SURMA, Alicja and AGNIESZKA PARAFIANOWICZ. Anesthetic Management in Obstructive Sleep Apnea: A Narrative Review. Journal of Education, Health and Sport. 2024;70:55814. eISSN 2391-8306.
https://dx.doi.org/10.12775/JEHS.2024.70.55814
https://apcz.umk.pl/JEHS/article/view/55814

The journal has had 40 points in Minister of Science and Higher Education of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of 05.01.2024 No. 32318. Has a Journal's Unique Identifier: 201159. Scientific disciplines assigned: Physical culture sciences (Field of medical and health sciences); Health Sciences (Field of medical and health sciences).
Punkty Ministerialne 40 punktów. Załącznik do komunikatu Ministra Nauki i Szkolnictwa Wyższego z dnia 05.01.2024 Lp. 32318. Posiada Unikatowy Identyfikator Czasopisma: 201159. Przypisane dyscypliny naukowe: Nauki o kulturze fizycznej (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki o zdrowiu (Dziedzina nauk medycznych i nauk o zdrowiu).
The authors declare that there is no conflict of interests regarding the publication of this paper.
Received:30.09.2024. Revised: 31.10.2024. Accepted: 01.11.2024. Published: 04.11.2024.

Anesthetic Management in Obstructive Sleep Apnea: A Narrative Review

Agnieszka Parfianowicz
District Hospital in Sochaczew,
ul.Batalionów Chłopskich 3/7, 96-500 Sochaczew, Poland
https://orcid.org/0009-0009-8415-6478
parfianowiczagnieszka@gmail.com

Alicja Surma
Provincial Hospital in Sochaczew,
ul. Batalionów Chłopskich 3/7, 96-500 Sochaczew, Poland
https://orcid.org/0009-0009-3921-478X
a.surma96@gmail.com

Abstract

Obstructive Sleep Apnea (OSA) introduces substantial difficulties in the management of anesthesia, largely due to its implications for airway management, sensitivity to sedative agents, and an elevated risk of complications during the perioperative period. This narrative review seeks to offer an in-depth exploration of the contemporary approaches to anesthesia management in patients diagnosed with OSA. It covers the entire continuum of care, including preoperative, intraoperative, and postoperative phases. The review underscores the critical importance of an accurate and thorough diagnosis of OSA, which is essential for formulating effective anesthetic strategies. Risk stratification is emphasized as a key element in identifying the specific challenges posed by each patient's condition and tailoring the anesthesia plan accordingly. By examining current practices and recommendations, the review aims to provide insights into how individualized anesthetic plans can be designed to reduce the risk of perioperative complications and enhance patient safety.

Introduction

Obstructive sleep apnea (OSA) introduces a host of complexities and risks during the perioperative period, primarily due to its significant associations with a variety of cardiovascular, respiratory, and metabolic complications. The presence of OSA makes the management of anesthesia more challenging, requiring a highly detailed and systematic approach that encompasses the entire surgical process, from preoperative assessment through to postoperative care.

The management of patients with OSA begins with a comprehensive preoperative evaluation. This evaluation involves a detailed assessment of the patient's overall health status, including a thorough review of any existing comorbid conditions that might elevate their perioperative risk. Identifying these conditions is crucial, as they can profoundly impact how the patient responds to anesthesia and surgery.

During the intraoperative phase, tailored strategies are necessary to manage the specific challenges presented by OSA. These challenges often include difficulties with maintaining a clear and open airway and managing adequate respiratory function throughout the surgical procedure. Effective intraoperative management involves the careful selection of anesthetic agents and the implementation of appropriate monitoring techniques. These measures are crucial to minimizing the risk of complications and ensuring stable and effective anesthesia management.

Postoperative care is equally critical for patients with OSA, requiring careful and continuous monitoring to detect and address any potential issues such as hypoxemia or respiratory distress as soon as they arise. This vigilant approach helps to ensure that any complications are promptly managed, thereby enhancing the overall safety and efficacy of the surgical outcome.

This review is designed to delve into the various considerations and strategies that are essential for the effective management of anesthesia in patients with OSA. By examining the importance of each phase of care - preoperative, intraoperative, and postoperative - this review underscores the necessity of a comprehensive and well-coordinated approach to achieve optimal surgical outcomes for these patients.

