly because of concerns of opioid-related sedation, airway obstruction, and respiratory depression. In the obese, remifentanil (titrated to hemodynamics) may be preferable because of its unique pharmacokinetics and ultrashort duration. If necessary, longer-acting opioids may be titrated to patient response in the postoperative period.

**It is well recognized that even a minor degree of residual neuromuscular blockade (usually not appreciated clinically) can increase postoperative morbidity, such as inadequate ventilation, hypoxia, and the need for reintubation, particularly in the high-risk population of obese and OSA patients.** Therefore, muscle relaxants should be used sparingly, and reversal with neostigmine should be utilized without hesitation. Importantly, the dose of neostigmine should be based upon the degree of blockade at the time of reversal.

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**At the end of surgery, the primary aim should be to washout the inhaled anesthetic rather than to increase the $ETCO_2$ levels.**

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### Mechanical Ventilation

Lung protective ventilation strategies including low tidal volumes (6-8 ml/kg, IBW) and PEEP of 5-10 $cmH_2O$ should be utilized routinely. In addition, recruitment maneuvers should be applied in obese patients. Unfortunately the effects of recruitment maneuvers are often limited by hemodynamic instability. It is important to avoid hyperventilation, as this may lead to postoperative hypoventilation. **Mild hypercapnia (i.e., $ETCO_2$ of 40 mmHg) is recommended, as it can improve tissue oxygenation through improved tissue perfusion resulting from increased cardiac output and vasodilatation as well as increased oxygen offloading from the shift of the oxyhemoglobin dissociation curve to the right.**

### Pain Prophylaxis

It is clear that opioids are the most common cause of postoperative complications in the obese and OSA population. Therefore, opioids should be used sparingly. It is recommended that non-opioid local/regional anesthetic techniques, acetaminophen, and non-steroidal anti-inflammatory drugs (NSAIDs) or cyclo-oxygenase (COX)-2 specific inhibitors should be the basis of any analgesic technique, unless there are specific contraindications (Table 5). This approach reduces perioperative opioid requirements and opioid-related side effects as well as improves postoperative pain relief.

A single intraoperative dose of dexamethasone 4-8 mg has been shown to provide excellent analgesic effects and should be used unless there is a contraindication. Recently, there is increasing interest in using low dose ketamine to provide pain relief. However, the routine use of ketamine is questioned. A recent systematic review suggests that the ketamine provides improved pain relief and reduces opioid requirements in surgical procedures with significant postoperative pain. In addition, ketamine may be beneficial in opioid-tolerant patients.

Implementation of procedure-specific pain management protocols has been shown to improve pain relief and reduce opioid-related adverse effects. Some evidence-based procedure-specific guidelines are published on the website postopain.org.

### Nausea and Vomiting Prophylaxis

Patients undergoing ambulatory surgery are at a higher risk of PONV. Therefore, multimodal antiemetic therapy is recommended in all outpatients (Table 6). Patients at a very high risk of PONV may receive more than two antiemetics as well as total intravenous anesthesia.

### Intraoperative Fluid Management

Adequate preoperative hydration (i.e., encourage patients to consume water until 2 hours preoperatively) and higher intraoperative fluid administration (20-40 ml/kg) have been reported to reduce postural hypotension, postoperative dizziness, drowsiness, nausea, and fatigue after ambulatory surgery. In addition, because the morbidly obese are at a higher risk of rhabdomyolysis, administration of higher fluid volumes may reduce the consequences of myoglobinuric acute renal failure associated with rhabdomyolysis.

**Table 5**
**Procedure-specific Multimodal Analgesia Techniques**

- **Regional analgesic techniques**
  - Wound infiltration
  - Peripheral nerve blocks
- **Non-steroidal anti-inflammatory drugs (NSAIDs) or cyclooxygenase (COX)-2 specific inhibitors**
- **Acetaminophen**
- **Adjuvants**
  - Dexamethasone
  - Ketamine
- **Opioids (minimal)**

**Emergence from Anesthesia**

One of the major concerns in obese patients, particularly those with OSA, is the risk of airway obstruction after tracheal extubation. Therefore, rapid emergence from anesthesia, with clear-headed recovery, is critical in this patient population.

