CHEST

CPAP in the Perioperative Setting
Evidence of Support

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OSA is a commonly encountered comorbid condition in surgical patients. The risk of cardiopulmonary complications is increased by two to threefold with OSA. Among the different treatment options for OSA, CPAP is an efficacious modality. This review examines the evidence regarding the use of CPAP in the preoperative and postoperative periods in surgical patients with diagnosed and undiagnosed OSA. CHEST 2016; 149(2):586-597

KEY WORDS: CPAP; OSA; perioperative period

OSA is a prevalent sleep breathing disorder in the general population with estimated prevalence of at least 9% to 25%.[1] Indeed, in a recent population-based study in Switzerland, the prevalence of moderate to severe OSA was 23.4% in women and 49.7% in men.[2] The prevalence of OSA in surgical patients using International Classification of Disease-9 codes has been reported to be 7% to 10%.[3-5] However, using polysomnography (PSG), the prevalence of OSA in surgical patients is expected to be significantly higher than simply using International Classification of Disease-9 codes from administrative databases. Indeed, the prevalence may be as high as 70% in high-risk populations such as patients undergoing bariatric surgery.[6,7] Surgical patients with OSA pose a significant clinical challenge to health-care professionals because of OSA's associations with several comorbidities, including cardiovascular disease, heart failure, arrhythmias, hypertension, stroke, and metabolic syndrome.[8-11] During the perioperative period, sleep is disrupted and the severity of sleep-disordered breathing (SDB) is increased postoperatively in surgical patients with OSA.[12,13]

The American Society of Anesthesiologists published a practice guideline recommending preoperative screening to identify undiagnosed OSA, preoperative initiation of CPAP if possible, and postoperative monitoring of patients with OSA.[14,15] Perioperative complications related to OSA are increasingly linked to malpractice lawsuits with severe financial penalties.[16,17] The lack of evidence behind the guideline recommendations and

ABBREVIATIONS: AHI = apnea hypopnea index; APAP = autotitrated positive airway pressure; PACU = postanesthesia care unit; RCTs = randomized controlled trials; RR = risk reduction; SDB = sleep-disordered breathing

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FUNDING/SUPPORT: This work was supported by the University Health Network Foundation and Department of Anesthesia, Toronto Western Hospital, University Health Network, University of Toronto, Toronto, Canada. Dr Mokhlesi is supported by National Institutes of Health [Grant R01HL119161].

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DOI: http://dx.doi.org/10.1378/chest.15-1777

the significant cost of guideline implementation have created a dilemma between potentially improved postoperative adverse events and increased health-care resource utilization. In practice, fewer than 20% of patients with a diagnosis of OSA receive CPAP therapy, are observed in advanced care settings, or both.[18] This review examines the evidence regarding the use of CPAP in the preoperative and postoperative periods in surgical patients with diagnosed and undiagnosed OSA.

Surgical Patients With OSA and Perioperative Complications

A close relationship exists among OSA, sleep, and anesthesia. Upper airway behavior during sleep serves to some extent as a surrogate of airway behavior during anesthesia and recovery from anesthesia. Likewise, upper airway abnormalities observed by anesthesiologists during the perioperative period is likely to predict upper airway behavior during sleep.[19] A patient with an upper airway that is prone to collapse may also be at increased risk of compromised arousal mechanism in the postoperative period. Several large database studies and two meta-analysis have shown that patients with OSA have increased risk of postoperative complications.[3,4,20-25] Two recent meta-analysis of 13 and 17 studies indicate that, compared with patients with OSA, patients with OSA have a higher incidence of respiratory complications, postoperative cardiac events, and increased ICU transfer.[24,25] In line with the meta-analysis, five recent studies using data from large national and international databases including millions of patients demonstrated a significantly increased risk of atrial fibrillation, respiratory failure, aspiration pneumonia, ARDS, increased emergent postoperative endotracheal intubation, and need for postoperative ventilation among patients with a diagnosis of OSA vs control subjects.[3,4,20-22,26] D'Apuzzo et al[20] demonstrated that there is increased mortality in OSA vs patients without OSA undergoing revision joint arthroplasty (OR, 1.9; $P = .002$). That this study included patients undergoing revision arthroplasty may suggest a higher burden of comorbidities. Paradoxically, the increased risk of cardiopulmonary complications did not translate into increased risk of in-hospital mortality in two studies.[4,20] There may be several reasons behind the reduction in in-hospital mortality: (1) patients with OSA may have received more vigilant care; (2) patients with OSA may have exhibited signs of deterioration earlier in their hospital course; (3) the reason behind respiratory failure in patients with OSA may have been easier to treat (eg, respiratory failure from upper airway compromise vs aspiration pneumonia or ARDS); or (4) in the control group, patients may have undiagnosed OSA with increased risk of mortality and morbidity. Indeed, in two studies of postsurgical patients,[4,20] those with an OSA diagnosis who developed respiratory failure were intubated earlier and received mechanical ventilation for a shorter period, suggesting that the cause of respiratory failure was rapidly reversible, perhaps related to upper airway complications resulting from sedatives and opioid analgesics.

In the general population, a significant proportion of patients with moderate to severe OSA remains undiagnosed.[27] This corollary may also apply to the surgical patients in the perioperative period. In a retrospective nested cohort study, preoperative screening followed by PSG was performed to identify patients with OSA, and the results were blinded to the perioperative care team. Both anesthesiologists and surgeons failed to identify a majority of the newly diagnosed patients with moderate to severe OSA.[28] Patients with undiagnosed OSA presenting for surgery may have further increase in cardiopulmonary complications.[29-31]

Postoperative Use of CPAP in Surgical Patients Without OSA

The efficacy of CPAP in patients without a diagnosis of OSA has been well-established by a recent meta-analysis of nine randomized controlled trials (RCTs) in patients undergoing abdominal surgery.[32] These studies have shown that perioperative use of CPAP leads to a reduction in the rate of postoperative pulmonary complications. In 200 patients who developed hypoxemia immediately after undergoing major abdominal surgery, the use of postoperative CPAP at 7.5 cm H_2O plus supplemental oxygen using a helmet interface led to a reduction in the incidence of endotracheal intubation, pneumonia, infection, and sepsis when compared with supplemental oxygen alone.[33] Significant reduction in the rate of pulmonary complications with the prophylactic use of nasal CPAP was also demonstrated in patients undergoing thoracoabdominal aortic surgery and cardiac surgery.[34,35]