Preoperative Assessment

Diagnosis and Screening

Accurate diagnosis and thorough screening for sleep apnea are essential components for managing patients effectively throughout the perioperative period. While polysomnography is widely recognized as the definitive method for diagnosing obstructive sleep apnea (OSA), several practical screening tools are commonly employed due to their ease of use and reliability.

Among these, the STOP-BANG questionnaire is a particularly valuable tool. This questionnaire evaluates a range of symptoms and risk factors associated with sleep apnea, including Snoring, Tiredness during the day, Observed apneas, high blood Pressure, Body mass index (BMI), Age, Neck circumference, and Gender. Its broad scope and high sensitivity make it an effective means for identifying individuals who may have OSA [1,2].

Another effective screening tool is the Berlin Questionnaire. This tool is well-regarded for its ability to pinpoint individuals who are at elevated risk for OSA. It assesses various risk factors and symptoms, providing a comprehensive evaluation that helps in identifying those who might benefit from further diagnostic testing [3,4].
These screening tools are instrumental in ensuring that patients with sleep apnea are accurately identified and appropriately managed before undergoing surgery.

Risk Stratification

Patients with obstructive sleep apnea (OSA) face heightened risks for perioperative complications, which can include challenges with airway management, hypoxemia, and cardiovascular instability. Effective risk stratification is critical and involves a comprehensive evaluation of several factors, including the severity of the sleep apnea, existing comorbidities, and the nature of the planned surgical procedure.
Severe OSA, characterized by an apnea-hypopnea index (AHI) exceeding 30, is particularly associated with an elevated risk of perioperative complications. [5,6] To properly assess this risk, a thorough preoperative evaluation is necessary. This evaluation includes a detailed review of the patient's medical history and a focused physical examination. Special attention should be given to identifying indicators related to OSA, such as obesity, hypertension, and anatomical irregularities in the upper airway.
Based on the findings from these assessments, patients should be classified into risk categories: low, moderate, or high. This categorization is determined by evaluating the severity of the patient's OSA and the presence of any additional health issues. [7,8] This stratification helps guide perioperative management strategies and informs the level of monitoring and interventions required to mitigate risks during and after the surgical procedure.

Preoperative Optimization

Preoperative optimization is a crucial step aimed at preparing patients to handle the demands of anesthesia and surgery as effectively as possible. This process involves enhancing the patient’s overall health and addressing any preexisting conditions that could impact their surgical outcome. Specifically, it is important to manage comorbidities commonly associated with obstructive sleep apnea (OSA), such as obesity, hypertension, and diabetes. [9,10]
Before scheduling elective procedures, significant efforts should be made to address these conditions. This includes implementing strategies for weight loss, improving cardiovascular health, and achieving tight control over blood sugar levels. These measures are intended to improve the patient's overall health and resilience.
In addition to managing comorbidities, initiating continuous positive airway pressure (CPAP) therapy in the period leading up to surgery is a critical component of preoperative care. CPAP therapy helps to mitigate perioperative risks by reducing airway obstruction and improving oxygenation levels. By addressing these factors before the surgery, patients are better prepared, which can contribute to a smoother surgical experience and improved outcomes. [11,12]

Education and Communication

Effective coordination among the surgical, anesthesia, and postoperative teams is vital. All team members must be fully informed of the patient's OSA diagnosis and the specific risks and management protocols associated with it. Patient education is also key, particularly regarding the importance of sticking to CPAP therapy and following perioperative care instructions closely. [13,14]

Special Considerations for Pediatric Patients

In children, OSA is often related to enlarged tonsils and adenoids or obesity. Managing anesthesia in these young patients requires special attention due to the unique characteristics of their airway anatomy and physiology. A thorough preoperative evaluation should be conducted, focusing on identifying OSA symptoms and related conditions. During surgery, smaller endotracheal tubes may be necessary, and anesthetic agents should be carefully adjusted to avoid depressing the child's respiratory function. [15]

