Society of Anesthesia & Sleep Medicine

SASM newsletter

Vol. 9 • Iss. 2 • 2020

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SASM

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Message from the President

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Dear SASM Members,

These are truly unprecedented times we are living in! Just a few short months ago we were all making big plans for 2020 when suddenly the Coronavirus (COVID-19) pandemic struck and turned our lives upside down. Many of us in SASM have been on the front lines helping to manage extremely ill patients in difficult circumstances, all while putting our personal health and safety at risk. I commend all who are working on this effort, particularly those in hard hit areas, and I extend thanks to you on behalf of your patients and the medical community as a whole for your tireless energy and dedication. SASM is here to support these efforts by serving as a conduit for rapidly evolving information. Given the fast pace of new information coming out about COVID-19, and that many of our members are occupied with clinical care responsibilities, we felt it best not to attempt to "reinvent the wheel" but rather to provide a site with easy access to a number of resourceful links for up-to-date information. This can be viewed at http://sasmhq.org/covid-19-resources/, where there are links to the most recent data, information and recommendations in Anesthesiology, Sleep Medicine and perioperative care in the era of COVID-19. We hope you find this useful.

The COVID crisis has placed a number of plans, personal and otherwise, on hold, so the focus can appropriately be on the pandemic. Several SASM projects are still being developed, but work on many have temporarily been paused until the crisis quiets down and we have time to refocus. Having said that, at the time of this writing, SASM is continuing to plan for the fall 10th anniversary SASM Annual Meeting to be held October 1-2 in Washington DC. An excellent line up of informative sessions has been prepared, though this is all subject to change pending the evolution of the COVID pandemic. SASM will continue to monitor the situation closely and, as the meeting is scheduled in concert with the annual American Society of Anesthesiologists (ASA) meeting, will await word from the ASA regarding whether the meeting can take place as scheduled. We expect to have more information by early to mid-summer and will keep the membership informed of any changes that may come.

Turning to this issue of the SASM newsletter, we find a timely update about COVID-19 and Sleep Medicine. Dr. Vivian Asare provides new information on changes in Sleep Medicine practices resulting from the COVID-19 outbreak. The outbreak has had a dramatic impact on Sleep Medicine, both from a provider and a patient standpoint, and shifts in practice care models have resulted. Some of these changes will also impact the perioperative environment (such as whether to continue PAP therapy perioperatively); thus, topics discussed in the article have direct implications for the entire SASM membership.

Despite the ongoing pandemic, important work continues in other areas of perioperative medicine, and the SASM newsletter also presents several articles on non-COIVD-19 topics germane to the

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SASM membership. Dr. Toby Weingarten offers insight into the recent warnings issued by the FDA about gabapentinoids and their potential for respiratory impairment, particularly when used in combination with opioids. This is especially relevant given the increasing use of "opioid sparing" pain management pathways in postoperative care, which reflects concerns raised by Dr. Weingarten and others about the potential serious side effects of combining these medications. Dr. Jim Wong and Dr. Clete Kushida discuss the economic impact that PAP adherence has on healthcare utilization, a not so insignificant long-term healthcare concern, but particularly pertinent as the economy begins to ramp back up. Drs. Matthew Pearsall and Rajeev Subramanyam provide important guidance on the perioperative approach to tonsillectomy and adenoidectomy in the pediatric population, an area in need of further attention and research. Additionally, Dr. Roop Kaw and I offer commentary on the results of the PRODIGY (PRediction of Opioid-induced respiratory Depression In patients monitored by capnoGraphY) study. The PRODIGY study has recently been published and gives new insights into the high rate of respiratory depression (RD) in patients receiving IV opioids in unmonitored settings. A risk prediction tool has been developed from the results of the PRODIGY study in order to help clinicians determine which floor patients might benefit most from enhanced respiratory monitoring. Finally, Dr. Susana Vacas continues her excellent job of posting new and important literature to keep us all "in the know" with regards to our field of perioperative care.

