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Is Ambulatory Shoulder Surgery Safe in A Patient With Obstructive Sleep Apnea?

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Stem Case and Key Questions Content

You're the only anesthesiologist at an outpatient surgery center that performs a variety of surgeries. Your orthopedic surgeons grant you "carte blanche" for regional anesthesia when appropriate. You have two uneventful cases ongoing when you see your next patient. He is a 47 year old male presenting for a right rotator cuff repair. Your center has a policy of discharging a patient home with a responsible adult. You discover that the patient's responsible party is a minor - his 17 year old daughter who drove them to the center.

1 - Are you concerned about discharging a patient home with an 'adult'?

Why or why not?

He is a former football player who injured himself while playing with his 'weekend warrior' buddies. He's had several surgeries in his twenties. However, he has gained 50 pounds since his playing days. His body mass index (BMI) is now 41.8. Your center has a guideline of refusing patients whose BMI>40 that require general anesthesia.

2-How do you proceed?

His past medical history is significant for hypertension and glucose intolerance. His medications are lisinopril and metoprolol. He does not have lab work. On physical exam, he is 5 feet 11 inches and he weighs 136 kg. His vital signs are heart rate 70, blood pressure 160/85, pulse oximetry 94% on room air. He has a Mallampati score of 3 but otherwise has a reassuring airway exam. He is clean shaven. You ask what size neck he has. He wears a 16 in shirt. Of note, his daughter states that he snores so loudly at home that he can be heard through a closed door. She can hear occasional pauses of breathing in the middle of the night.

3- What are your concerns? What other tests (if any) would you pursue?

The patient mentions that the orthopedic surgeon said something about a nerve 'block' for the case.

4- How do you respond?

An interscalene nerve block is performed in the designated pre block space. He received midazolam 1 mg, fentanyl 100 mcg, ketamine 10 mg for sedation and the patient is barely arousable. Your assistant is performing chin lift to prevent airway obstruction.

5- How would you manage his airway?

After adequate preoxygenation, an induction sequence of lidocaine 100 mg and propofol 150 mg are given intravenously. He is a moderate mask ventilation requiring two hands and an oral airway. After rocuronium 100 mg is given, he is an easy intubation.

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While prepping the patient and placing in right lateral decubitus position, the blood pressure drops to 70/40 despite half MAC of desflurane and a liter of normal saline.

6- How do you treat this hypotension?

7 - If this patient was to be positioned in the beachchair instead of lateral decubitus position, what are your concerns?

Surgery commences uneventfully. At the end of the one hour case, patient is spontaneously breathing 16 times per minute with tidal volumes of 250 ml. A total of fentanyl 250 mcg (including sedation) has been given as well as labetalol 10 mg.

8 - Your CRNA asks whether to extubate awake or deep. How do you respond?

Due to an emergency in another room, you are not present for extubation. Your CRNA proceeds to extubate the patient. While you're wrapping up the first emergency, your circulating nurse tells you that you're needed emergently in the PACU. When you arrive, the shoulder patient's oxygen saturation is 70% and the patient appears cyanotic. The PACU resident is attempting to mask ventilate the patient.

9 - What do you do next?

You mask ventilate the patient to a maximum oxygen saturation of 90%. The patient appears quite groggy. Flumazenil and naloxone have been administered with no improvement. He is breathing 30x/minute with assistance. He is barely awake and not responding to commands. Of note his heart rate is in the 130s with ST depression and blood pressure is 80/40.

10 - What do you do now?

It is now one month after you anesthetized the patient. The patient followed your advice to undergo sleep apnea testing where he was diagnosed with severe sleep apnea.

11- How is sleep apnea stratified? Is there any evidence to suggest that the more severe the sleep apnea, the most complicated the patient?

He is now on BiPAP at night. He is now scheduled for tonsillectomy and adenoidectomy for OSA correction.

The scheduler is asking if he is a good candidate for surgery at your free standing surgery center.

12 - How do you respond?

Model Discussion Content

1 - Why are you concerned about discharging a patient home with an "adult"?