Advanced Diagnostic Testing

For patients who are deemed to be at high risk or exhibit significant symptoms indicative of severe obstructive sleep apnea (OSA), it is important to consider additional diagnostic evaluations. One such evaluation is overnight polysomnography, a comprehensive test that plays a vital role in confirming the diagnosis of OSA and assessing its severity. This detailed analysis provides essential information for effectively planning and managing perioperative care. In situations where access to full polysomnography may be restricted, such as in remote or underserved areas, portable sleep studies can serve as an alternative diagnostic tool. These portable studies, while not as exhaustive as traditional polysomnography, can still offer valuable insights into the patient's sleep patterns and apnea events, aiding in the appropriate management of their condition. [16]

Intraoperative Management

Airway Management

Managing the airway in patients with sleep apnea presents unique challenges due to both anatomical and functional irregularities. These patients often have physical features like an increased neck circumference, craniofacial abnormalities, and a tendency for airway collapse, all of which complicate mask ventilation and endotracheal intubation. [11,17] As such, a meticulous and comprehensive airway management plan is essential, incorporating both primary and backup strategies.

Video laryngoscopy has emerged as a valuable tool in this context, offering improved visualization of the vocal cords compared to traditional laryngoscopy. This technique enhances the success rates of intubation and minimizes the risk of airway trauma, making it particularly useful for patients with sleep apnea who are prone to difficult intubations. [18] Additionally, when a challenging airway is anticipated, awake fiberoptic intubation may be the preferred method. This technique allows the anesthesiologist to visualize the airway in real-time and navigate it carefully, reducing the likelihood of complications that can arise from blind intubation attempts.

In situations where traditional intubation proves difficult, adherence to the Difficult Airway Society's stepwise approach is recommended. This begins with thorough preoxygenation to maximize oxygen reserves, followed by the use of adjunctive devices, such as supraglottic airway devices, which can serve as an effective alternative when direct intubation fails. [19] Employing a videolaryngoscope as the first-line tool for intubation is often advisable, as it provides superior glottic visualization, which is critical in managing the compromised airways typical in sleep apnea patients.

Ensuring that these strategies are in place before induction of anesthesia can significantly reduce the risk of adverse events and improve overall patient outcomes. [20]

Anesthetic Agents

The selection of anesthetic agents is crucial in managing patients with sleep apnea, particularly because of their increased risk for respiratory complications. Anesthetics with short durations, such as propofol and remifentanil, are favored because they are rapidly metabolized, leading to quick recovery and minimal lingering effects on breathing. [21], [22] This makes them ideal for patients with sleep apnea, as they help maintain respiratory stability during and after surgery. The use of total intravenous anesthesia (TIVA), which typically involves a combination of propofol and remifentanil, allows for a controlled and stable anesthetic experience with a swift emergence from anesthesia, thereby lowering the risk of postoperative respiratory issues. [23]

In addition to careful selection of anesthetic agents, the incorporation of regional anesthesia techniques can significantly reduce the reliance on systemic opioids, which are known to depress respiratory function. Methods such as epidural analgesia, peripheral nerve blocks, and local anesthetic infiltration offer effective pain control while maintaining respiratory function. These techniques not only provide targeted pain relief but also minimize the potential for opioid-induced respiratory depression. If opioids are necessary, short-acting options like fentanyl are preferred due to their quick onset and brief duration of action. However, their administration should be carefully titrated to the lowest effective dose to mitigate the risk of impairing the patient's ability to breathe postoperatively. [14]

Intraoperative Monitoring

Enhanced intraoperative monitoring is critical for ensuring patient safety, particularly for those with obstructive sleep apnea (OSA). Continuous capnography and pulse oximetry are fundamental tools for detecting respiratory issues early. Continuous capnography provides real-time feedback on ventilation status, allowing for the immediate identification of hypoventilation or apnea. This prompt detection facilitates timely intervention, thereby reducing the risk of severe respiratory compromise. [24] Furthermore, employing neuromuscular monitoring is crucial to guide the administration of muscle relaxants. This helps prevent residual neuromuscular blockade, a condition that can be especially hazardous in patients with OSA due to their increased susceptibility to respiratory complications. [25]

In cases where patients exhibit signs of cardiopulmonary dysfunction or have severe OSA combined with significant comorbidities, more invasive monitoring may be required. Arterial blood pressure monitoring and central venous pressure monitoring can provide detailed

insights into the patient's hemodynamic status, which is essential for managing fluid levels and medication effectively. [26]
Additionally, the use of transesophageal echocardiography may be advantageous for intraoperative assessment of cardiac function, helping to guide decisions related to cardiovascular management. [18]