It is common practice to reduce the respiratory rate at the end of surgery with the aim of increasing end-tidal carbon dioxide ($ETCO_2$) to facilitate respiration. However, reduction in respiratory rate reduces minute ventilation, which may delay removal of inhaled anesthetic and thus delay emergence. Therefore, at the end of the surgery, the primary aim should be to washout the inhaled anesthetic rather than increase the $ETCO_2$ levels. Adequate ventilation during recovery from anesthesia and muscle relaxants should allow washout of inhaled anesthetics and facilitate emergence as well as reduce postoperative pulmonary atelectasis and hypoxemia.

Tracheal extubation should be performed in a semi-upright (25-30° head-up) position, when possible. Also, in patients with a difficult airway or stormy intraoperative period, placement of a nasal airway may avoid post-extubation airway obstruction as well as facilitate mask ventilation, if necessary. In patients on preoperative CPAP, application of CPAP immediately after tracheal extubation may be protective against post-extubation obstruction as well as improve pulmonary function.

**The risk of respiratory complications may last for several days after surgery.**

## Immediate Postoperative Considerations

Potential postoperative complications include respiratory problems such as airway obstruction, respiratory failure, need for reintubation, life-threatening hypoxia and cardiovascular complications such as systemic hypertension, ischemia, and cardiac arrhythmias. In the PACU, patients should be maintained in a semi-upright (25-30° head-up) position, if possible. Supplemental oxygen should be administered with caution, as it may reduce the hypoxic respiratory drive and increase the incidence and duration of apneic episodes in this patient population. Because obese patients might have unrecognized OSA, recurrent severe hypoxemia may be better treated with CPAP or bi-level positive airway pressure (BiPAP) **along with oxygen rather than oxygen alone.** Complaints of postoperative shoulder, hip, or buttock pain along with discolored urine and unexplained elevations in serum creatinine and creatine phosphokinase (>5000 IU/L) levels should raise suspicion of rhabdomyolysis.

The ASA-OSA Practice Guidelines suggest that OSA patients be monitored for a median of 3 hours longer than their non-OSA counterparts before discharge from the facility. In addition, the monitoring should continue for a median of 7 hours after the last episode of airway obstruction or hypoxemia while breathing room air in an unstimulated environment. Unfortunately, the recommendations for longer postoperative stays have no scientific evidence.

**Table 6**
**Postoperative Nausea and Vomiting Prophylaxis**

- **Intraoperative**
  - Dexamethasone 4-8 mg
  - Ondansetron 4 mg (end of surgery)
- **High risk population (add)**
  - Droperidol 0.625-1.25 mg (intraop)
  - Transdermal scopolamine (preop)
  - Aprepitant 40 mg po (preop)
  - TIVA
- **Postoperatively**
  - Promethazine 6.25 mg
  - Dimenhydrinate 1 mg/kg

## Post-discharge Considerations

One of the major concerns after discharge home is nocturnal apnea with catastrophic consequences. Postoperative sleep disturbances have been well described. The severity of sleep disturbances depend upon the surgical stress response (based upon the location and invasiveness of surgery), anxiety, pain, and opioid usage. This period is followed by a rebound effect that makes patients with OSA even more vulnerable to airway obstruction and life-threatening apnea. The risk of respiratory complications may last for several days after surgery.

## Patient and Family Education

**It is necessary to educate patients and their family (or caregivers) regarding the need for increased vigilance after discharge home. It is important that the post-discharge instructions emphasize the potential for aggravation of OSA and the need to use opioids judiciously.** Patients on preoperative CPAP should be instructed to use CPAP for several days postoperatively. Patients who have the presumptive diagnosis of OSA based on clinical indicators should be asked to follow-up with their primary physician for a possible sleep study.

## Summary

Obese patients, particularly those with OSA, are at a high risk of perioperative complications and pose several challenges to the anesthetist. It is recommended that BMI or weight should not be the sole determinant for performing a procedure on an outpatient basis. Patient selection for ambulatory surgery should depend upon several factors such as the severity of comorbid conditions, invasiveness of surgery and the type of anesthesia, as well as on the

venue of the procedure (i.e., hospital-based outpatient center, freestanding ambulatory center with or without overnight stay, and office setting).

