

Message from the President



Frances Chung, MBBS, FRCPC

President, SASM

Professor, Department of Anesthesiology, Toronto Western Hospital, University Health Network, University of Toronto

CPAP Therapy Reduces Cardiopulmonary Complications in Surgical Patients with Obstructive Sleep Apnea

Obstructive sleep apnea (OSA) has been shown to be independently associated with increased incidence of perioperative complications.¹⁻³ These studies do not specifically identify patients who are not treated preoperatively or those who have the diseases but are undiagnosed. In preparation for surgery, an anesthesiologist may screen patients for sleep apnea. It is important to know whether continuous positive airway pressure (CPAP) has benefits for surgical patients in the perioperative period. In the recent eight months, there have been three specific publications in the Anesthe-

sia and Analgesia Journal, Sleep and Anesthesiology, respectively, that examined the benefits of continuous positive airway pressure (CPAP) for surgical patients in the perioperative period.⁴⁻⁶

Mahesh et al. did a meta-analysis of the literature.⁴ The studies included 1) adult surgical patients with information on OSA; 2) patients using either preoperative CPAP and/or postoperative CPAP or no CPAP; 3) postoperative adverse events, Apnea Hypopnea Index (AHI) and length of stay (LOS). Six studies including 904 patients were eligible for the meta-analysis. Due to the small number of patients, there was no significant difference in the postoperative adverse events between the CPAP vs. the no-CPAP group. However, there was a twelve percent reduction in risk of adverse events.

The preoperative baseline AHI was reduced significantly with postoperative CPAP use (preoperative AHI vs. postoperative AHI, 37±19 vs. 12±16 events/h, P<0.001). The LOS showed a trend towards significance in the CPAP group vs. the no-CPAP group (4.0 ± 4 vs. 4.4 ± 8 days, P=0.05).⁴

The compliance with preoperative CPAP was also observed to be low in previous studies. Guralnick et al. found that the surgical patients with suspected OSA had low compliance with anesthesiologists' request to undergo sleep studies and those that were diagnosed with obstructive sleep apnea showed suboptimal adherence.⁷ Liao et al. also found that the CPAP compliance was only 45%.⁸

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Editor's File

Satya Krishna Ramachandran, MD, FRCA

Editor

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New Horizons

It is that time of the year when we must decide which specialty meetings to attend around the American Society of Anesthesiologists Annual Meeting. Over the last few years, the SASM meetings have developed excellent themes, exploring controversial issues around the interface of sleep, anesthesia and perioperative care. This year promises to emulate previous programs, with a rich mix of clinical research and practice, to engage sleep medicine and anesthesiology audiences. We welcome you to join us in San Diego and are confident that you will find our meeting program one of the best you have experienced. More details follow in this newsletter.

The field has seen an amazing increase in published literature in the last couple of years. Specifically, clinically

relevant outcomes-based studies are now emerging that will define the perioperative management of sleep disordered breathing in the near future. Capitalizing on this upsurge of studies, the SASM consensus guideline group has been working hard to develop user-friendly and evidence based guidelines for clinical management of patients with OSA. These will be presented as well during the Annual Meeting, marking an important milestone for our young society.

In this newsletter, two articles call out the importance of postoperative opioids and developing effective postoperative monitoring strategies. Jean Wong reports that chronic opioid intake in the preoperative patient is associated with an increase

in the risk of abnormal breathing patterns, specifically central apneas and ataxic breathing. These dynamic effects are not routinely measured in the preoperative period, and could be used to phenotype patients for presence of significant clinically relevant hypoventilation. On the other hand, postoperative hypoxemia is more widely recognized due to the utilization of pulse oximetry in the early postoperative period. This throws up challenges though, as the thresholds for assigning high-risk status based on oximetry need to be based on the cost-effectiveness of each threshold. Toby Weingarten describes the Mayo protocol for postoperative monitoring that enables interventions on breaching specific monitoring thresholds. ❖