Positioning and Ventilation Strategies

Effective patient positioning is a key factor in managing anesthesia for individuals with OSA. The head-elevated laryngoscopy position (HELP) has been demonstrated to improve glottic visualization and facilitate intubation, particularly in obese patients and those with OSA. [27] and laryngeal axes, this positioning technique reduces the likelihood of airway obstruction, thereby improving overall airway management.
Ventilation strategies should focus on maintaining adequate oxygenation and ventilation while avoiding complications such as hypercapnia and hypoxia. Implementing positive end-expiratory pressure (PEEP) during mechanical ventilation is beneficial for preventing airway collapse and enhancing oxygenation in patients with OSA. [28] Additionally, adopting lung-protective ventilation strategies, such as using low tidal volumes and avoiding excessively high peak inspiratory pressures, can mitigate the risks of barotrauma and volutrauma. [27] These measures contribute to safer and more effective ventilation management, ensuring better outcomes for patients undergoing anesthesia with OSA.

Postoperative Management

Extubation and Recovery

Extubation should be carefully timed, ensuring it is only performed when the patient is fully conscious and able to maintain their airway independently. This cautious approach helps reduce the risk of airway obstruction, a common concern in patients with obstructive sleep apnea (OSA). To further support airway patency and enhance oxygenation in the immediate postoperative period, the application of continuous positive airway pressure (CPAP) therapy is highly beneficial. CPAP helps prevent airway collapse, a frequent issue in OSA patients, and ensures adequate oxygen delivery. [23,24] For patients with severe OSA or those with significant comorbidities, close monitoring in a high-dependency unit or intensive care unit is recommended to quickly address any respiratory difficulties or other complications that may arise during recovery. [23]

Pain Management

Effective pain management in OSA patients requires a multimodal approach to minimize the risk of respiratory depression while ensuring adequate analgesia. [25,30] This strategy often includes the use of regional anesthesia techniques, non-opioid analgesics, and opioid-sparing methods. Nonsteroidal anti-inflammatory drugs (NSAIDs) and acetaminophen are commonly

used as part of this regimen to provide effective pain relief without the respiratory risks associated with opioids. [25]

Additionally, local anesthetic infiltration and regional nerve blocks can significantly reduce the need for systemic opioids, thereby lowering the potential for postoperative respiratory complications. By incorporating these techniques, healthcare providers can manage postoperative pain effectively while maintaining respiratory safety. [27]

Postoperative Monitoring

Postoperative monitoring is crucial for patients with sleep apnea, necessitating rigorous observation for at least 24 hours following surgery.

These patients are at a higher risk for respiratory complications, making continuous monitoring essential to detect early signs of issues such as hypoxemia or respiratory depression. Implementing continuous pulse oximetry and capnography can provide real-time data on oxygen saturation and carbon dioxide levels, respectively, which is vital for promptly identifying any deterioration in respiratory function .[31] This continuous monitoring helps in ensuring that any signs of respiratory distress are addressed immediately.

In addition to monitoring oxygenation and ventilation parameters, it is important to assess patients' readiness for discharge with careful consideration. This assessment should include evaluating the patient's ability to maintain stable oxygenation and effective ventilation independently, without relying on supplemental oxygen or continuous positive airway pressure (CPAP) therapy. Only when a patient consistently demonstrates adequate respiratory function and stability, as verified through thorough postoperative monitoring, should they be considered for discharge. [29] This approach helps to minimize the risk of postoperative complications and ensures that the patient has recovered sufficiently to handle the demands of postoperative recovery safely

Postoperative Complications

Patients with obstructive sleep apnea (OSA) face a heightened risk of postoperative complications, including hypoxemia, respiratory depression, and cardiovascular events. The presence of OSA significantly increases the likelihood of adverse outcomes, such as severe hypoxemia, unplanned ICU admissions, and prolonged hospital stays. Studies consistently demonstrate that patients with OSA experience more frequent and severe episodes of postoperative hypoxemia compared to those without the condition. These complications are particularly concerning because they can lead to further respiratory compromise and increase the risk of serious cardiovascular incidents, such as arrhythmias and myocardial infarctions. To mitigate these risks, vigilant monitoring of oxygen saturation, respiratory function, and cardiovascular status is essential in the immediate postoperative period. [24] Early intervention, including the use of supplemental oxygen, continuous positive airway pressure (CPAP) therapy, and careful management of analgesia, is crucial to prevent deterioration and ensure safe recovery.