Despite the turbulent times, SASM remains focused on furthering our knowledge and disseminating information with regards to perioperative Anesthesia and Sleep Medicine. Our goal is to remain flexible and evolve as determined by the challenges imposed by the pandemic, and we welcome any and all feedback as to how we, as a society, can best serve you, the membership.

Thank you for all each and every one of you do.

Please stay safe!

Editors' File

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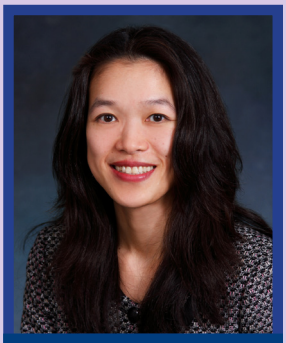

Dear SASM Members,

We hope that you and your families are well during this challenging time. The events of the past few months have been unprecedented. We would like to recognize and thank all of you and all healthcare providers for their hard work and dedication. We hope that you are also taking care of your own mental health and wellness as we have all had to adjust our professional and personal lives during the pandemic. We will get through this together, and there will be many valuable lessons learned from the pandemic.

In this issue of the SASM newsletter, we feature an article by Vivian Asare, MD about the changes in Sleep Medicine practice and care of patients with sleep-disordered breathing due to the COVID-19 pandemic. These changes will likely continue for an extended period of time and will impact patients on the surgical wards as elective surgery resumes.

Toby Weingarten, MD provides an insightful article about the recent FDA warning about respiratory problems that have been reported in patients on gabapentin or pregabalin, particularly in those with underlying respiratory problems or using concomitant CNS depressants. Clinicians need to be aware of the FDA warning since these agents have quickly been incorporated into enhanced surgery recovery protocols and multi-modal analgesic regimens without considering possible adverse effects. Dr. Weingarten discusses some of the limitations of existing meta-analyses and RCTs that have not shown that gabapentin or pregabalin are associated with respiratory problems.

In this issue, Jim Wong, MD and Clete Kushida, MD review recent studies that suggest the economic value of CPAP therapy for OSA is likely underestimated. They emphasize the cost-effectiveness of CPAP, especially long-term, needs to be brought to the attention of payers and policy-makers in order to improve efficient allocation of health care resources.

This issue also features an update on the perioperative approach of pediatric ambulatory tonsillectomy and adenoidectomy by Matthew Pearsall, MD and Rajeev Subramanyam, MD. Since tonsillectomy and adenoidectomy are common procedures in pediatric patients, with many of these procedures being performed in non-pediatric hospitals, appropriate management to maximize safety is critical. Appropriate selection criteria and management strategies are reviewed.

Roop Kaw, MD and Dennis Auckley, MD summarize the recently published PRODIGY (PRediction of Opioid-induced respiratory Depression In patients monitored by capnoGraphY) study in this issue. Whether continuous capnography monitoring of inpatients on opioids is effective for improving patient outcomes is controversial. In this multi-center, international study, a risk prediction tool was developed to predict which hospitalized patients would benefit from enhanced respiratory monitoring to reduce respiratory deterioration.

Susana Vacas, MD provides a summary of the featured article "Prevalence of Undiagnosed Obstructive Sleep Apnea Among Patients Hospitalized for Cardiovascular Disease and Associated In-Hospital Outcomes: A Scoping Review" by Suen et al. The relevance of undiagnosed OSA, CVS risks, and risk for COVID-19 are discussed.

We thank all of the contributors to this issue of the SASM newsletter. We always welcome SASM members to contact us if they would like to join the SASM Newsletter Subcommittee or to submit an article for future SASM newsletters.

Sleep in the Time of COVID-19

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In addition to causing a high death toll, significant strains on hospital systems, and widespread economic damage, the COVID-19 outbreak is also forcing dramatic changes to the practice of out-patient medicine. In the United States, the field of Sleep Medicine in the era of COVID-19 has employed unique and innovative modifications to continue to provide needed care to patients, while also protecting both patients and healthcare providers from exposure. This article will review several ways in which Sleep Medicine has adapted to the current environment, including operational changes to clinic structure, adoption of telemedicine and telephone visits to take the place of in-person clinic visits, and changes to sleep study testing. We will also discuss how insurance companies and durable medical equipment (DME) companies have changed their protocols.