Because the patient is scheduled for general anesthesia, patients are usually discharged home with a responsible party. Although the risks of general anesthesia are usually minimal for outpatient surgery, residual sedation may linger after discharge home. Age, comorbidities, and certain drugs may contribute to slow metabolism and thus patients may not be as alert and awake as when they presented for surgery. Patients are frequently warned not to operate heavy machinery (including driving their own car). Similarly, patients are warned not to make important legal decision while in the postanesthetic/sedated state.

In addition to having altered sensorium, patients may have respiratory depression due to a combination of anesthesia and long-acting opioids. It is important that patients have someone who can frequently monitor them after discharge. This “responsible party” receives discharge instructions and cares for the patient. The party assumes responsibility of understanding instructions such as wound care, rehabilitation, and pain medication side effects. If the patient is overmedicated, the responsible party is in charge of assessing the patient’s condition and calling 9-1-1, in the most emergent of cases.

Typically, this responsible party is an adult, but being a certain age may not be mandatory. Just because a person is old enough to vote or old enough to purchase alcoholic beverages does not necessarily imply that they have the capacity to act responsibly. Similarly, a patient whom is old enough but possesses a debilitating condition (i.e - dementia) may not be able to physically tend to the patient’s postoperative care. One must consider the responsible party’s ability to comprehend and follow discharge instructions. In certain instances, a responsible teenager may be able to perform these tasks – even if they’re not legally an adult.

If there is any question about whether a patient’s responsible party is indeed “responsible,” then a discussion should occur between the anesthesiologist, surgeon, and surgery center’s administrators as to whether it is safe to discharge the patient home.

2- How do you proceed?

Increasingly obese patients are becoming quite prevalent in not just the inpatient setting but also the ambulatory surgery centers. Obese patients pose a challenge because they may be at higher risk of having a difficult airway or having adverse respiratory events. In addition to these physiologic challenges, logistical challenges may exist such as not having stretchers or operating tables that can accommodate these heavy patients. Obese patients may present difficult intravenous access issues that can slow the flow of a busy outpatient center. Because of these issues, BMI limits exist at some surgery centers.

One theoretical risk of providing general anesthesia to patients at ambulatory surgery center is the possibility of requiring transfer to an inpatient facility. Obese patients may require transfer for prolonged postoperative hypoxemia that is worsened with opioids. Hofer et al 2008 showed that obesity was not a significant independent risk factor for unplanned admission after ambulatory surgery. Although obese patients were more likely than non obese patients to have respiratory issues (bronchospasm, higher supplemental O₂ requirement, treatment for PONV), they were not associated with higher postoperative hospital admissions.

Scheduling obese patients for outpatient surgery should be individualized to each patient’s scheduled surgery, anesthetic plan (MAC vs regional vs general anesthesia), capability to handle the unanticipated difficult airway, and the center’s ability to transfer patient to an inpatient facility.

3 - What are your concerns? What other tests (if any) would you pursue?

This patient’s sleeping habits and body habitus indicate that he likely has undiagnosed obstructive sleep apnea (OSA). Several questionnaires exist that correlate with OSA such as STOP-Bang, Berlin, etc. In particular, the STOP-BANG questionnaire has high sensitivity to detect such patients. Its specificity is not as high, but can be improved with using a greater

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number of positive indicators (≥ 6 as opposed to just 3) (Chung et al 2012).

One of the concerns about scheduling a patient with OSA at a free standing ambulatory surgery center is the potentially higher risk of unplanned transfer to a hospital. Overall, 1-2% of patients at an ambulatory surgery center are transferred to inpatient facilities (Fortier 1998). Reasons for these transfers may include need for impaired ventilation or pain control – a challenge for OSA patients.

Bryson et al 2012 investigated whether OSA patients had a higher unplanned admission rate vs non-OSA patients undergoing ambulatory surgery. By investigating 77,809 ambulatory procedures from 2003-2009, they identified 1547 patients with preoperative polysomnograms. Of these, 674 were confirmed OSA patients whom were compared with 893 known non-OSA patients. Unplanned admission rates were investigated for the 7 days postop. They saw no significant difference in admission rates between OSA patients (7.0%) vs non OSA patients (5.6%) (p value 0.246). These findings occurred at The Ottawa Hospital – an institution that required OSA patients to have a 4 hour observation postop period as well as previously used either CPAP or BiPAP. These findings may not necessarily apply to a majority of ambulatory surgery centers that have observation periods much shorter than 4 hours. Also, these OSA patients were required to have preoperative CPAP or BiPAP – again something many ASC's many not require.