Enhanced Recovery After Surgery (ERAS) Protocols

Enhanced Recovery After Surgery (ERAS) protocols, which emphasize a multidisciplinary and multimodal approach to perioperative care, can be particularly beneficial for patients with OSA. These protocols are designed to minimize surgical stress, reduce complications, and accelerate recovery by incorporating evidence-based practices across all phases of surgical care. [23] For OSA patients, ERAS protocols typically include tailored pain management strategies that avoid excessive opioid use, thus minimizing the risk of respiratory depression. Early mobilization is encouraged to prevent venous thromboembolism and promote lung function, which is especially important in this patient population. Nutritional support is another key element, ensuring that patients maintain their strength and immune function throughout the perioperative period. By optimizing each aspect of care, ERAS protocols not only reduce the length of hospital stays but also improve overall surgical outcomes, making them an effective strategy for managing OSA patients undergoing surgery. [24]

Long-term Management

Obstructive sleep apnea (OSA) requires ongoing management beyond the initial perioperative period. It is essential for patients to be referred to sleep specialists for continuous assessment and treatment. Key aspects of long-term care include the consistent use of Continuous Positive Airway Pressure (CPAP) therapy, which is critical for maintaining open airways and improving sleep quality. Weight management is also crucial, given that excess weight can exacerbate OSA. Additionally, addressing comorbid conditions such as hypertension, diabetes, and cardiovascular issues is important, as these can worsen OSA. A coordinated approach involving regular follow-ups with a sleep specialist and coordination with other healthcare providers ensures comprehensive management and enhances the patient's quality of life. [23]

Follow-up and Patient Education

Postoperative follow-up is vital to assess recovery and ensure adherence to CPAP therapy. During these follow-up visits, healthcare providers should evaluate the patient’s adherence to CPAP therapy and any necessary modifications to their treatment plan. Education about the importance of consistent CPAP use and lifestyle changes - such as weight loss, smoking cessation, and moderation of alcohol intake - is crucial for long-term health. Tailored education helps patients understand how these changes can mitigate OSA symptoms and reduce the risk of future complications. Ongoing engagement with a sleep specialist can facilitate effective management of the condition and support patients in maintaining their health over time. [24]

Special Considerations for Pediatric Patients

In pediatric patients, managing OSA involves special considerations due to their distinct airway anatomy and physiological responses. Common causes of OSA in children include adenotonsillar hypertrophy, which requires specific treatment approaches. Postoperative monitoring for these patients should be rigorous to detect any signs of airway obstruction or respiratory issues. In some cases, CPAP or bilevel positive airway pressure (BiPAP) therapy may be necessary to maintain airway openness and ensure adequate oxygen levels. [29] Education for families is crucial, as parents and caregivers need to be well-informed about the

use of CPAP devices, the signs of OSA, and the importance of adhering to treatment protocols. Supporting families in this manner helps ensure effective management of pediatric OSA.

Conclusion

Effectively managing anesthesia in patients with obstructive sleep apnea (OSA) requires meticulous planning and a collaborative, multidisciplinary approach. The process begins with a comprehensive preoperative assessment, which includes screening for OSA and categorizing patients based on the severity of their condition and the presence of any comorbidities. This risk stratification is critical for tailoring anesthesia and surgical plans to each patient's needs.

During the intraoperative phase, the primary focus must be on maintaining airway patency and minimizing factors that could exacerbate respiratory issues. This includes judicious use of sedatives and opioids, as these medications can increase the risk of respiratory depression and other complications in patients with OSA. Utilizing techniques such as video laryngoscopy or fiberoptic intubation can improve the success rate of intubation and reduce potential airway trauma.