Under the guidance of the Centers for Disease Control and Prevention (CDC) and the American Academy of Sleep Medicine (AASM), sleep clinics across the United States have switched a majority of clinical encounters to virtual visits. While telemedicine was previously a small (but growing) component of Sleep Medicine, practices have broadly established or expanded telemedicine platforms in response to the need for social distancing caused by COVID-19. Telephone visits have been scheduled for patients without access to telemedicine services, for example, those without a smart phone. Fortunately, experiences thus far suggest that Sleep Medicine visits can be conducted via telemedicine with no detriment to patient care (Singh et al 2015).

The pandemic has also forced significant changes to sleep study testing operations due to the need for physical distancing. The AASM announced that sleep clinicians should "postpone and reschedule in-lab administration of positive airway pressure (PAP) therapy (ie., PAP titration studies and split night studies) except in emergencies, in which case, review the potential for aerosolization and ensure technologists use appropriate PPE. Avoid PAP use in the clinic setting due to risk of aerosolization… and postpone and reschedule PSG for adults and children, except in emergencies." This announcement has led to the cancellation and postponement of in-laboratory sleep studies and PAP titrations, except for cases of emergencies. Instead, more patients have received home sleep testing (HST) with CDC guidance on sanitizing and disinfecting reusable equipment and ideally removing a reusable device from service for at least 72 hours in addition to disinfection before its next use. Consideration of using single-use disposable devices has been encouraged and allowing mail delivery or pick-up and drop off boxes with video or telemedicine instructional brochures are now being used in HSTs.

As the above mentioned changes have been implemented in response to the pandemic, collaboration with insurance companies to change policies to allow for these mitigation strategies has been important. Medicare and several private insurers have temporarily changed policies. Medicare is expanding coverage for telemedicine services and waiving requirements for face-to-face or in-person encounters. In urgent or critical patients, Medicare is covering PAP devices based on the clinician's assessment of the patient without requiring PSG or a home sleep apnea test (HSAT). Compliance guidelines for patients on PAP and the need to re-qualify with sleep studies in patients who do not meet requirements has also been waived by some insurers.

Durable medical equipment (DME) companies supplying PAP and other equipment have also changed their approach to caring for patients with obstructive sleep apnea (OSA). Acknowledging the changes made by clinicians and insurers, renewal supplies and new PAP orders have continued. DMEs have also employed mitigation strategies and have shifted PAP delivery and setup from in-person setup and education to drop-off delivery and subsequent phone or virtual instructional sessions with respiratory therapists.

Of course, with all of these changes have come some new challenges. Complex patients with multiple comorbidities are often poor candidates for HST, instead needing either PAP titration studies or in-lab diagnostic studies. Although some in-lab testing is reserved for emergencies, weighing risk and benefit of a high-risk patient coming in for a test raises difficult clinical questions. Those patients requiring immediate titration studies have necessitated case by case clinical decision making as to whether postponing or initiating empiric treatment with NIV and other PAP modalities is appropriate. In cases where empiric treatment is initiated, close monitoring is needed until adequate

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confirmatory therapeutic testing can be performed. Fortunately, due to the ability to closely monitor patients remotely through PAP/NIV data on efficacy and response to therapy, empiric treatment can still be closely followed and titrated based on available monitored information in some patients.

Other challenges concern COVID-positive patients discharged from hospitals returning home to family members and bedpartners. Due to the high risk of aerosolization posed by PAP mask interfaces (Kryger 2020), patients are being cautioned of the risk for spreading infection to household members and the importance of self-isolation practices to help decrease the risk of spreading the virus. Patients are instructed to sleep alone and in a closed bedroom if possible, and all cleaning and sanitation precautions should be utilized. In cases where patients cannot self-isolate from household members, the risk and benefit of PAP use must be considered. In some cases, especially in milder OSA cases, PAP therapy use should be discontinued until the patient is no longer infectious.

