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Review article

Anesthesiological Risk in Obstructive Sleep Apnea Patients

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SUMMARY

Introduction. When receiving anesthesia, patients with obstructive sleep apnea (OSA) are more likely to experience perioperative difficulties than those without this diagnosis.
Aim. The aims of the paper were to highlight the correlation between OSA and increased risk of perioperative complications and present possible complications and pathophysiological mechanisms that may condition them in the perioperative environment; to review available preoperative screening methods of OSA and treatment planning strategies that should be considered as part of the perioperative care of these patients.
Methodology. Standard databases were searched to identify qualified studies that included adult surgical patients without, suspected or diagnosed OSA.
Results. Anesthesia method selection, airway management, and patient monitoring are all part of the customized care plan that must be used for each patient who is at risk for or has been diagnosed with OSA.
Conclusion. The rising prevalence and heterogeneity of OSA, as well as the lack of solid risk predictors and well-documented evidence-based studies on the effectiveness of perioperative interventions, pose a challenge for future research in order to implement an appropriate strategy for perioperative care of OSA patients and prevent life-threatening consequences.

Keywords: **anesthesiological risk, obstructive sleep apnea, risk factors, surgery postoperative complications**

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INTRODUCTION

For more than a century, surgery has been a crucial component of healthcare, and its importance is only expanding (1). It is estimated that 312.9 million surgical procedures were completed worldwide in 2012, which stands for a considerable rise from the 226.4 million operations estimated in 2004 (2). Numerous studies have found that 22% – 82% of preoperative patients have obstructive sleep apnea (OSA), of which 82% – 93% go undiagnosed and untreated. As a result, anesthesiologists frequently encounter patients with undiagnosed OSA initially (3, 4).

Because of the frequent relationship of OSA and obesity, its prevalence is especially high in patients undergoing bariatric surgery, which is becoming more common due to the rising frequency of morbid obesity (5). In their prospective multicenter study, Peromaa-Haavisto and associates showed that 71% of the 197 patients from three bariatric surgery centers in Finland had OSA, of which 90% and 60% of men and women, respectively (6). Asian individuals undergoing bariatric surgery were the subject of an investigation by Loo and associates into the frequency and severity of OSA. Eighty point five percent of the sample had OSA, with 24.3% having mild, 23.9% having moderate, and 32.3% having severe form of OSA. OSA was more common in men (93.7%) than in women (75.5%). Prior to bariatric assessment, only 17.3% of patients had an OSA diagnosis (7).