Because undiagnosed OSA is common and failure to recognize OSA preoperatively is one of the major causes of perioperative complications, a focused history and physical examination can help identify patients with OSA. Prudent perioperative management should be guided by awareness of the potential complications based on the severity of comorbidities, invasiveness of diagnostic or therapeutic procedure, and requirement of postoperative opioids.

Use of "fast-track" anesthesia techniques with aggressive pain and PONV prophylaxis should allow rapid emergence and hasten recovery as well as reduce postoperative cardiorespiratory complications. Patients should be educated regarding the deleterious effects of opioids and asked to limit their use. Perioperative care should include education of the patient and their caregivers. Finally, developing and implementing protocols (clinical pathways) is the best way to avoid adverse events and improve postoperative outcomes.

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Dr. Joshi received his medical degree (Bachelor of Medicine and Bachelor of Surgery, M.B.B.S.) and Doctor of Medicine (M.D.) in anesthesiology from B. J. Medical College at the University of Pune, India. He received his fellowship in anesthesiology (F.F.A.R.C.S.I.) from the College of Anaesthetists, Royal College of Surgeons, Ireland, and then received an M.D. degree from the University College Dublin, Ireland. He is a diplomate of the American Board of Anesthesiology. Dr. Joshi has published extensively. He has authored or co-authored over 200 peer-reviewed journal articles, editorials and abstracts as well as numerous book chapters. He is an Associate Editor for Anesthesia & Analgesia and a member of the Editorial Board of the Anesthesiology Research and Practice Journal and BMC Anesthesiology. He performs reviews for several prestigious journals including *Anesthesiology* and *Anesthesia & Analgesia*. Dr. Joshi has made numerous presentations as a visiting professor and invited lecturer. He has also attended several national and international meetings as a speaker.

Dr. Joshi is an active member of many professional societies, including the American Society of Anesthesiologists, Texas Society of Anesthesiologists (TSA), International Anesthesia Research Society (IARS), Society for Ambulatory Anesthesia (SAMBA), Association of University Anesthesiologists, Society of Anesthesia and Sleep Medicine (SASM), and Accreditation Association for Ambulatory Health Care (AAAHC). He is the Past President of SAMBA and serves on the Board of Directors of the TSA and AAAHC. He is the chair of the SAMBA committee on guidelines development. He is also a member of the Procedure Specific Pain Management (PROSPECT) Group, which is an international collaboration of anesthesiologists and surgeons that formulates evidence-based recommendations for postoperative pain management specific to different surgical procedures.

## Tips for your Clinical Practice: Key Points

- Numerous comorbidities associated with significant obesity (OSA, cardiac problems, respiratory compromise, difficult airway, renal dysfunction) have led some to question the appropriateness of such patients for **ambulatory surgery**.
- **OSA** is underdiagnosed in 60-70% of patients with this disorder.
- Signs of **RVH** (right-bundle block, right axis deviation) suggest pulmonary hypertension, while left bundle-branch block can indicate occult heart disease.
- **Sedation** with propofol (rapid recovery) or dexmedetomidine (no respiratory depression) is preferable to midazolam.
- High BMI, excess weight or OSA alone do not mandate **awake intubation**; other indicators of a difficult airway (Mallampati III or IV, limited prognathism, neck circumference $\geq$ 40 cm, and severe OSA also should be sought.
- No valid reasons to routinely avoid **$N_2O$** in the obese have been demonstrated.
- **Washout of anesthesia** (increased ventilation) is of greater importance at the end of surgery than increasing $P_{ET}CO_2$ (decreased ventilation).
- Postoperatively, recurrent hypoxemia is better treated with **CPAP** or **BiPAP** and oxygen rather than oxygen alone.

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### ERRATUM

In Volume 36, Lesson 11, the value of the pre-diabetes range for HBA1C in Table 1 should read: **HBAIC 5.7-6.4%.**