SASM 5TH ANNUAL MEETING

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**PRACTICAL MAGIC:
OPTIMIZING RESOURCES
FOR BEST OUTCOMES**

Abdelsattar et al. utilized prospectively collected data from the Michigan Surgical Quality Collaborative: 52 community and academic hospitals in Michigan.⁵ Adult patients undergoing various general or vascular operations were categorized as: 1) no diagnosis or low risk of obstructive sleep apnea; 2) documented OSA without therapy or suspicion of OSA; and 3) diagnosis of OSA with treatment (e.g. CPAP). Of 26,842 patients, 10% had a diagnosis or suspicion of OSA. Of those, half were untreated. Compared to treated OSA, untreated obstructive sleep apnea was independently associated with 2-3 fold cardiopulmonary adverse events, particularly unplanned reintubations and myocardial infarction.⁵

Mutter et al. analyzed matched cohorts of polysomnography data and Manitoba health administrative database.⁶ Postoperative outcomes in adult OSA patients up to 5 yr. before (undiagnosed OSA, n = 1,571) and anytime after (diagnosed OSA, n = 2,640) polysomnography and prescription of CPAP for a new diagnosis of OSA were compared with controls at low risk of having sleep apnea (n = 16,277). Patients with a preoperative diagnosis of OSA and prescription for CPAP were less than half as likely to experience cardiovascular complications as those diagnosed after surgery.⁶ The cardiopulmonary adverse events that were increased significantly were mainly cardiac arrest and shock. Importantly, the authors demonstrated a positive association

between OSA severity and postoperative risk. Significant trends to increase risk with increasing OSA severity were present for respiratory adverse events and cardiovascular complications. This finding supports effort to target patients with more severe undiagnosed obstructive sleep apnea in preoperative screening.⁹

There are limitations to these studies as these are not randomized controlled trials (RCT). However, it is difficult to conduct RCT with a placebo arm in patients that are newly diagnosed with OSA and waiting for their CPAP treatment. O’Gorman et al. had to discontinue their RCT after enrolling a small number of patients with suspected OSA due to increased physician and patient awareness of postoperative adverse events associated with OSA and an unwillingness for these suspected OSA patients to be randomized to no-CPAP group.¹⁰ Surgical patients identified to have OSA in the preoperative clinic who were compliant with CPAP therapy were shown to have long term health benefits: better sleep quality, less daytime sleepiness and reduction of medication usage for the associated medical diseases.¹¹

In conclusion, three recent studies indicated that in patients with OSA, there are potential benefits of CPAP in reducing both cardiac and pulmonary complications by two to three folds. This suggests that preoperative screening with CPAP treatment may have benefits in patients with OSA. ❖

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Hypoxemia in the PACU, Is It the Best Measure of Respiratory Depression?

A few months ago Epstein et al.¹ analyzed the course of more than 130,000 patients during Phase I recovery to determine the incidence and timing of hypoxemic events in the postanesthesia care unit (PACU).¹ The authors hypothesized that the majority of hypoxemic episodes would occur within the first 30 minutes of PACU admission because of the potential effects of residual neuromuscular blockade on postoperative respiration.² What they found was the opposite, that the majority of hypoxemic episodes occurred after 30 minutes, suggesting residual neuromuscular blockade was not a primary factor. Though reasons for these hypoxemic episodes were difficult to ascertain retrospectively and certainly multifactorial, the administration of opioids was greater in patients who developed hypoxemic episodes than in those that did not.

While reading the Epstein report I asked myself, what if other signs of respiratory depression antecedent to the hypoxemic episodes could have been detected and thus allowing the anesthesiologist to intervene and prevent hypoxemia? While hypoxemia identified by pulse oximetry can detect hypoventilation in patients breathing room air, its effectiveness is impaired

with modest oxygen supplementation.³ In an elegant study, Fu et al. measured arterial oxyhemoglobin saturations (S_{PO_2}) with pulse oximetry in patients undergoing general anesthesia at different fractions of inspired oxygen (F_{IO_2}). During the experiment they reduced the minute ventilation by 50% and measured how long it took for oxyhemoglobin saturations to decrease. In subjects ventilated with F_{IO_2} of 0.21 S_{PO_2} dropped within 5 minutes, but in patients ventilated with F_{IO_2} of 0.25 S_{PO_2} did not decrease in over 10 minutes.³ Computer simulation models using the alveolar air equation suggest that with an F_{IO_2} of only 0.25, P_{ACO_2} can rise to 100 mm Hg before P_{AO_2} decreases to 60 mm Hg.³ Though Epstein did not report the number of patients who received supplemental oxygen, consistent with modern practice the majority probably did, suggesting that many patients with opioid-induced respiratory depression were unrecognized. How many patients (and for how long) developed apnea and bradypnea prior to the hypoxemic event?

