Obstructive sleep apnea (OSA) is a prevalent disorder characterized by recurrent episodes of complete or partial collapse of the upper airway during sleep, leading to intermittent hypoxemia and hypercapnia and sleep fragmentation. A recent community-based study reported an increasing prevalence of OSA in parallel with the obesity epidemic. Concurrently, the number of surgical cases performed globally is increasing. In fact, Weiser et al. estimated that 234 million major surgeries were performed in 2004 worldwide. Although the reported prevalence of OSA in presurgical cohorts has varied, undoubtedly most anesthesiologists are bound to encounter patients with OSA in their daily clinical practice. This is of clinical relevance since sedatives, narcotics, and anesthetics can exacerbate upper airway collapsibility and blunt the arousal response.

Several single-institution studies have reported an association between OSA and a myriad of adverse postoperative outcomes. In the absence of large-scale, well-controlled, prospective studies, analysis of administrative databases can shed some light on the association between OSA and postoperative outcomes and provide data that are more generalizable than single-center smaller studies. This is of importance because implementation of systematic screening for OSA and initiating treatment in the perioperative period for those patients at risk would impose a significant cost burden, particularly in the setting of large surgical volumes.

Accordingly, the study by Memtsoudis et al., in this issue of Anesthesia & Analgesia is a timely contribution to the field of perioperative medicine. In an observational study performed using the Premier Perspective database, these investigators extracted data on 530,089 patients who underwent total hip or total knee arthroplasty between 2006 and 2010 in nearly 400 hospitals in the United States. OSA was present in 8.4% of the cohort based on the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) diagnostic codes. With robust statistical methodology and after adjusting for important confounders, they found that OSA was independently associated with increased odds ratio (OR) for the composite outcome of major postoperative adverse events (OR 1.47; 95% confidence interval [CI], 1.39–1.55). Not surprisingly, the association was stronger with pulmonary complications (OR 1.86; 95% CI, 1.65–2.09) than cardiac complications (OR 1.59; 95% CI, 1.48–1.71) with the risk of cardiac complications mainly due to atrial fibrillation. It is interesting to note that this type of arrhythmia has been strongly associated with OSA in nonsurgical cohorts as well. The risk of emergent reintubation was significantly increased in patients with OSA (OR 10.26; 95% CI, 9.01–11.69). OSA patients without hypertension and chronic obstructive pulmonary disease were 14 times more likely to receive mechanical ventilation and 46 times more likely to undergo noninvasive ventilation (NIV) than non-OSA patients. OSA was also independently associated with escalation of care, increased health care resource utilization, and length of stay.

The types of complications associated with OSA reported by Memtsoudis et al. are similar to the findings from a recent analysis of the Nationwide Inpatient Sample. Mokhlesi et al. examined a cohort of 1,058,710 hospitalized adult patients undergoing 4 categories of elective procedures (orthopedic, prostate, abdominal, and cardiovascular cases) and a cohort of 91,028 adult patients undergoing bariatric surgeries between 2004 and 2008. Similar to the Premier Perspective database, OSA was independently associated with significantly increased odds of emergent intubation and mechanical ventilation, NIV, respiratory failure, and atrial fibrillation. A recent meta-analysis of 13 single-center studies also demonstrated a higher incidence of respiratory failure, cardiac events, and intensive care unit transfers in patients with OSA.

In the study by Memtsoudis et al., despite the increased rates of complications, there was no significant increase in the risk of in-hospital mortality in patients with OSA. In patients undergoing elective surgeries and bariatric surgeries, OSA was also found not to be associated with increased in-hospital mortality.D’Apuzzo and Browne examined a cohort of 258,488 patients undergoing revision total hip arthroplasty or total knee arthroplasty surgeries between 2006 and 2008. Contrary to these studies, OSA was associated with increase in-hospital mortality (OR 1.9; 95% CI, 1.3–2.8) with a mortality of 0.2% in patients without OSA.
and 0.4% in patients with OSA. However, this study only included patients undergoing revision arthroplasty that may suggest a higher comorbidity burden.

So what do these results tell us? First and foremost, it appears that OSA is consistently and independently associated with increased postoperative respiratory failure, requiring NIV or invasive mechanical ventilation, pulmonary complications, and atrial fibrillation. Second, despite an increase in adverse events and resource utilization, OSA does not appear to be associated with increased risk of in-hospital mortality with the exception of revision total hip or revision total knee arthroplasty. One can only speculate as to why increased postoperative complications do not lead to an increase in in-hospital mortality. A few possibilities include obesity paradox or ischemia preconditioning, playing a protective role. It is also possible that OSA patients with impending respiratory failure were recognized earlier, and definitive treatment (i.e., endotracheal intubation or NIV) was implemented in a more timely fashion. Indeed, Mokhlesi et al. reported that in the subgroup of postoperative patients who were emergently reintubated, reintubation occurred significantly earlier in OSA patients. Another speculation is that some of the patients without a diagnosis of OSA may have had unrecognized OSA, leading to an underestimation of mortality rates. Indeed, studies using cohorts from databases to identify OSA patients are bound to include only those patients with diagnosed OSA, leaving us to wonder whether outcomes in undiagnosed patients may be worse. Irrespective of the reasons for these findings, however, one should not lose sight of the fact that mortality is a rare outcome in total hip and knee arthroplasties and that other more frequently encountered complications, although less severe, may be more relevant drivers of medical decision making and resource utilization.

Most large administrative databases lack longitudinal data, therefore, limiting inferences about outcomes after hospital discharge. A recent observational cohort study of 14,962 patients undergoing elective surgery at a single institution over a 4-year period also did not find an independent association between having high risk for OSA and 30-day or 1-year mortality. However, there is overwhelming evidence from longitudinal community and clinic-based studies that untreated severe OSA is an independent predictor of mortality. Since most patients with clinically significant OSA remain undiagnosed, anesthesiologists can have a pivotal role in recognizing these patients and referring them for clinical evaluation. Recent studies have indeed shown that continuous positive airway pressure (CPAP) can effectively treat OSA during the perioperative period, decrease the risk of postoperative emergent intubation, and have a beneficial long-term effect. However, it is important to note that adherence to CPAP therapy during the perioperative period is suboptimal, and there is a need to explore ways to improve compliance to CPAP and explore alternative treatment modalities.

Notwithstanding the strengths of the study by Fleischut et al., there are several limitations that are inherent to the analysis of any large administrative database. Undoubtedly, prospective multicenter practice-based evidence study design or randomized controlled trials, albeit challenging, would provide superior evidence and establish the direction of causality. The results of these desperately needed trials will also provide guidance for protocol developments that are supported by evidence and not by opinions. In the meantime, Memtsoudis et al. have provided us with incremental evidence warranting such clinical trials in the near future. We believe that such significant increases in adverse postoperative outcomes in patients with diagnosed OSA is a wake-up call for all stakeholders (i.e., patients, patient advocates, health care providers, hospital administrators, policy makers, and funding agencies). Without collective support, we will continue to lack the high level of evidence needed to guide us in providing the best possible perioperative care to our surgical patients.

**REFERENCES**


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