As the U.S. enters a new phase of the pandemic and the country slowly re-opens, new challenges will emerge for Sleep Physicians. The AASM as of May 1st has provided guidelines for mitigation strategies in planning for cautious re-opening for sleep clinics nationwide. Each strategy is highly dependent on regional COVID-19 prevalence, which will impact the ability to re-open safely while utilizing all recommended CDC safety guidelines. As the situation evolves, the Sleep Medicine field will continue to adapt as needed to provide high quality care while protecting the health of patients and healthcare providers.

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FDA and Gabapentinoids: Problems with RCT/ Meta-analyses and Safety

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On December 19, 2019, the FDA issued a warning regarding "'serious breathing problems,'" which can occur in patients using gabapentin or pregabalin, especially in those with underlying lung problems or using other central nervous system depressants.[1] In part, this warning was issued because of 49 cases of respiratory depression (12 fatalities) which were reported to the FDA Adverse Event Reporting System (FAERS) database. The majority of these cases were in patients with pulmonary disease or use of a CNS depressant, including all fatalities. Two animal studies were cited, which found that gabapentinoids had independent respiratory depressive effects, and these were augmented by co-administration of opioids.[2,3] Two small prospective trials in humans found similar results.[4,5] Myhre et al[4] found in 12 healthy volunteers that the respiratory depressive effects of remifentanil were enhanced with the administration of pregabalin. Piovezan et al[5] performed sleep studies on eight older, non-obese men following administration of gabapentin or placebo, and found the apnea-hypopnea index increased and oxyhemoglobin desaturation worsened during sleep following gabapentin administration.

An FDA warning quoted three studies from the Mayo Clinic, specifically. Specifically, Weingarten et al[6]. We examined respiratory depression during anesthesia recovery in 11,000 patients undergoing elective, lower extremity, joint arthroplasty operations with peripheral nerve blocks. The preoperative use of gabapentin (administered as a part of an enhanced recovery after surgery [ERAS] pathway) was associated with increased risk of respiratory depression following both spinal anesthetic (odds ratio [OR] 1.60, 95% confidence interval [CI] 1.27, 2.02) and general anesthesia (OR 1.47, 95% CI 1.26, 1.70). In Cavalcante et al report[7], we found that preoperative gabapentin, as part of ERAS pathways for laparoscopic surgery, was associated with increased respiratory depression during anesthesia recovery (OR 1.26, 95% CI 1.02, 1.58). Lastly, Deljou et al[8] reported a six-fold increased risk for receiving naloxone on surgical wards if they were on chronic gabapentinoid therapy preoperatively. Though not referenced by the FDA warning, we presented an abstract at the 9th annual SASM meeting reviewing our results of our study, examining risk factors for postoperative patients requiring emergency response team activations, (ERTs, rapid response team and code blue team activations) and we found that gabapentin (as part of ERAS protocol) was associated with increased risk (OR 1.60, 95% CI 1.17,2.20) for ERT activation.[9] When a sub-analysis was performed based on indication for ERT, the preoperative use of gabapentin was associated with even a greater risk (OR 2.81, 95% CI 1.20, 6.60) for ERT activations associated with pulmonary problems.[9] Also concerning is a large population based study by Gomes et al[10], which examined 1,256 deaths among patients who were using chronic opioid therapy for non-malignant pain and died secondarily from opioids. These patients were matched 4:1 with controls on chronic opioid therapy for non-malignant pain and did not die. The investigators found that the concomitant use of gabapentin was associated with an increased risk of opioid related death (OR 1.49, 95% CI 1.18, 1.88).