Recently, Lee et al⁴ published findings from an analysis of Anesthesia Closed Claim Project examining claims that arose from episodes of postoperative opioid-induced respiratory depression. They found

that the majority of lawsuits filed from complications secondary to respiratory depression were for serious brain damage or death, occurred within 24 hours of surgery, and were preventable.⁴ This report reminds us of the gravity of postoperative hypercapnic respiratory failure secondary to opioid analgesic therapy. Is our reliance on pulse oximetry to detect hypoxemia related to opioid-induced respiratory depression really the best practice to identify patients at risk for these catastrophic complications, especially when it can be such a late sign of respiratory depression in the setting of supplemental oxygen? Yet the reliance of pulse oximetry to determine if patients meet a defined S_{PO_2} value (while on supplemental oxygen) continues to be part of Phase I discharge criteria widely used in modern PACUs across the country.⁵

Several years ago our institution expanded our Phase I discharge criteria to include other assessments for respiratory depression. Specifically, PACU nurses monitor postoperative patients for 4 specific measures of respiratory depression: apnea (defined as single apneic spell of ≥ 10 seconds), bradypnea (three episodes of < 8 respirations/min), hypoxemia (three episodes of pulse oximetry readings $< 90\%$

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or < preoperative oxyhemoglobin saturation with or without supplemental oxygen) and “pain/sedation mismatch” (Richmond Agitation-Sedation Scale⁶ score ≤ -2 with a numeric pain scale rating > 5 of 10).⁷ It was observed that patients who had more than one respiratory depressive event during Phase I recovery were 21 times more likely to have a postoperative respiratory complication.⁸ One third of patients at high risk for obstructive sleep apnea (OSA) and had multiple episodes of respiratory depression experienced a postoperative respiratory complication such as admission to the intensive care unit for respiratory failure, unplanned use of noninvasive ventilatory support, or development of pneumonia.⁸ Patients who experienced a single episode of respiratory depression were found to be at 5-fold risk of receiving emergent naloxone within 48 hours of PACU discharge compared to event free patients.⁹ Also, 58% of these patients were administered naloxone with 12 hours of PACU discharge and 82% within 24 hours of discharge.⁹ A similar temporal relationship of opioid induced respiratory depression following PACU discharge was also observed in a close claim analysis where 88% of events occurred within 24 hours of surgery.⁴

In response to these findings, our patients are now systematically monitored for respiratory depression during Phase I recovery by PACU nurses. Patients who are observed to experience a respiratory depressive event 30 minutes after extubation must subsequently have two 30-minute evaluation periods free of recurrent events before

discharge from Phase I recovery. In addition, any patient who has a positive screen for or known diagnosis of OSA and has recurrent respiratory events but is identified as appropriate for discharge to a standard postsurgical ward is monitored remotely with continuous pulse oximetry for the first 48 postoperative hours. Depending on the clinical circumstances, some patients are fitted with a noninvasive positive pressure ventilation device and/or triaged to higher levels of postoperative monitoring. An analysis of 11,970 of our patients undergoing elective total knee or hip arthroplasty, who experienced a respiratory depressive event during Phase I recovery, found that the majority of patients experienced apnea (76.5%) or hypoventilation (64.9%), while 44.5% became hypoxemic.¹⁰ This supports our suspicion that most respiratory difficulties experienced during Phase I recovery are secondary to hypoventilation and/or OSA rather than primary hypoxic respiratory failure. Per our protocol, patients who experienced events had longer PACU stays and higher admission rates to a monitored setting (6.8% vs. 1.3%), but ultimately had similar hospital lengths of stay as patients without events and no mortality.¹⁰ We have similarly found that increasing severity of OSA in patients undergoing bariatric surgery was not associated with increased rates of postoperative respiratory complications.¹¹

