

Patient Safety Tip of the Week

October 20, 2020

More on Post-operative Risks for Patients with OSA

It’s been over 10 years since our August 17, 2010 Patient Safety Tip of the Week [“Preoperative Consultation – Time to Change”](#) in which we recommended screening for obstructive sleep apnea (OSA) as one of the 3 most important preoperative considerations (the other 2 being screening for delirium risk and frailty). OSA is, of course, one of the biggest risk factors for opioid-induced respiratory depression (OIRD), which may occur in both surgical and medical patients. This month there were several key studies published in Anesthesia and Analgesia on OSA in the perioperative period.

The Society of Anesthesia and Sleep Medicine partnered with the Anesthesia Closed Claims Project to create an international registry of unexpected critical events occurring in patients with OSA. Bolden et al. published a comprehensive analysis of 66 cases submitted to the “OSA Death and Near Miss Registry” who had procedures under general anesthesia or combined general plus regional anesthesia ([Bolden 2020](#)). Most patients (83%) had a confirmed diagnosis of OSA and the rest had been screened as high risk for OSA. Sixty-five percent of patients died or had brain damage; the remaining 35% experienced other critical events.

Fifty-six percent of events occurred on the hospital ward and **21% occurred at home** after discharge. The **majority of events occurred within the first 24 postoperative hours**. Inadequate respiratory monitoring, no supplemental oxygen, lack of personnel closely observing the patient, and coadministration of sedatives and opioids were all associated with worse outcomes.

Of the events that occurred at home, half occurred within 24 hours of procedure end. Notably, these patients were ASA physical status III or IV, and all had received **opioids** within 24 hours of the event.

Lack of monitoring was an important contributing factor. Whereas most patients in the PACU, stepdown unit, or ICU were monitored, only 57% on the ward and none at home were monitored. Monitoring consisted of intermittent or continuous pulse oximetry.

There were no reports of chest impedance or end-tidal carbon dioxide monitoring (capnography).

52% of the patients were receiving supplemental oxygen at the time of the event. But only 7.5% had a positive airway pressure (PAP) device at the time of the event. Nearly all PACU or ICU/step-down unit events were witnessed, with most ward or at-home cases not witnessed.

Ninety-seven percent received opioids within 24 hours before the event, with a wide MME (morphine milligram equivalent) range (0 to 423 MME, median = 122,). Sedative medications were co-administered with opioids in 62%.

As you'd expect, death or brain damage was less common when the event was witnessed. It was also less common when patients were receiving supplemental oxygen or when patients had respiratory monitoring.

There was no evidence for an association between the outcome and sex, age, body mass index (BMI), ASA physical status, OSA diagnosed versus suspected, presence of cardiovascular or pulmonary comorbidities, or hours between anesthesia end and the event. There was also no evidence for an association between severity of OSA and outcome. There was no evidence for an association between MME and outcome.

There was, however, a strong association of death or brain damage with **use of sedatives in addition to opioids** compared to patients receiving opioids without sedatives (OR = 4.133).

Timing appears to be very important. The majority of events occurred within the first 24 postoperative hours. Note that a previous systematic review of opioids and OSA ([Cozowicz 2018](#)) also found the initial 24 hours after opioid administration appear to be most critical with regard to life-threatening OIRD.

Bolden and colleagues called for special attention to the fact that 21% of these events occurred at home. They stress that, with the trend toward ambulatory rather than inpatient surgery, OSA patients will increasingly have ambulatory surgery and potentially be at risk for catastrophic outcomes after discharge. They also note that, despite use of CPAP, patients may still experience postoperative hypoxic events.

Though they found no statistically significant association between severity of OSA and outcome, they note that lack of an association might be attributed to the small sample size. They cite two large studies which demonstrated that patients with severe OSA had higher risk for postoperative adverse outcomes. They also note the lack of an association between MME and outcome might be attributable to the small sample size.