How can this be? Gabapentin and pregabalin are widely thought to be relatively safe medications, importantly devoid of respiratory depressive properties. Two large meta-analyses examining the perioperative administration of gabapentin[11] and pregablin[12] did not report episodes of respiratory depression. These two analyses consisted of 188 studies. Why did these studies not show a problem? I invite the readers to read two critiques of randomized control trials and their resultant meta-analyses by Moore and Singh.[13,14] Most randomized control trials are designed to test if an intervention (or drug) has efficacy compared to placebo. While safety issues can certainly arise during a trial, these experiments are often designed to decrease the likelihood of adverse events by excluding higher risk patients. For example, a study proposal published in JAMA surgery regarding preoperative gabapentin and postoperative pain excluded patients with the following conditions: cognitive impairment, severe respiratory insufficiency, obstructive sleep apnea, kidney disease, and chronic pain.[15] Any of these conditions would reasonably be expected to increase the risk of respiratory depression after surgery. Other common problems with RCTs establishing safety is that definition of adverse events may differ, thus limiting the ability of meta-analyses to identify risk, and that adverse events may be infrequent enough that the RCTs are underpowered to establish risk.

Through my involvement at SASM, I have been impressed with our members' dedication to patient safety. It is important for us to remember not to be lulled into a false sense of security by RCTs. We must not allow ourselves to jump on a bandwagon with the thought that something is safe if everyone else is doing it. Establishing safety is difficult, and requires large numbers of patients,

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and often relies on retrospective, imperfect data. Studies from NSQIP, MPOG, the ASA Closed Claim Analysis, and from major academic institutions with sophisticated data-analysis capabilities such as the Cleveland Clinic and the Mayo Clinic must lead the way in our efforts to find unanticipated risks.

We are in the midst of an opioid epidemic (which in part was fueled by the now discredited, but widely-held, though completely unsubstantiated belief that opioid analgesics would not be addictive if used to treat pain), and that we are all trying our best to reduce perioperative opioids. However, the endeavor to reduce perioperative opioids should be done carefully and with great deliberation, otherwise new "practice trends" may be developed and enthusiastically adopted while creating a host of unanticipated problems. This recent FDA warning will make us rethink the utility of perioperative gabapentinoids to achieve perioperative opioid reduction. I am concerned about the recent enthusiasm for perioperative methadone.[16] With widely variable pharmacokinetics and pharmacodynamics, an important question is whether methadone represents a safe perioperative analgesic for opioid-naïve patients.? We SASM members must continually be critical when evaluating evidence regarding practice management.

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What is the Economic Value of CPAP for OSA? Hard to Measure, But Likely to Be a Good Deal

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In 2017, the United States spent 18% of its gross domestic product—roughly $3.5 trillion--on health care.[1] From the payers' and policy-makers' perspectives, efficient allocation of health care resources should be of paramount importance. Several recent reports in the journal *Sleep* focused on the economics of obstructive sleep apnea (OSA) and continuous positive airway pressure (CPAP) treatment. We briefly review their findings.

Using the Medicare Fee-for-Service beneficiary dataset, Vo et al.[2] reported their findings on over 1,300 men with a mean age of 76 years who were part of the Outcomes of Sleep Disorders in Older Men study (MrOS Sleep). They compared health care utilization among participants with no OSA, mild OSA, and moderate-to-severe OSA. Participants in the study underwent Type II polysomnography testing. Investigators excluded participants who were already being treated for their OSA. They did not indicate whether participants were treated after enrollment. Participants' health care utilizations, which included inpatient costs, Part A paid skilled nursing facility costs, inpatient rehabilitation facility costs, outpatient costs, and home healthcare costs were recorded for 36 months following enrollment. The adjusted annualized total healthcare cost was not different among patients with no OSA, mild OSA, or moderate-to-severe OSA. However, the investigators observed that participants with moderate-to-severe OSA had a 1.4-fold increased odds of experiencing at least one hospitalization during the 36 month follow-up period, with a significantly higher rate of cardiovascular disease related admissions.