It is worth noting that once you suspect a patient has undiagnosed sleep apnea, you may proceed with treating them similarly to a diagnosed sleep apnea patient. There is no clear evidence to suggest that a sleep study and preoperative continuous positive airway pressure (CPAP) or bilevel positive airway pressure (BiPAP) would improve perioperative outcome. (Joshi et al 2012)

4 - The patient mentions that the orthopedic surgeon said something about a nerve 'block' for the case. How do you respond?

Interscalene nerve blocks can provide adequate postoperative analgesia for shoulder operations. However, these nerve blocks are often associated with close to 100% blockade of the phrenic nerve, especially when volumes exceed 20 ml. In a patient with compromised respiratory system, an interscalene nerve block may lead to adverse respiratory outcomes like postoperative hypoxemia. Other strategies to minimize phrenic nerve blockade involve using a smaller volume of local anesthetic, performing a "lower" / more distal interscalene nerve block, or adding a suprascapular nerve block. Please refer to the Verelst 2013 article for an evidence based discussion of caring for a shoulder patient with minimal respiratory impact.

5 - How would you manage his airway?

Obese patients with suspected OSA likely have a difficult airway. OSA has been shown to correlate with difficult intubation [Hiremath 1998]. In addition to being a possibly difficult intubation, the patient may also be difficult to mask ventilate. Per Kheterpal 2006's study, this patient possesses multiple risk factors (OSA, snoring, BMI>30) for difficult mask ventilation as well as difficult intubation. Limited or severely limited mandibular protrusion and abnormal neck anatomy, are the other independent predictors.

In terms of securing the airway, an LMA is often used for these arthroscopic surgeries. LMA allows for effective ventilation by the spontaneously breathing patient. LMAs have been used not just in supine cases but also in lateral decubitus as well as prone positions. Because of this

patient's lateral decubitus position, one may choose to definitely secure the airway via endotracheal tube (ETT). A secured ETT reduces the risk of aspiration and allows for delivery of positive end-expiratory pressure. PEEP may be beneficial in this patient who is at high risk of developing atelectasis and postoperative hypoxemia.

Successful intubation can be accomplished by the successful optimization of many factors. First, adequate preoxygenation with CPAP will maximize the apnea time for a possibly prolonged intubation. Preoxygenation can be enhanced by ramping the patient with blankets or other commercial devices such as ramps or inflatable ramps. The optimal position may be a 'sniffing position' that aligns the ear with the sternal notch. In addition, video laryngoscopes and bronchoscopes may be used instead of standard laryngoscopes. The advantage of these devices is that other personnel in the room may be able to see what the laryngoscopist is seeing. They may be able to externally manipulate the larynx to facilitate intubation.

6- How do you treat this hypotension?

It is not unusual to see hypotension after induction of anesthesia. The fasting patient may be hypovolemic and therefore hypotensive after anesthesia-induced vasodilation. In particular, this patient may be at risk of angiotensin-converting enzyme inhibitor (ACEi) or angiotensin receptor blocker (ARB) induced hypotension. This hypotension can be treated with volume, decreased anesthetic, and pressors such as phenylephrine or ephedrine. If the hypotension is refractory to these treatments, vasopressin is also an option.

In addition to vasopressin, methylene blue may also help if hypotension is refractory to these treatments. In these cases of vasoplegia, methylene blue can bind to nitric oxide synthase. By lowering nitric oxide production, there is less guanylate cyclase activation and therefore less vasodilation. For a further description of the advantages of methylene blue for vasoplegia, the reader is referred to Riha 2010 article.

7 - If this patient was to be positioned in the beachchair instead of lateral decubitus position, what are your concerns?

Whenever the head is above the level of the surgical field, cerebral hypoperfusion should be a major concern. Case reports have described patients undergoing shoulder surgery in the beach chair position who have woken with stroke-like symptoms (Pohl and Cullen 2005). These cases were performed in 4 healthy middle aged patients under general anesthesia with positive pressure ventilation in the upright position. All four patients awoke with symptoms of cerebral hypoperfusion. None of the patients had prior histories of hypertension.