The Postoperative Vascular Complications in Unrecognized OSA (POSA) study ([Chan 2019](#)) was a large, multicenter, prospective observational cohort study designed to evaluate the association between the results of preoperative sleep testing for OSA and 30-

day postoperative cardiovascular outcomes among patients undergoing noncardiac surgery. Rates of undiagnosed OSA were high. 37.1% of patients had mild OSA, 19.3% moderate OSA, and 11.2% severe OSA. Postoperative cardiovascular events occurred in 19.3% of patients. Severe OSA was significantly associated with a higher rate of postoperative cardiovascular events (adjusted hazard ratio 2.23) but the associations for mild or moderate OSA did not reach statistical significance.

They found a higher risk for postoperative cardiovascular events with longer duration of postoperative oxygen desaturation less than 80%. No significant association was observed between the type of anesthesia or supplemental oxygen therapy and perioperative outcomes. Somewhat surprisingly, they found no significant association with postoperative opioids.

In an editorial accompanying the Chan study, Auckley and Memtsoudis ([Auckley 2019](#)) state “Although the effectiveness of these interventions is poorly studied, some suggested strategies may include enhanced monitoring (oximetry, CO₂ monitoring), conservative measures (elevating the head of the bed, avoiding supine sleep position, minimizing opioids), and specific OSA therapies such as the perioperative use of positive airway pressure.”

Since the vast majority of patients with OSA are undiagnosed at the time of surgery, we rely heavily on **screening tools** to identify patients at high risk for OSA. Multiple screening tools are available, including the ASA Check List, the Berlin Questionnaire, the STOP and STOP-Bang Questionnaires, the BOSTN tool, and the P-SAP Score.

The most frequently used tool is the STOP-Bang questionnaire. Sequin et al. ([Seguin 2020](#)) note that STOP-Bang has a high sensitivity at scores ≥ 3 , but its specificity is moderate, particularly for scores of 3-4. So, they prospectively studied 115 surgical patients with preoperative STOP-Bang scores of 3–8. Patients were categorized into 2 subgroups: patients with an intermediate (STOP-Bang 3–4) or a high risk of OSA (STOP-Bang 5–8). Patients had a portable polygraph study at their homes (recording blood oxygen saturation (SpO₂), electrocardiogram, movements of the chest and abdomen, and breathing events via a nasal cannula overnight).

After adjustment for age, sex, BMI, history of hypertension, diabetes, and major adverse cardiac and cerebrovascular events, patients with a STOP-Bang score of 5–8 had a significantly higher risk of an apnea-hypopnea index (AHI) >15 than those with a STOP-Bang score of 3–4 (odds ratio 2.9).

They concluded that the STOP-Bang questionnaire detected moderate-to-severe OSA patients when scores reached 5–8. However, STOP-Bang scores of 3–4 and alternative scoring models with specific combinations of factors failed to improve the screening of these patients.

They suggest that using the lower STOP-Bang cutoff may result in unnecessary referrals for sleep studies. As an example, they note that a 55-year old man with a history of

hypertension scores a 3 on STOP-Bang, even though he has no OSA symptoms or obesity.

One alternative screening tool we have previously highlighted is the BOSTN tool (see our April 2019 What's New in the Patient Safety World column "[New Simple OSA Screening Tool: BOSTN](#)"). Raub et al. ([Raub 2020](#)) recently assessed use of the BOSTN score and a perioperative pathway for management of patients with suspected obstructive sleep apnea (OSA) in patients undergoing noncardiac surgery. Their results were somewhat surprising. Patients at high risk of OSA required postoperative mechanical ventilation less frequently and were hospitalized for shorter periods of time, despite higher odds of early post-extubation oxygen desaturation.

Those authors note that some previous studies have shown lower perioperative mortality rates for patients at high risk for OSA but others have shown higher rates. In attempt to explain the seeming paradox that lower mortality rates might be seen, they note that, in OSA, intermittent hypoxia and ischemic preconditioning have been postulated as potential mechanisms underlying the protective effects of obesity on mortality.

Our January 2020 What's New in the Patient Safety World column "[Opioids and Apnea: Not Just Surgical Patients](#)" noted that opioid-induced respiratory depression is not just a problem in surgical patients. The OpiatesHF Study ([Niroula 2019](#)) showed that a large percentage of inpatients with acute heart failure and sleep disordered breathing received opioids. Among those with an AHI greater than or equal to 10/h, escalation of care occurred in 26% of those who received opiates versus 4% of those who did not.