Postoperative care for OSA patients is equally important and requires vigilant monitoring to detect and address complications early. The use of continuous positive airway pressure (CPAP) therapy immediately after surgery can prevent airway collapse and ensure proper oxygenation, thereby reducing the risk of postoperative hypoxemia and related issues. Enhanced Recovery After Surgery (ERAS) protocols can be particularly beneficial, as they are designed to reduce surgical stress, improve recovery times, and enhance overall outcomes.

Ongoing education for healthcare providers about the latest guidelines and best practices is essential to optimize the perioperative management of patients with OSA. Adhering to updated protocols and continuously educating the surgical and anesthesia teams help ensure that these patients receive the highest level of care, enhancing their safety and recovery throughout the surgical process.

Disclosure

Conceptualization, Agnieszka Parfianowicz, and Alicja Surma;
Methodology, Agnieszka Parfianowicz;
Software, Alicja Surma;
Check, Alicja Surma;
Formal analysis, Agnieszka Parfianowicz;
Investigation, Alicja Surma;
Resources, Alicja Surma;
Data curation, Agnieszka Parfianowicz;
Writing - rough preparation, Agnieszka Parfianowicz;
Writing - review and editing, Alicja Surma;
Visualization, Agnieszka Parfianowicz;
Supervision, Alicja Surma;
Project administration, Agnieszka Parafinowicz;
Receiving funding, Alicja Surma;

All authors have read and agreed with the published version of the manuscript.

Funding Statement:
The study did not receive special funding.

Institutional Review Board Statement:
Not applicable.

Informed Consent Statement:
Not applicable.

Data Availability Statement:
Not applicable.

Conflict of Interest Statement:
The authors declare no conflict of interest.

References:

1. Memtsoudis, S. G., Cozowicz, C., Nagappa, M., Wong, J., Joshi, G. P., Wong, D. T., Doufas, A. G., Yilmaz, M., Stein, M. H., Krajewski, M. L., Singh, M., Pichler, L., Ramachandran, S. K., & Chung, F. (2018). Society of Anesthesia and Sleep Medicine Guideline on Intraoperative Management of Adult Patients With Obstructive Sleep Apnea. Anesthesia & Analgesia, 127(4), 967–987. https://doi.org/10.1213/ANE.0000000000003434
2. Seet, E., Nagappa, M., & Wong, D. T. (2021). Airway Management in Surgical Patients With Obstructive Sleep Apnea. Anesthesia & Analgesia, 132(5), 1321–1327. https://doi.org/10.1213/ANE.0000000000005298
3. Ravesloot, M. J. L., de Raaff, C. A. L., van de Beek, M. J., Benoist, L. B. L., Beyers, J., Corso, R. M., Edenharter, G., den Haan, C., Heydari Azad, J., Ho, J.-P. T. F., Hofauer, B., Kezirian, E. J., van Maanen, J. P., Maes, S., Mulier, J. P., Randerath, W., Vanderveken, O. M., Verbraecken, J., Vonk, P. E., … de Vries, N. (2019). Perioperative Care of Patients With Obstructive Sleep Apnea Undergoing Upper Airway Surgery. JAMA Otolaryngology–Head & Neck Surgery, 145(8), 751. https://doi.org/10.1001/jamaoto.2019.1448
4. Florea, D., & Florea Matei, A. (2019). Riesgos anestésicos en los pacientes con apnea obstructiva del sueño. Revista Chilena de Anestesia, 48(1), 13–19. https://doi.org/10.25237/revchilanestv48n01.04
5. Hassan, H. S., & Abelgheit, A. (2023). Sleep-Related Breathing Disorder and its Relation to Anesthetic Practice. In Benha Journal of Applied Sciences (BJAS) (Issue 8). http://bjas.journals.ekb.eg
6. Urman R, Chung F, Gan T. Obstructive Sleep Apnea and Ambulatory Surgery: Who Is Truly at Risk? Anesthesia & Analgesia. 2019. https://doi.org/10.1213/ANE.0000000000004217
7. Cok, O. Y., Seet, E., Kumar, C. M., & Joshi, G. P. (2019). Perioperative considerations and anesthesia management in patients with obstructive sleep apnea undergoing ophthalmic

surgery. Journal of Cataract and Refractive Surgery, 45(7), 1026–1031. https://doi.org/10.1016/j.jcrs.2019.02.044