The authors hypothesized that the upright position combined with other anesthetic considerations decreased cerebral perfusion pressure. Upright position, which decreases venous return, combined with vasodilating effects of anesthetics could reduce stroke volume and cardiac output by up to 20%. Usually this is compensated by increased systemic vascular resistance. But under general anesthesia, this response is blocked.

Cerebral perfusion pressure in the awake adult normally stays the same or rises slightly. This is due to the preservation of the autonomic response. Under general anesthesia, this compensatory response is blunted and therefore blood pressure falls in the upright position. In addition, positive pressure ventilation may impair venous return and therefore also contribute to decreased blood pressure.

In contrast to the ventilated patient, Rohrbaugh et al 2013 published a recent series describing 15,014 shoulder arthroscopies in the beach chair position. Unlike the patients in Pohl and Cullen's case series, these patients' primary anesthetic was an interscalene nerve block combined with propofol sedation. In these patients whom were spontaneously breathing, they reported no major neurologic adverse events in the immediate postop period. They speculated that spontaneous breathing lead to less decrease in arterial pressure than GA with PPV. PPV may have increased intrathoracic pressure which decreases preload, stroke volume and cardiac output.

8 - Your CRNA asks whether to extubate awake or deep. How do you respond?

The same vigilance used in placing an endotracheal tube should be exercised upon its removal. Airway management of the OSA patient requires a well-planned emergence and extubation plan. Assuming that the patient is able to be mask ventilated and is spontaneously breathing at the end of the procedure, one may consider deep versus awake extubation. Advantages of awake extubation include the patient's ability to protect the airway and maintain spontaneous respiration. Benumof 2007 reminds us that the ASA OSA guideline recommends awake extubation when possible. If the patient had a difficult intubation, Cavallone 2013 recommends that airway exchange catheters (AECs) may provide a way to emergently replace an ETT if necessary – as well provide a means of ventilation via its hollow bore. These AECs are well-tolerated by patients, sometimes staying in place as long as hours post extubation if necessary. Awake extubation's benefits must be contrasted with its possible disadvantages. There is a small risk that a patient may emerge violently with an endotracheal tube in place. If the patient is biting on the tube, the potential for negative pressure pulmonary edema exists. Valsalva movements and coughing may increase risk of rupturing suture lines or cause rebleeding. In addition, hemodynamic instability in the form of tachycardia and hypertension may necessitate pharmacologic treatment to prevent myocardial ischemia. Performing awake extubation allows for maximal ability to ventilate a patient but it has some disadvantages.

Alternatively, removing the ETT while the patient is still under general anesthesia can provide for a smoother emergence. Patients that are extubated deeply usually have less coughing and bucking since the stimulus of an ETT is removed before airway reflexes are fully activated. However, the biggest risk is that the patient is at high risk of airway complications if stimulated during the transition from Stage 2 to Stage 1 of anesthesia. During this transition phase, laryngospasm and bronchospasm are potentially life-threatening if mask ventilation is unable to deliver adequate volumes.

Regardless of whether the patient is extubated deeply or awake, the postoperative OSA patient should be monitored appropriately. Standard monitors such as continuous pulse oximetry and telemetry should be employed. At our institution, capnography is not standard in the PACU but it may be indicated in some OSA patients. Also, CPAP and/or BiPAP should be readily available especially if the patient received preoperative PAP treatment. For further information, the reader is referred to a recent review article regarding extubation of the difficult airway by Cavallone 2013.

9 - What do you do next?

OSA patients are at high risk of airway related complications upon extubation. These include airway obstruction, hypoventilation, and increased sensitivity to residual anesthetic and opioids. In this situation, correction of hypoventilation via mask ventilation with oral airway should be first

attempted. If the patient had preoperative PAP therapy, CPAP / BiPAP should be reestablished promptly. All reversible causes of hypoventilation (muscular blockade, opioid or benzodiazepine respiratory depression) should be corrected. If unsuccessful, progression to more invasive methods like LMA or intubation should follow.