Khanna et al. ([Khanna 2020](#)) recently reported the results of the PRODIGY trial, a prospective, observational trial of blinded continuous capnography and oximetry conducted at 16 sites in the United States, Europe, and Asia aimed at prediction of opioid-induced respiratory depression on inpatient wards. Over 1300 patients on general care floors were receiving parenteral opioids (note: patients enrolled in the US were non-surgical patients and those enrolled elsewhere were postsurgical).

46% had one or more episodes of respiratory depression. Patients with ≥ 1 episode of respiratory depression were 2.5 times more likely to require some rescue intervention, including activation of a rapid response team. They also experienced 3 days longer mean hospital length of stay, which adds to costs.

A prediction model was developed using 5 independent variables: age ≥ 60 (in decades), sex, opioid naivety, sleep disorders, and chronic heart failure. The resultant PRODIGY score accurately predicted 74% of patients who would have episodes of respiratory depression and allowed separation of 3 groups (low-, medium-, and high-risk). Patients in the high-risk group by PRODIGY score were >6 times more likely to experience OIRD than the patients in the low-risk group.

The authors suggest that implementation of the PRODIGY score could determine the need for continuous monitoring and may be a first step to reduce the incidence and

consequences of respiratory compromise in patients receiving opioids on the general care floor. This could certainly be welcome in those facilities that are resource-poor and cannot afford to do universal continuous monitoring with these modalities.

In the editorial accompanying the Khanna study, Prielipp et al. ([Prielipp 2020](#)) note that, although OIRD can occur at any time, the highest incidence has been reported in the first 6–24 postoperative hours and that a majority of fatalities due to OIRD occur at night (midnight to 6 am), underscoring the likely contribution of decreased vigilance and availability of night shift staff. They also note other risk factors for development of OIRD: age >65 years, ASA PS \geq III, presence of OSA, cardiac or neurologic disease, diabetes mellitus, hypertension, use of PCA, concomitant use of sedative drugs, different routes of opioid administration, and multiple prescribers of opioids. They also note that, although OIRD can occur following any surgical procedure, the highest incidence appears to be in orthopedic patients, likely reflecting their older age.

Prielipp et al. acknowledge the potential utility of stratifying such patients by risk. However, they also point out the “sobering statistic” that 26% of patients who experience respiratory depression were **not** identified.

The Society of Anesthesia and Sleep Medicine has published guidelines on preoperative screening and assessment of adult patients with obstructive sleep apnea ([Chung 2016](#)) and the intraoperative management of adult patients with obstructive sleep apnea ([Memsoudis 2018](#)). A recent overview of OSA diagnosis and management ([Gottlieb 2020](#)) has limited discussion on OSA patients undergoing surgery. But it does state that patients with known OSA should inform all clinicians involved in their perioperative care, including their surgeon and anesthesiologist, of their OSA diagnosis. It recommends patients using PAP should continue this therapy in the perioperative period and those with known or suspected OSA should be monitored closely during the perioperative period, and the use of opiate analgesics should be minimized or avoided if possible.

Our prior columns on obstructive sleep apnea in the perioperative period and other acute settings:

June 10, 2008	“Monitoring the Postoperative COPD Patient”
August 18, 2009	“Obstructive Sleep Apnea in the Perioperative Period”
August 17, 2010	“Preoperative Consultation – Time to Change”
July 2010	“Obstructive Sleep Apnea in the General Inpatient Population”
July 13, 2010	“Postoperative Opioid-Induced Respiratory Depression”
November 2010	“More on Preoperative Screening for Obstructive Sleep Apnea”
February 22, 2011	“Rethinking Alarms”
November 22, 2011	“Perioperative Management of Sleep Apnea Disappointing”
March 2012	“Postoperative Complications with Obstructive Sleep Apnea”
May 22, 2012	“Update on Preoperative Screening for Sleep Apnea”
February 12, 2013	“CDPH: Lessons Learned from PCA Incident”