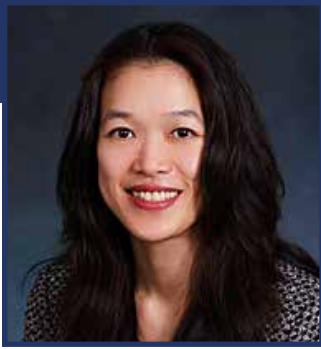
Though the efficacy of our practice of systematically monitoring patients for hypoventilation and apnea has not been validated prospectively or in other institu-

tions, we feel our findings suggests that with increased care, patients experiencing postoperative respiratory depression can have similarly good outcomes compared to patients with unremarkable Phase I recoveries. However, this requires identifying those patients at risk. However, this level of monitoring has limitations, namely it is labor intensive and depends on subjective observations of PACU nurses. Further, there is a trend towards more private postoperative recovery rooms, which will impede a PACU nurse to continually assess patients for signs of respiratory depression. Thus there is a need for the development of reliable monitors that can be used widely to assess patients for apnea and bradypnea in addition to hypoxemia. In the meantime, as a specialty we need to have a conversation regarding what constitutes PACU discharge criteria and if more sensitive measures of respiratory depression, such as apnea and bradypnea, should be included. ❖

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Chronic Opioid Use and Sleep Disordered Breathing

Over the last two decades the use of opioid medication for management of chronic non-cancer pain has increased worldwide following a consensus statement on liberalization of opioids for the treatment of chronic non-cancer pain by the American Academy of Pain Medicine and the American Pain Society in 1997.¹ Between 1997 and 2006 in the United States, there was a marked increase in retail distribution of oxycodone, hydrocodone, morphine, fentanyl and methadone.² At the same time, there has been an escalation in unintentional deaths in patients without malignancy following the use of prescription opioids like methadone and oxycodone.³

The prevalence of chronic non-cancer pain in the general population has been reported to be 15-29%.⁴ Although respiratory depression is a well-recognized adverse effect of opioids; they remain the mainstay for management of moderate to severe acute and chronic pain. It has been estimated that more than 3% of adults are on long-term opioid therapy for chronic non-cancer pain.⁵ More recently, chronic opioid use has been associated with the development of various sleep disordered breathing (SDB) such as obstructive sleep apnea (OSA), central sleep apnea (CSA), hypoxemia and

other types of abnormal breathing patterns.⁶⁻⁹ OSA is characterized by complete or incomplete upper-airway closure during sleep, in the presence of respiratory effort during some portion of the event. CSA is defined as the absence of airflow for ≥ 10 seconds with absence of breathing efforts. Patients may have a mixed picture of both central and obstructive apnea if both the central apnea index and obstructive apnea index are ≥ 5 /hr. However, CSA is considered to be the primary diagnosis when $\geq 50\%$ of apneas are scored as central in origin on the polysomnography. The lack of respiratory effort in CSA distinguishes this sleep disorder from OSA where there is an absence of or reduced airflow, but continued respiratory effort. CSA results in inadequate or absent ventilation and compromised gas exchange.

A large number of patients on chronic opioids may suffer from unrecognized SDB that contributes to increased risk for morbidity and mortality. Of particular concern is that in the perioperative period, fatal complications may occur in these patients undergoing outpatient surgery or who are discharged after a short hospital stay and are receiving acute or increased opioids without oxygen therapy or monitoring. Therefore, it is important

for anesthesiologists, surgeons, and other perioperative healthcare providers to be aware that patients taking opioids for chronic pain may have associated SDB.