In addition to the respiratory problems, the patient may still be having cardiac problems. A 12 lead EKG should be ordered. Even in the absence of ST changes, a NSTEMI should be in the differential diagnosis. Reversible causes of ischemia (hypoxemia, tachycardia) can be treated via oxygen and beta blockers. If EKG reveals ST elevation, dialing 9-1-1 and transferring to a facility capable of heart catheterization should be arranged emergently. Per ACLS 2010 ACS guidelines, time from ischemia to catheterization lab should be under 90 minutes. MONA (morphine-oxygen-nitroglycerin-aspirin) therapy should be instituted while awaiting transport.

10 - What do you do now?

The patient's postoperative course has progressed to a combination of cardiac and respiratory instability. He is tachypneic and hypoventilating for multiple reasons. His deteriorating mental status is concerning for CO₂ narcosis. His hypoxemia may also be creating a demand ischemia that is concerning for impending myocardial ischemia. He needs a secure airway to facilitate mechanical ventilation to correct his hypoxemia and hypercarbia.

Re-intubation of the OSA patient may be fraught with complications. Even though the patient was an easy intubation a few hours earlier, one should consider the possibility that the airway has deteriorated. The airway may have changed if the patient had airway or neck surgery leading to a bloody airway, neck hematomas compressing the airway, or airway edema. Also, prone positioning and excessive intravenous fluid administration may also lead to an edematous airway. Although neither of these risk factors should be affecting our shoulder surgery patient, one may still consider using different means to re-secure the airway. It may be prudent to have a video laryngoscope or bronchoscope available. Not only would these airway devices possibly attain a better view than standard direct laryngoscopy (DL), but the video screen capabilities can allow others to facilitate airway management since they can also visualize the status of the airway.

11 - How is sleep apnea stratified? Is there any evidence to suggest that the more severe the sleep apnea, the most complicated the patient?

Severity of sleep apnea was mentioned as an important variable as to whether or not a patient can undergo safe outpatient surgery in the 2006 ASA OSA Guideline. By combining factors such as severity of OSA, invasiveness of surgery/anesthesia, and the postoperative opioid requirement, an OSA patient can be classified into a risk category (Gross et al 2006).

Hathaway 2006 described a retrospective study of 110 patients who underwent uvulopalatopharyngoplasty (UPPP) for OSA correction. These patients ranged in BMI from 20.5 to 61.4 (average 32.2). Sleep apnea was defined based on their respiratory disturbance index (RDI). Severe OSA was defined as RDI > 50. They found that only 3 /110 patients were admitted for persistent hypoxemia in the immediate postop period. Although one might assume that all three admitted patients had severe sleep apnea, one of the three had very mild OSA based on RDI 22 – which was better than the other two patients whose RDIs were 96. They concluded from their small sample size that severity of OSA doesn't necessarily correlate with hospital admission. This is one of many small studies that attempted to analyze a relationship

between severity of OSA and postoperative risks. Further larger studies are needed to elucidate this relationship.

12- How do you respond?

The 2006 ASA Guidelines for OSA patients describes a scoring system to calculate the perioperative risks of surgery. By combining factors such as severity of OSA, invasiveness of surgery/anesthesia, and the postoperative opioid requirement, an OSA patient can be classified into a risk category. This patient would be classified as “significantly increased risk” and would likely be a poor candidate for an ASC. He is better suited for a hospital-based surgery center because of his higher risk for postoperative hypoxemia and need for overnight monitoring. The 2006 ASA OSA guideline specifically states that OSA patients should not undergo upper airway surgery (such as UPP). This is based on expert consensus and not an evidence-based guideline since studies are lacking. The 2012 SAMBA OSA Guideline similarly agrees with this recommendation that these cases in OSA patient are unsuitable for ambulatory surgery center sites.

The decision to anesthetize the OSA patient undergoing airway surgery should be made on an individual case basis. This decision should be based on the patient’s other co-morbidities, type of surgery, facility’s ability to handle difficult airway, and facility’s ability to transfer patient for hospitalization – if necessary. Discussion with the surgeon will help elucidate necessary information to maximize patient safety.

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