COMPLICATIONS

Patients with OSA who undergo anesthesia have a higher risk of perioperative complications than patients without this diagnosis, and their surgical safety is gaining attention around the world (8, 9). According to numerous studies, surgical patients with OSA are more likely to experience difficult intubation, hypoxemia onset, pneumonia, atelectasis, pulmonary embolism, myocardial infarction, cardiac arrhythmias, cerebrovascular stroke, and unexpected admission to critical care units (10 - 17). Memtsoudis and colleagues concluded in a large retrospective study covering 2,610,441 orthopedic and 3,441,262 general surgical procedures performed between 1998 and 2007 that OSA is an independent risk factor for perioperative pulmonary complications such as aspiration pneumonia, acute respiratory distress syndrome (ARDS), and intubation/mechanical ventilation (18). In the presence of OSA, the likelihood of developing postoperative cardiac problems is 2.07, of acute respiratory insufficiency 2.43, desaturation 2.27, and transfer to critical care units 2.81, according to a meta-analysis by Kaw and colleagues that included thirteen trials (n = 3,942) (19). The study "Postoperative Vascular Complications in Unrecognized OSA (POSA)" by Chan and colleagues looked at whether there is a link between undiagnosed and untreated OSA and the primary outcome of unwanted cardiovascular (CV) events (myocardial infarction, heart failure, atrial fibrillation, stroke, thromboembolism, and cardiac death) up to 30 days after surgery. The study had a prospective design, involved a sizable sample (n = 1,218), was multicenter, international, and multiethnic, and had strict monitoring. The patients who were recruited were ≥ 45 years old and underwent significant non-cardiac surgery, and had one or more risk factors for postoperative CV problems, such as existing peripheral, myocardial, or cerebrovascular disease, managed diabetes, heart or renal failure. Standard procedures were followed during anesthesia and surgery. Despite a high prevalence (67.6%) of undiagnosed OSA (defined as all patients with AHI > 5), only a modest percentage of the studied population had severe (11.2%) or moderate (30.5%) OSA. Thirty days following surgery, primary outcomes were recorded: there were 30.1% (41/136) of patients with severe OSA, 22.1% (52/235) of patients with moderate OSA, 19.0% (86/452) of patients with mild OSA, and 14.2% (30/237) of patients without OSA. A statistically significant association between the primary outcome and severe OSA was only discovered after adjusting for known risk factors for unwanted postoperative CV events (adjusted HR 2.23; 95% CI, 1.49 - 3.34; P = 0.001) but not in patients with mild (adjusted HR 1.36; 95% CI, 0.97-1.91; P = 0.08) or moderate OSA (adjusted HR 1.47; 95% CI, 0.98-2.09; P = 0.07). Patients with severe OSA had an increased risk of cardiac death that was 13-fold higher (adjusted HR 13.56; 95% CI, 1.60 - 114.19; P = 0.02), heart failure that was 7-fold higher (adjusted HR 7.04; 95% CI, 1.86 - 26.66; P = 0.004), and newly formed atrial fibrillation that was almost 4-fold higher (adjusted HR 3.75; 95% CI, 1.19 - 11.87; P = 0.03) (20).

In patients undergoing coronary artery bypass grafting (CABG), OSA is independently linked to the development of significant adverse cardiac and cerebrovascular events such as cardiac death, nonfatal

myocardial infarction, nonfatal stroke, and unplanned revascularization (major adverse cardiac and cerebrovascular events-MACCE) (21). According to a meta-analysis of 11 studies (n = 1801) by Nagappa and colleagues, OSA patients had 2.4 and nearly 2 times the likelihood of developing newly documented postoperative atrial fibrillation (POAF) and MACCE, respectively, compared to patients without OSA (22).

The biggest comprehensive investigation on perioperative critical complications, including death, in OSA patients found an elevated risk exposure, especially in the first 24 hours after surgery. Risk factors for mortality or near-death experiences include morbid obesity, male gender, undiagnosed OSA, partially treated/untreated OSA, use of opiates, sedatives, and lack of monitoring. Within the first 72 hours following surgery, 92% of significant complications occurred, with 80% being reported in the first 24 hours. Sixty-seven percent of complications occurred in surgical wards, 18% in post-anesthetic care units, 13% in operating rooms, and the remaining 2% after discharge from hospital treatment (23).

In one of the most recent studies conducted by Habchi and colleagues, OSA was linked to a higher incidence of hospital readmission 30/90 days following surgery (24).

PATHOPHYSIOLOGICAL BASIS

For the first time, Hiremat and colleagues discovered a direct connection between OSA and difficult intubation (25). Intubation was challenging in 22% – 44% of OSA patients in various studies, compared to 2% – 3% of patients without OSA, and it failed in 5% of cases. OSA is an independent predictor of difficult intubation (26, 3, 27, 28). The explanation could include the upper respiratory tract's physical shape, as well as excess fat deposits in the neck and occipital area (5).

Difficult mask ventilation (DMV) during general anesthesia was identified as a predictor of OSA in a pilot investigation by Plunkett and colleagues (29). According to a recent Chinese study, AHI is connected with DMV as a new independent risk factor in Chinese patients. Age and Malampathy score should not be the only determinants used in DMV screening; also, AHI should be included (30).

In order to find appropriate studies involving adult surgical patients without, suspected or diagnosed OSA with at least one event reported, such as difficult intubation, DMV or unsuccessful insertion of the supraglottic airway, Nagappa and colleagues searched standard databases from 1946 to April 2017. The conclusion was that compared to patients without OSA, OSA patients had a three to four times higher risk of experiencing trouble with intubation, DMV, or both. The rate of failed supraglottic airway insertion was not significantly different (31). According to Seet and colleagues, moderate to severe OSA is linked to challenging intubation and increased neck circumference to DMV (32).