We have recently performed a systematic review of the literature to determine the prevalence, mechanism, risk factors and treatment of CSA associated with chronic opioid use.¹⁰ We found a total of 8 studies and 4 case reports involving a total of 560 patients. All of the patients in the included studies had polysomnography. The overall prevalence of SDB was very high (from 42% to 85% of subjects). There was a range of SDB including obstructive apneas, central apneas, hypopneas, hypoxemia and ataxic or irregular breathing patterns. The overall prevalence of CSA in patients with chronic opioid use was high (24%). The populations included in the various studies were heterogeneous and included patients on opioids for chronic pain as well as patients at addiction/detoxification clinics. The mechanism underlying the development of CSA in patients taking long-term opioids is unclear. Some of the risk factors identified in our systematic review include a morphine equivalent daily dose of more than 200 mg. Concurrent use of benzodiazepines and hypnotics was associ-

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ated with a higher risk in one study. Body mass index was inversely related to the severity of sleep disordered breathing. There are no consensus guidelines for the best positive airway pressure therapy for opioid associated SDB. We found conflicting results for the best positive airway pressure therapy for the treatment of opioid-associated CSA. Continuous positive airway pressure (CPAP) may be ineffective in eliminating or may even increase CSA. Adaptive servoventilation and bilevel positive airway pressure ventilation successfully treated CSA that was unresponsive to CPAP in some studies.

There are limited data available on the perioperative management of patients with CSA associated with chronic opioid use. There is a need for further prospective studies on the perioperative risks, in order to guide perioperative management and formulate practice guidelines for the treatment of these patients. ❖

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THURSDAY, OCTOBER 22, 2015

Time	Topic	Speaker
	<i>Moderator: Peter Gay, MD, MS</i>	
1:00 – 3:00 pm	Sleep Issues in Hospitalized Patients	
1:00 – 1:05 pm	Welcome – 5-Year Anniversary	<i>Peter Gay, MD, MS</i>
1:05 – 1:25 pm	Overview: Sleep and Disease Issues in the Hospitalized Patient	<i>David Hillman, MD</i>
1:25 – 1:45 pm	Impact of Sleep on Hospital Outcomes: What Can be Done?	<i>Vineet Arora, MD, MA</i>
1:45 – 2:05 pm	Sleep in the ICU	<i>Richard J. Schwab, MD</i>
2:05 – 2:25 pm	OSA and Outcomes After Elective Outpatient Procedures	<i>Amir Sharafkhaneh, MD, PhD</i>
2:25 – 2:45 pm	Sleep and Circadian Rhythm in the Perioperative Period	<i>Philip Kurien, MD</i>
2:45 – 3:00 pm	Q&A/Discussion	<i>Panel</i>
3:00 – 3:30 pm	Break	
	<i>Moderator: Bhargavi Gali, MD</i>	
3:30 – 5:30 pm	Rapid Fire Technology	
3:30 – 3:35 pm	Rapid Fire Technology Overview	<i>Bhargavi Gali, MD</i>
3:35 – 4:00 pm	High Flow Humidification Therapy	<i>Bernardo Selim, MD</i>
4:00 – 4:25 pm	Portable Sleep Testing in Hospitalized Patients	<i>Rami Khayat, MD</i>
4:25 – 4:50 pm	Evolving Options for Respiratory Monitoring on Med/Surgical Floors	<i>Frank Overdyk, MSEE, MD</i>
4:50 – 5:15 pm	Contrasting Neural Mechanisms of Sleep and Anesthesia	<i>Patrick Purdon, PhD</i>
5:15 – 5:30 pm	Q&A/Discussion	<i>Panel</i>
5:30 – 6:00 pm	Welcome Reception	
6:00 – 9:00 pm	Dinner *Additional Fee Applies for Non-Gold Patron Members	
6:00 – 6:05 pm	Welcome and Introductions	<i>Frances Chung, MB BS</i>
6:05 – 6:10 pm	Anesthesia Analgesia: New Vision	<i>Jean-Francois Pittet, MD</i>
6:10 – 6:30 pm	Anesthetic Roulette, Anyone?	<i>David Dawson, MB, ChB, FRCA</i>
6:30 – 7:30 pm	Dinner	
7:30 – 8:00 pm	Innovation and Entrepreneurship in SDB	<i>Peter Farrell, PhD</i>