Chhatre et al.[3] also used a sample of Medicare Fee-for-Service beneficiary participants to report their comparison of health care utilization between CPAP adherent and non-adherent OSA patients. The mean age of this cohort was 67 years. Participants were followed for 2 years from date of OSA diagnosis. Investigators observed a significantly higher total cost of care (over $1,000 increase in mean monthly cost) for the 2 years after diagnosis compared to the 2 years prior, irrespective of CPAP adherence. However, those who met Medicare criteria for PAP adherence had roughly a 6-8% smaller increase compared to those who were not treated. Despite variations in study design and population, this finding is mostly consistent with previous work reporting the cost advantages of PAP treatment versus no treatment.[4-7]

An important aspect of these two reports is that they studied an older population. This is a relatively understudied age group, and the negative impact of OSA on healthcare utilization has not been consistently observed in older patients.[8-10] It is plausible that the impact of OSA on healthcare utilization in the older population may be diluted by increased comorbidities associated with aging.

Streatfeild et al.[11] approached the issue of economics of CPAP use differently. Using Markov modeling, they estimated the cost-effectiveness of CPAP therapy. Markov modeling uses the probability of events to transition from one health state to another (e.g., stroke [event] resulting in transition from a completely well health state to a disabled health state) and assigns a health utility and cost to each health state. Instead of the more commonly used health utility to derive a quality-adjusted life years (QALY), Steatfeild et al. used the similar concept of disability-adjusted life year (DALY), which was "the sum of the years of healthy life lost due to disability and the years of life lost due to death". The disability scale ranged from 0 (perfect health) to 1 (dead). Markov modeling does not use primary data. Markov models for CPAP therapy allows for a longer 'follow-up' period than what might be feasible in studies that gather primary data. Comorbid conditions and their associated costs that might be averted by CPAP therapy may manifest years after OSA diagnosis. Steatfeild et al. ran the simulation for a hypothetical 5-year CPAP use period. Another advantage is additional 'events' can be added to the model. Earlier models included only motor vehicle accidents. Steatfeild et al. included coronary heart disease, stroke, heart failure, vehicle and work accidents, diabetes, and depression. In addition to these direct health care costs, which are important to payers, the authors also included estimated indirect costs in their model, such as productivity losses and

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increased insurance costs for vehicles and work place accidents, which are important societal considerations. From a payer's perspective, the authors estimated the cost per DALY averted was $12,495. For context, it has been reported that the cost per QALY gain after percutaneous coronary intervention compared to medical therapy for stable angina with multivessel disease was $126,000.[12] From a society's perspective (accounting for estimated indirect costs as well), CPAP therapy was the dominant option. Being the dominant option means CPAP therapy results in better outcomes for less cost.

In summary, there are many reports documenting the cost-effectiveness of CPAP therapy for OSA. Important questions still remain. How does age affect the relationship between CPAP treatment and health care utilization? What is the true magnitude of the economic burden of OSA, and how much does CPAP alleviate that burden? Health care utilization studies using primary data are limited by duration of follow-up and may not fully capture the impact of CPAP treatment because OSA associated comorbidities may not manifest for years after OSA diagnosis. Markov models do not use primary patient data, so comorbid conditions that CPAP may impact might not be accounted. Thus, given the methodologic limitations of currently available reports, it is likely that the cost-effectiveness of CPAP treatment for OSA is underestimated.

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Perioperative Approach of Pediatric Ambulatory Tonsillectomy and Adenoidectomy

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Pediatric tonsillectomy & adenoidectomy (T&A) are very common surgical procedures.[1] According to recent estimates, there are 289,000 ambulatory tonsillectomies in children less than 15 years of age.[2] Based on a pediatric inpatient hospital database from 2000-2009, approximately two thirds of pediatric ambulatory T&A are being performed at non-children's hospitals.[3] Thus, pediatric sleep disordered breathing (SDB), obstructive sleep apnea (OSA), and the resultant physiology are very commonly encountered by both pediatric and adult anesthesiologists in the U.S.