February 19, 2013	“Practical Postoperative Pain Management”
March 26, 2013	“Failure to Recognize Sleep Apnea Before Surgery”
June 2013	“Anesthesia Choice for TJR in Sleep Apnea Patients”
September 24, 2013	“Perioperative Use of CPAP in OSA”
May 13, 2014	“Perioperative Sleep Apnea: Human and Financial Impact”
March 3, 2015	“Factors Related to Postoperative Respiratory Depression”
August 18, 2015	“Missing Obstructive Sleep Apnea”
July 7, 2016	“CPAP for Hospitalized Patients at High Risk for OSA”
October 11, 2016	“New Guideline on Preop Screening and Assessment for OSA”
November 21, 2017	“OSA, Oxygen, and Alarm Fatigue”
July 17, 2018	“OSA Screening in Stroke Patients”
April 2019	“New Simple OSA Screening Tool: BOSTN”
January 2020	“Opioids and Apnea: Not Just Surgical Patients”
October 6, 2020	“Successfully Reducing Opioid-Related Adverse Events”

Other Patient Safety Tips of the Week pertaining to opioid-induced respiratory depression and PCA safety:

- January 4, 2011 [“Safer Use of PCA”](#)
- July 13, 2010 [“Postoperative Opioid-Induced Respiratory Depression”](#)
- May 12, 2009 [“Errors With PCA Pumps”](#)
- September 21, 2010 [“Dilaudid Dangers”](#)
- November 2010 [“More on Preoperative Screening for Obstructive Sleep Apnea”](#)
- February 22, 2011 [“Rethinking Alarms”](#)
- May 17, 2011 [“Opioid-Induced Respiratory Depression – Again!”](#)
- September 6, 2011 [“More Tips on PCA Safety”](#)
- December 6, 2011 [“Why You Need to Beware of Oxygen Therapy”](#)
- February 21, 2012 [“Improving PCA Safety with Capnography”](#)
- September 2012 [“Joint Commission Sentinel Event Alert on Opioids”](#)
- September 2012 [“FDA Warning on Codeine Use in Children Following Tonsillectomy”](#)
- July 3, 2012 [“Recycling an Old Column: Dilaudid Dangers”](#)
- February 12, 2013 [“CDPH: Lessons Learned from PCA Incident”](#)
- February 19, 2013 [“Practical Postoperative Pain Management”](#)
- May 6, 2014 [“Monitoring for Opioid-induced Sedation and Respiratory Depression”](#)
- March 3, 2015 [“Factors Related to Postoperative Respiratory Depression”](#)
- June 2, 2015 [“Reminders of Dilaudid Dangers”](#)
- August 11, 2015 [“New Oxygen Guidelines: Thoracic Society of Australia and NZ”](#)
- August 18, 2015 [“Missing Obstructive Sleep Apnea”](#)
- December 2015 [“Opioid Alert Fatigue”](#)
- March 2016 [“Guideline for Management of Postoperative Pain”](#)

- June 14, 2016 “[Nursing Monitoring of Patients on Opioids](#)”
- October 11, 2016 “[New Guideline on Preop Screening and Assessment for OSA](#)”
- December 6, 2016 “[Postoperative Pulmonary Complications](#)”
- May 2017 “[Another Twist in Opioid-Induced Respiratory Depression](#)”
- June 2017 “[Masterpiece: Monitoring for Opioid-Induced Respiratory Depression](#)”
- June 20, 2017 “[Dilaudid Dangers #4](#)”
- October 3, 2017 “[Respiratory Compromise: One Size Does Not Fit All](#)”
- November 2017 “[Bad Combination: Gabapentin and Opioids](#)”
- November 21, 2017 “[OSA, Oxygen, and Alarm Fatigue](#)”
- July 31, 2018 “[Surgery and the Opioid-Tolerant Patient](#)”
- February 12, 2019 “[2 ER Drug Studies: Reassurances and Reservations](#)”
- March 2019 “[Gabapentin and Pregabalin on the Radar Screen](#)”
- June 18, 2019 “[Found Dead in a Bed](#)”
- January 2020 “[FDA Warning on Gabapentinoids](#)”
- January 2020 “[Opioids and Apnea: Not Just Surgical Patients](#)”
- October 6, 2020 “[Successfully Reducing Opioid-Related Adverse Events](#)”
- Tools: [PCA Pump Audit Tool](#) and the [PCA Pump Criteria](#)

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