Upper airway collapse, diminished ventilation response, poor wake-up reaction (respiratory arousal), and hypoxemia are perioperative risk factors associated with OSA (33, 10).

Anesthetics such as thiopentone, propofol, nitric oxide, opioids, and benzodiazepines can lower the tone of the pharyngeal musculature, which is responsible for maintaining airway patency. This is due to central depression to the upper respiratory tract dilator muscles, which may be made worse by reduced sensitivity to chemical stimuli. Patients with OSA may experience considerable upper respiratory muscle hypotonia at relatively modest levels of general anesthesia (5). Under general anesthesia, the upper respiratory tract muscles are more depressed than the diaphragm in OSA patients. As a result, the effort of breathing continues although the activity of the muscles of the upper airways is greatly reduced, predisposing to upper airway collapse during inspirium. It has also been suggested that the increasing collapsibility of the upper airways is mostly attributable to a progressive decrease in the activity of the genioglossus muscle (10, 34, 35).

In the supine posture, the induction of anesthesia induces an immediate considerable loss in functional residual capacity of 16% - 20%, resulting in the collapse of up to 20% of the lung bases. Together with the obstruction of the upper airways, This increases the risk of hypoxemia together with upper airway blockage (33).

Halothane has been found in studies to attenuate the ventilation response to hypoxemia and hypercapnia. The most likely cause of this depression is a specific action of halotan on the peripheral chemoreflex loop. Similarly, it has been demonstrated that a subanesthetic dose of isoflurane reduces the hypoxemic ventilation response via peripheral chemoreceptors (10).

Furthermore, general anesthesia directly inhibits laryngeal respiratory mechanoreceptors and thus the upper airway reflexes, which decreases the wake-up response (36).

All of these factors increase the risk of desaturation following extubation in the immediate postoperative period as well as the days that follow, especially during the rapid eye movement (REM) phase of sleep (5). On the 1st and 2nd postoperative nights, it was noted that surgical patients had very fragmented sleep, with a marked decline in REM sleep and an increase in the second stage of non-rapid eye movement (N REM) sleep. These sleep disturbances are caused by surgical stress, the use of anesthetics, pain and analgesics (37). With the surgical trauma, in particular, comes a spike in cortisol levels, which causes a considerable impairment in REM sleep. Furthermore, surgical trauma causes a considerable inflammatory response, as seen by higher levels of pro-inflammatory markers such as tumor necrosis factor alpha (TNF), interleukin 1 (IL-1) and IL-6, all of which, particularly IL-1 and TNF, decrease REM sleep. This is usually accompanied by a significant increase in REM sleep (REM rebound sleep) during the 3rd to 5th night of recovery. Because of hypotonia and unstable breathing, episodes of sleep disturbances and hypoxemia intensify during REM sleep. Additionally, REM sleep is linked to elevated sympathetic tone, which causes myocardial ischemia, tachycardia, and hemodynamic instability. It is generally recognized that the majority of postoperative issues happen in the 1st postoperative week, particularly between the 2nd and 5th postoperative days, which correspond to REM rebound periods. After surgery, episodes of hypoxemia generally happen between the 2nd and 5th postoperative night. The risk of infections, early brain impairment, and cardiac arrhythmias may all increase as a result of these events. The incidence of acute myocardial infarction increased on the 3rd postoperative day, according to a Mayo Clinic observational research. Similarly, during the 3rd and 5th postoperative nights, episodes of delirium, nightmares, and psychomotor impairment have been described (10, 38, 39).