8. Gupta, R., & Pyati, S. (2018a). Controversies in office-based anesthesia: obstructive sleep apnea considerations. Minerva Anestesiologica, 84(9). https://doi.org/10.23736/S0375-9393.18.12628-9
9. Cozowicz, C., & Memtsoudis, S. G. (2021). Perioperative Management of the Patient With Obstructive Sleep Apnea: A Narrative Review. Anesthesia & Analgesia, 132(5), 1231–1243. https://doi.org/10.1213/ANE.0000000000005444
10. Nagappa, M., Subramani, Y., & Chung, F. (2018). Best perioperative practice in management of ambulatory patients with obstructive sleep apnea. Current Opinion in Anaesthesiology, 31(6), 700–706. https://doi.org/10.1097/ACO.0000000000000661
11. Bolden, N., Posner, K. L., Domino, K. B., Auckley, D., Benumof, J. L., Herway, S. T., Hillman, D., Mincer, S. L., Overdyk, F., Samuels, D. J., Warner, L. L., Weingarten, T. N., & Chung, F. (2020a). Postoperative Critical Events Associated With Obstructive Sleep Apnea: Results From the Society of Anesthesia and Sleep Medicine Obstructive Sleep Apnea Registry. Anesthesia & Analgesia, 131(4), 1032–1041. https://doi.org/10.1213/ANE.0000000000005005
12. Bamgbade, O. (2018). Anesthesiologist preference for postoperative analgesia in major surgery patients with obstructive sleep apnea. Saudi Journal of Anaesthesia, 12(3), 475–477. https://doi.org/10.4103/sja.SJA_25_18
13. Erwin, A. M., Noble, K. A., Marshall, J., & Cooper, S. (2019). Perianesthesia Nurses' Survey of Their Knowledge and Practice With Obstructive Sleep Apnea. Journal of PeriAnesthesia Nursing, 34(1), 39–50. https://doi.org/10.1016/j.jopan.2018.01.008
14. Bamgbade, O., Oluwole, O., Khalaf, W., Namata, C., & Metekia, L. (2021). Perioperative care of obstructive sleep apnea patients: A survey of European anesthesiologists. Saudi Journal of Anaesthesia, 15(2), 101–108. https://doi.org/10.4103/sja.sja_1010_20
15. Weingarten, T. N., & Sprung, J. (2022). Perioperative considerations for adult patients with obstructive sleep apnea. Current Opinion in Anaesthesiology, 35(3), 392–400. https://doi.org/10.1097/ACO.0000000000001125
16. Corso R, Russotto V, Gregoretti C, Cattano D. Perioperative management of obstructive sleep apnea: a systematic review. Minerva Anestesiologica. 2018;84:81-93. https://doi.org/10.23736/S0375-9393.17.11688-3
17. Fassbender, P., Bürgener, S., Haddad, A., Silvanus, M.-T., & Peters, J. (2018). Perioperative incidence of airway obstructive and hypoxemic events in patients with confirmed or suspected sleep apnea - a prospective, randomized pilot study comparing propofol/remifentanil and sevoflurane/remifentanil anesthesia. BMC Anesthesiology, 18(1), 14. https://doi.org/10.1186/s12871-018-0477-9
18. Melesse, D. Y., Mekonnen, Z. A., Kassahun, H. G., & Chekol, W. B. (2020). Evidence based perioperative optimization of patients with obstructive sleep apnea in resource limited areas: A systematic review. International Journal of Surgery Open, 23, 23–34. https://doi.org/10.1016/j.ijso.2020.02.002