FRIDAY, OCTOBER 23, 2015

Time	Topic	Speaker
7:00 – 7:30am	Registration and Continental Breakfast	
7:30 – 7:55 am	Annual General Meeting	<i>Frances Chung, MB BS</i>
	<i>Moderator: Frances Chung, MB BS</i>	
8:00 – 10:15 am	Keynote Speakers and Special Topics	
8:00 – 8:05 am	Welcome	<i>Frances Chung, MB BS</i>
8:05 – 8:45 am	Keynote: Why Focus on Sleep Hygiene in the Perioperative and Critical Care Settings?	<i>Mervyn Maze, MB, ChB</i>
8:45 – 9:25 am	Keynote: Sleep Evaluation in Newly Discovered OSA in & After Hospital	<i>Clete Kushida, MD, PhD</i>
9:25 – 9:55 am	Outpatient ENT Surgery for OSA Patients: Is it Suitable?	<i>Eric Kezirian, MD, MPH</i>
9:55 – 10:15 am	Q&A/Discussion	<i>Panel</i>
10:15 – 10:45 am	Refreshment Break and Poster Viewing	
	<i>Moderator: Babak Mokhlesi, MD, MSc</i>	
10:45 – 12:15 pm	Sleep Issues and Post-Operative Complications	
10:45 – 11:10 am	Outpatient General Surgery Complications	<i>Nancy Collop, MD</i>
11:10 – 11:35 am	Sleep Disordered Breathing & Peri-Operative Atrial Fibrillation	<i>Reena Mehra, MD</i>
11:35 – 12:00 pm	Using Mobile to Educate and Empower Patients at Risk	<i>David Cook, MD</i>

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FRIDAY, OCTOBER 23, 2015 (program continued)

12:00 - 12:15 pm	Q&A/Discussion	Panel
12:15 - 1:15 pm	Luncheon (Sponsored by Masimo Corporation) With Speaker & Awards	Frances Chung, MB BS Anthony Doufas, MD, PhD
12:15 - 12:25 pm	Luncheon	
12:25 - 12:50 pm	Moderate Sedation by Anesthesiologists or Non-Anesthesiologists: An Institutional Perspective	Ronald Pearl, MD
12:50 - 1:00 pm	Research and Abstract Awards	Roop Kaw, MD Anthony Doufas, MD, PhD
	<i>Moderator: Girish P. Joshi, MBBS</i>	
1:15 - 2:45 pm	Sleep and Anesthesia Messages	
1:15 - 1:45 pm	New Perspectives in Sedation-Analgesia	Pedro Gambus, MD
1:45 - 2:10 pm	Procedural Sedation in Patients with OSA	Girish P. Joshi, MBBS
2:10 - 2:35 pm	Opioid Free Anesthesia: Is it Necessary?	Jan Mulier, MD, PhD
2:35 - 2:45 pm	Q&A/Discussion	Panel
2:45 - 3:05 pm	Refreshment Break and Poster Viewing	
	<i>Moderator: Dennis Auckley, MD</i>	
3:05 - 4:15 pm	Preoperative Screening for OSA Patients	
3:05 - 3:15 pm	Consensus Statement Methodology and Design	Frances Chung, MB BS
3:15 - 3:25 pm	Does a Diagnosis of OSA Change Outcome?	Stavros Memtsoudis, MD, PhD
3:25 - 3:40 pm	Preoperative Screening for OSA	Satya Krishna Ramachandran, MD
3:40 - 3:55 pm	Best Peri-Operative Practices for Surgical Patients with Suspected or Known OSA	Dennis Auckley, MD
3:55 - 4:15 pm	Q&A/Discussion	Panel
	<i>Moderator: Norman Bolden, MD</i>	
4:15 - 5:00 pm	Obstructive Sleep Apnea Registry - Searching for the Light	
4:15 - 4:30 pm	Design of the Registry	Norman Bolden, MD
4:30 - 4:50 pm	Early Case Insights	Karen Posner, PhD
4:50 - 5:00 pm	Q&A/Discussion	Panel
5:00 pm	i-Pad Give Away and Closing Remarks	Peter Gay, MD, MS
	The Next Five Years for the SASM	

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SASM

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