According to current research, patients with OSA may be at a much increased risk of postoperative outcomes caused by residual neuromuscular blockade, such as pulmonary problems, hypoxemia, and respiratory failure. Therefore, after the administration of reversing drugs, the reversal of neuromuscular blockade should be examined to rule out residual effects that encourage pharyngeal dysfunction, airway blockage, and aspiration. Sugammadex is still prescribed similarly to neostigmine in the United States, however, a more recent multicenter cohort study (STRONGER) indicated that sugammadex was linked to a 30% lower risk of pulmonary complications, a 47% lower risk of pneumonia, and a 55% lower risk of respiratory failure. These findings strongly support the use of sugammadex instead of neostigmine to reverse neuromuscular inhibition (40).

Opioids are frequently administered to surgical patients to alleviate pain. In the postoperative phase, the use of opioid analgesics may increase the likelihood of hypoventilation, hypercapnia, or central apnea (5). OSA is linked to a 50% increase in the risk of opioid-induced respiratory depression (41). Opioids reduce the respiratory response to hypoxia and hypercapnia, affecting both the central and peripheral chemoreflex mechanisms of carbon dioxide. This reduces the central ventilation stimulus (42). Gender and ethnicity appear to influence respiratory opiate depression. Morphine has been found to lessen the respiratory responses to hypoxia and hypercapnia in women but not in males. On the other hand, it increases the apnea threshold in men while having no impact on women. When opiates and benzodiazepines are combined, substantial episodes of hypoxemia and apnea occur. This is most probable because both opiates and benzodiazepines significantly reduce the hypoxic ventilation response (10, 41). One of the most recent research indicated that the use of several benzodiazepine sedatives induces modest respiratory depression in patients with chronic opioid pain, but paradoxically, the risk and severity of OSA decreased due to an elevation in the respiratory awakening threshold (43).

These patients are more critical from an anesthesiological perspective due to the presence of severe comorbidities such arrhythmias, elevated pressure in the pulmonary artery, chronic pulmonary heart disease, and congestive heart failure (44).

PREOPERATIVE SCREENING

The goal of the preoperative evaluation is to identify patients who have a high clinical likelihood of developing complications during surgery and to optimize controllable risk factors to reduce morbidity and death. High sensitivity and conveniently available information-based specificity are necessary

for a successful screening procedure. Preoperative diagnosis of patients with OSA is challenging because interrupted sleep and snoring, frequently the only reported symptoms, are non-specific, as well as well-known risk factors such as anthropometric measures and concomitant cardiovascular illness. There is little applicability of the Mallampati score, which is frequently used to assess the upper airways and identify patients with oropharyngeal traits that make intubation challenging and many of them also share an anatomical predisposition to OSA in OSA screening (45, 46). The analysis of gases in arterial blood is the gold standard in the diagnosis of acute and chronic respiratory failure, however, serum bicarbonate levels do not detect isolated nocturnal hypoventilation with daytime eupcapnia.

A number of publications have been published with the goal of detecting people at risk for major OSA, with various protocoled procedures based on screening questionnaires followed by a diagnostic examination. The time required for diagnostic treatment, on the other hand, should be carefully considered in relation to the urgency of the procedure. Patients referred for diagnostic testing must go through a two-step process, however, there may be waiting lists for diagnostic testing which can postpone surgery (46).

In order to recognize OSA, the majority of anesthesiologists still use clinical suspicion only. OSA subjective clinical judgments typically have low specificity (63%) and sensitivity (60%) levels. OSA screening is performed only by 34.7% of anesthesiologists (47). It is essential to establish a concise but systematic method of identifying patients at risk of OSA because the anesthesiologist's interaction with a patient during preoperative screening is time-limited. A realistic and efficient technique to preoperatively identify individuals who are likely to develop OSA is is to use a simple questionnaire screening. This enables sufficient preoperative planning and optimizes postoperative recovery. The Berlin Questionnaire, the American Society of Anesthesiologists-ASA checklist, the STOP-Bang questionnaire, and the Flemons index are screening questionnaires that have been developed to aid in the diagnosis of OSA and have been validated for preoperative screening. They include risk factors, clinical symptoms, and physical parameters. The STOP-Bang questionnaire is the most commonly used questionnaire proposed by the American Society of Anesthesiologists in the assessment of OSA in the surgical population (48, 49). For the diagnosis of moderate to severe OSA, its specificity and sensitivity were reported to be 30.7% and 87.3%, respectively (50). Its high sensitivity makes it an effective tool for detecting at-risk patients in a general preoperative population, but its low degree of specificity limits its usefulness in high-risk populations, such as patients undergoing bariatric surgery. High sensitivity but relatively low specificity indicate that patients still need to undergo confirmatory diagnostic testing, which is why it is recommended for these patients to be directly tested for diagnostics (51). As a result, preoperative screening using respiratory polygraphy is typical for these patients, and OSA is frequently recognized and treated before surgery (5).