19. Wanderer, J. P., & Nathan, N. (2018). Poor Sleep, Worse Outcomes: Obstructive Sleep Apnea and Perioperative Care. Anesthesia & Analgesia, 127(4), 804–804. https://doi.org/10.1213/ANE.0000000000003745
20. Cozowicz, C., & Memtsoudis, S. G. (2020). Perioperative Care of the Orthopedic Patient with Sleep-Disordered Breathing: Obstructive Sleep Apnea. In Perioperative Care of the Orthopedic Patient (pp. 245–256). Springer International Publishing. https://doi.org/10.1007/978-3-030-35570-8_19
21. Singh, M., Tian, C., Hyman, J. B., Siddiqui, S., Auckley, D., Khanna, A. K., Wong, J., Englesakis, M., Singh, K. P., & Ramachandran, S. K. (2023). Level of Evidence of Guidelines for Perioperative Management of Patients With Obstructive Sleep Apnea: An Evaluation Using the Appraisal of Guidelines for Research and Evaluation II Tool. Anesthesia & Analgesia, 136(2), 262–269. https://doi.org/10.1213/ANE.0000000000006320
22. Holt, N. R., Downey, G., & Naughton, M. T. (2019). Perioperative considerations in the management of obstructive sleep apnoea. Medical Journal of Australia, 211(7), 326–332. https://doi.org/10.5694/mja2.50326
23. Jonsson Fagerlund, M., & Franklin, K. A. (2021). Perioperative Continuous Positive Airway Pressure Therapy: A Review With the Emphasis on Randomized Controlled Trials and Obstructive Sleep Apnea. Anesthesia & Analgesia, 132(5), 1306–1313. https://doi.org/10.1213/ANE.0000000000005480
24. Bae, E. (2023). Preoperative risk evaluation and perioperative management of patients with obstructive sleep apnea: a narrative review. Journal of Dental Anesthesia and Pain Medicine, 23(4), 179. https://doi.org/10.17245/jdapm.2023.23.4.179
25. Park, J. H., & Kwon, M. A. (2021a). Perioperative Management for the Patients with Obstructive Sleep Apnea. Journal of Sleep Medicine, 18(1), 12–21. https://doi.org/10.13078/jsm.210001
26. Wong, J. K., Rodriguez, E. M., Wee-Tom, B., Lejano, M., Kushida, C. A., Howard, S. K., Memtsoudis, S. G., & Mariano, E. R. (2020). A Multidisciplinary Perioperative Intervention to Improve Positive Airway Pressure Adherence in Patients With Obstructive Sleep Apnea: A Case Series. A&A Practice, 14(4), 119–122. https://doi.org/10.1213/XAA.0000000000001165
27. Suen, C., Wong, J., Warsame, K., Subramani, Y., Panzarella, T., Waseem, R., Auckley, D., Chaudhry, R., Islam, S., & Chung, F. (2021). Perioperative adherence to continuous positive airway pressure and its effect on postoperative nocturnal hypoxemia in obstructive sleep apnea patients: a prospective cohort study. BMC Anesthesiology, 21(1), 142. https://doi.org/10.1186/s12871-021-01371-0
28. Hershner, S., & Auckley, D. (2021). Perioperative Management of Insomnia, Restless Legs, Narcolepsy, and Parasomnias. Anesthesia & Analgesia, 132(5), 1287–1295. https://doi.org/10.1213/ANE.0000000000005439
29. Seet, E., Saw, C. J., & Kumar, C. M. (2022). Obstructive sleep apnea and perioperative management of the difficult airway. International Anesthesiology Clinics, 60(2), 35–42. https://doi.org/10.1097/AIA.0000000000000358

30. Chambers, T., Bamber, H., & Singh, N. (2023). Perioperative management of Obstructive Sleep Apnoea: Present themes and future directions. Current Opinion in Pulmonary Medicine, 29(6), 557–566. https://doi.org/10.1097/MCP.0000000000001012

Editorial, E. (2019). ANESTHESIA & ANALGESIA. www.anesthesia-analgesia.org

31. Ayas, N. T., Laratta, C. R., Coleman, J. M., Doufas, A. G., Eikermann, M., Gay, P. C., Gottlieb, D. J., Gurubhagavatula, I., Hillman, D. R., Kaw, R., Malhotra, A., Mokhlesi, B., Morgenthaler, T. I., Parthasarathy, S., Ramachandran, S. K., Strohl, K. P., Strollo, P. J., Twery, M. J., Zee, P. C., & Chung, F. F. (2018). Knowledge Gaps in the Perioperative Management of Adults with Obstructive Sleep Apnea and Obesity Hypoventilation Syndrome. An Official American Thoracic Society Workshop Report. Annals of the American Thoracic Society, 15(2), 117–126. https://doi.org/10.1513/AnnalsATS.201711-888WS