Chung and colleagues created and tested the Stop and STOP-Bang questionnaires, which are self-administered questionnaires. STOP is an acronym that stands for four questions about snoring (S-eng. Snore), tiredness (T-eng. Fatigued), observed apnea (O-eng. Observed), and arterial hypertension (P-eng. Pressure). The STOP-Bang questionnaire is an improved version of the STOP questionnaire that includes questions about body mass index (> 35 kg/m^2) (B-eng. BMI), age (> 5 0 years) (E-eng. Age), neck circumference (> 40 cm) (N-eng. Neck), and a half (male) (G-eng. Gender), with improved sensitivity at the expense of slightly lower specificity. Both questionnaires have a high sensitivity but a relatively low specificity for detecting patients with sleep disordered breathing (SDB). The STOP questionnaire identifies a patient as being at high risk for SDB if at least two positive replies are present, whereas the STOP-Bang questionnaire identifies a patient as being at high risk if at least three positive responses are present. The STOP-Bang questionnaire is frequently used to anticipate and expedite patient triage precisely because of its simplicity. In a research that compared STOP, the Berlin questionnaire, and an ASA OSA checklist for scoring, the ASA OSA checklist had the highest sensitivity but the lowest specificity. It should be kept in mind that most clinical screening tests miss a sizable part of OSA patients because of false negative results (33, 52).

Patient care protocol

Patients who are classified as "high risk" for OSA should be approached as such or referred to a

sleep specialist. Depending on how urgent the procedure is, a decision will be made on whether to move forward with it right away or to refer the patient for further sleep and breathing testing. To improve 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 supervision of an anesthesiologist, the American Society of Anesthesiologists, Society for Ambulatory Anesthesia, American Academy of Sleep Medicine, American College of Chest Physicians, Canadian Anesthesiologists' Society, International Bariatric Consensus Guideline Group have published practice guidelines as recommendations to aid decision-making (8, 28, 51 - 57). Despite a considerable body of clinical evidence associating OSA patients' perioperative risks, research supporting perioperative safety interventions is mainly missing. A recent study that used the Appraisal of Guidelines for Research and Evaluation II-AGREE II instrument to evaluate the quality of clinical practice guidelines relating to the perioperative care of OSA patients discovered that 60% of the recommendations were evidence-based using validated methods for evaluating medical literature, while the remaining 40% were based on consensus. At this time, adherence to the recommendations cannot assure success, but it should assist in creating personal plans for increased patient safety (58).

It is still challenging to get an agreement on how to routinely and timely identify high-risk patients while balancing the benefits of preoperative diagnostics with the danger of postponing surgery (46).

The increased awareness of perioperative risks linked with undiagnosed OSA has necessitated the introduction of standardized questionnaires to identify high-risk patients (5). It is advised to delay elective surgery for high-risk patients who have not yet been diagnosed with OSA, get a diagnostic test done first, and start continuous positive airway pressure (CPAP) therapy before surgery. Modifying the illness by using CPAP therapy while sleeping can be beneficial, but it comes at the expense of postponing surgery. Although the ideal time to begin treatment before elective surgery is still unknown, the preoperative benefit of using CPAP may need at least 4 - 6 weeks to be optimized because the airways can frequently be swollen as a result of turbulent airflow and repeated microtrauma during nocturnal occlusions. Additionally, the patient will need this time to get used to the therapy (54, 59). Patients who are successfully treated with CPAP therapy do not exhibit an increase in risk and should continue using CPAP during the perioperative period. One possible explanation is that CPAP has a beneficial impact on the upper airway edema and their stability (5). By lowering the work of breathing during the perioperative period, improving the nervous respiratory stimulus, and restoring normal sympathetic tone, the use of CPAP therapy plays an important role in preventing tachyarrhythmias and atrial fibrillation, which is crucial for the prevention of perioperative cardiovascular and respiratory complications (47). Unfortunately, adherence to CPAP can be problematic, especially in a patient population with minimal symptoms. Only 40% of patients in a trial using a patient cohort diagnosed as part of preoperative screening were adherent, using CPAP on average for 2.5 hours within the first 30 days (60). Routine postoperative use of CPAP therapy in high-risk patients who have not previously been diagnosed and treated is not recommended (5). In patients who have not previously been treated, CPAP therapy may be considered if there is evidence of frequent or severe airway obstruction or hypoxemia during postoperative follow-up. CPAP, however, should only be used after patients are awake and supervised (8). It has been demonstrated that transitioning morbidly obese individuals from anesthesia to CPAP therapy after laparoscopic bariatric surgery can help in preventing atelectasis (61). Although there have been assumptions about the potential risks of aerophagy associated with postoperative CPAP use, this has been largely debunked in studies that have not discovered a significant rise in postoperative nausea and vomiting or an increase in anastomosis leakage in patients undergoing bypass surgery (51).

Individual perioperative care plans must be developed for patients who have been discovered to be at risk of OSA or who have been diagnosed with OSA (5, 46).

Intraoperative care for patients with high perioperative risk comprises anesthesia technique selection, airway management, and patient monitoring. Local or regional anesthetics should be used, with caution, whenever feasible. Even in healthy persons, small doses of opioids delivered epidurally have a depressing effect on respiratory function (10). General anesthesia with secured airways is preferable to deep sedation without a safe airway, es-

pecially for procedures that can mechanically compromise the airways. Not all OSA patients have difficulty intubating. However, it might be inferred that OSA patients have conditions such as macroglossia, redundant or excess oropharyngeal tissue, and similar conditions. As a result, when treating these patients' airways, one should take additional caution. Sedatives and opioids must be used responsibly if "vigilant" tracheal intubation is intended. If the patient is to be intubated while asleep, it is necessary to completely preoxygenate the patient since an obese patient with a low functional residual capacity and high oxygen demand desatu-rates faster during obstructive apnea. The best position for a laryngoscopy is when "snorting." To perform mask ventilation optimally, two anesthesiologists may be required to do a bilateral jaw push with two or three hands and a mask gasket. Options for escaping the scenario "cannot ventilate, cannot intubate" must be accessible at the anesthetic site promptly.

In OSA patients, the risk of airway obstruction after extubation is increased. Aside from the risk of death from an obstructed airway, another important risk of spontaneous breathing against an obstructed airway is the rapid development of severe edema due to negative pressure. Patients at elevated perioperative risk of OSA should be extubated while awake in a semi-erect position if possible, unless there is a medical or surgical contraindication. The remaining muscular relaxation should be appropriately antagonized; otherwise, a minimal muscle relaxant may impact the muscles of the airways, resulting in airway blockage. After sedation, patients with OSA should not be left unsupervised.

Careful observation of myocardial ischemia and rhythm disturbances is required because an OSA patient may have an elevated risk of coronary artery disease or myocardial dysfunction. Transesophageal echocardiography is being utilized more frequently for non-cardiac surgery and may be helpful in some OSA patients as it can reveal information about pulmonary artery pressure and heart function. If the patient is also morbidly obese, an intra-arterial catheter may be useful because noninvasive blood pressure monitoring is inaccurate or not possible due to technical constraints. Alpha and beta-receptor regulation may be less tightly regulated in OSA patients, and they may not react to vasoactive drugs as expected.

The risk of prolonged obstructive apnea in OSA patients was substantially enhanced for about a week due to two factors: the increased requirement for analgesics and the REM rebound effect. To lessen or eliminate the requirement for systemic opioids, regional analgesic treatments should be examined. OSA patients benefit from the prophylactic multimodal analgesia technique using non-opioid analgesics such as local/regional anesthesia, acetaminophen, nestreroid anti-inflammatory drugs-NSAIDs, ketamine and alpha-2-agonist, ice, and transcutaneous electrical nerve stimulation. This is because opioids may be associated with pronounced respiratory depression. The risk of respiratory depression and airway obstruction is increased when sedatives (benzodiazepines, barbiturates) are used together. Although the use of nasal CPAP in OSA patients may allow the use of systemic analgesics and minimize hemodynamic abnormalities, further randomized clinical trials are required to better characterize the role of CPAP. If neuraxial analgesia is anticipated, the benefits (better analgesia, decreased requirement for systemic opioids) should be balanced against the hazards (respiratory depression due to rostral spread) of utilizing an opioid or an opioid-local anesthetic mixture over a local anesthetic alone. Continuous background infusions should be administered with extreme caution or avoided if systemic opioids are used.

Although most patients may benefit from more oxygen, it should be used with caution because it can decrease hypoxic respiratory stimulation and lengthen apnea episodes. Recurrent hypoxemia is more effectively treated with CPAP in conjunction with oxygen than with oxygen alone. Patients should, whenever feasible, be placed in non-lying positions throughout the duration of their rehabilitation (bed head raised by 30°).

Continuous monitoring should be kept up as long as patients are at risk. Continuous oximetry without continuous observation or intermittent pulse oximetry do not offer the same level of assurance. Before being discharged from the intensive care unit, patients with OSA are advised to be observed for three hours longer than patients without OSA, according to the ASA's "Guidelines for Perioperative Treatment of Patients with Obstructive Sleep Apnea." In addition, monitoring should continue while breathing room air for an average of seven hours following the previous episode of airway obstruction or hypoxemia (44, 46, 62).

CONCLUSION

The challenge for further research is to implement an adequate strategy of perioperative care for OSA patients and prevent life-threatening complications. This is made difficult by the increasing prevalence of OSA and its heterogeneity as well as the lack of credible risk predictors and evidence based on well-documented studies on the effectiveness of perioperative measures.

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Rizici anestezije kod obolelih od opstruktivne apnee tokom spavanja

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SAŽETAK

Uvod. Oboleli od opstruktivne apnee tokom spavanja (engl. *obstructive sleep apnea* – OSA) koji se podvrgavaju procedurama pod anestezijom imaju povećan rizik od razvoja perioperativnih komplikacija u poređenju sa bolesnicima bez ove dijagnoze.
Cilj. Cilj ovog rada je da ukaže na povezanost OSA i povećanog rizika od razvoja perioperativnih komplikacija, da predstavi moguće komplikacije i patofiziološke mehanizme koji ih mogu usloviti u perioperativnom okruženju i, naposletku, da pregleda dostupne preoperativne metode skrininga OSA i strategije planiranja i lečenja koje treba uzeti u obzir u okviru perioperativnog zbrinjavanja ovih bolesnika.
Metode. Pretražene su standardne baze podataka kako bi se pronašle kvalifikovane studije koje su uključivale odrasle hirurške bolesnike bez OSA, sa sumnjom na OSA ili sa dijagnostikovanom OSA.
Rezultati. Bolesnici za koje je utvrđeno da su izloženi riziku od OSA, odnosno oni sa dijagnostikovanom OSA moraju imati individualni pristup zbrinjavanju, koji uključuje izbor tehnike anestezije, upravljanje disajnim putevima i praćenje bolesnika.
Zaključak. Rastuća prevalencija OSA i njena heterogenost, kao i nedostatak pouzdanih prediktora rizika i dokaza zasnovanih na dobro dokumentovanim studijama o efikasnosti perioperativnih mera, predstavljaju izazov za dalja istraživanja u cilju primene adekvatne strategije perioperativnog zbrinjavanja OSA bolesnika i sprečavanje komplikacija opasnih po život.

Ključne reči: **rizici anestezije, opstruktivna apnea tokom spavanja, hirurgija**