Factors that determine the appropriateness for ambulatory versus inpatient admission include underlying conditions, age, severity of hypoxia, severity of OSA based on hypercapnia and apnea – hypopnea index (AHI) measured from polysomnography. At our institution, which includes a large free-standing quaternary care teaching hospital and four remote (all greater than a 20 mile drive) ambulatory surgical centers, we have formal guidelines for ambulatory patient selection, along with individual case review before the day of surgery. While no single standardized anesthetic technique exists, there are several generally accepted and recommended strategies to minimize anesthetic complications and need for admission to an inpatient or intensive care unit.

Ambulatory Selection Guidelines for Pediatric T&A:

Our institution has a robust pathway program, and our present ambulatory management for pediatric T&A at our remote ambulatory surgical centers (ASCs) is summarized in Table 1.

Many patients will present without a formal sleep study for ambulatory surgery for T&A. The surgical need would either be based on history, physical examination, or lateral neck x-ray or flexible nasal endoscopy. Patients presenting for ambulatory T&A are very unlikely to have other diagnostic modalities, like Drug Induced Sleep Endoscopy or Cine MRI, which are usually reserved for complex patients or patients with untreated OSA.

How Do We Manage Pediatric Ambulatory T&A:

Most pediatric patients above the age of 9 months develop stranger anxiety. There are various options to help these children: medication anxiolysis, parental induction, and distraction techniques. At our institution we administer midazolam 0.5 mg/kg orally if the patient is cooperative with taking an oral medication up to 10 mg. Midazolam may be administered up to 20 mg orally in cases of excessive patient anxiety. If the patient is not cooperative with taking oral medication and premedication is still indicated, then the intravenous form of midazolam can be given intranasally 0.2-0.4 mg/kg, up to a maximum dose of 10 mg. Alternatively, intranasal dexmedetomidine can be used. Dexmedetomidine dosing is 1-2 mcg/kg, with a maximum dose of 50 mcg, given 30 - 60 minutes prior to the induction of anesthesia.

Mask induction is preferred by the majority of younger patients and frequently by adolescents with needle phobia. Reasons to avoid mask induction include, but are not limited to, a strong fear of the mask, poor heart or lung function, morbid obesity, and potential difficult airway. Endotracheal intubation is most commonly used for T&A, but a laryngeal mask airway (LMA) can be used [4,5] if surgical exposure is adequate. Deep airway removal can be done safely [6,7] and is frequently utilized based on individual anesthesiologist preference and on a case-by-case judgment. Analgesic regimens are varied, but an opioid sparing or opioid limiting technique is supported by literature.[8,9] We typically use adjunctive intravenous acetaminophen age based (1month-2 years: 10 mg/kg and >2 years: 12.5 - 15mg/kg)[10], adjunctive intravenous dexmedetomidine 0.5-1 mcg/kg, and either intravenous fentanyl 1-2 mcg/kg or intravenous morphine 0.05 – 0.1 mg/kg or both. Opioids sparing techniques, including adjunctive intravenous ketamine 1 mg/kg, is used in select patients. However, it is strongly recommended that any opioids be used sparingly as age decreases and OSA severity increases to minimize potential residual airway compromise due to upper airway obstruction and decreased respiratory drive.[11,12]

A single dose of intraoperative dexamethasone is routinely indicated, and 0.5mg/kg is the most commonly used dose, although smaller doses are effective. A dose range of 0.1 to 1 mg/kg (8mg to 25 mg) has been described.[1] At our institution, we limit the dose to 10 mg of dexamethasone. Post-operative nausea and vom-

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iting prophylaxis is accomplished by the administration of both intravenous dexamethasone (as above) and intravenous ondansetron 0.1mg/kg (maximum dose 4mg).

After emergence, pain should be assessed using an objective measurement. Our institution uses Face, Legs, Activity, Cry, and Consolablility (FLACC) scores. If additional analgesia is determined to be necessary, then a combination of oral oxycodone and/or intravenous fentanyl or morphine is administered based on the score. Discharge from PACU to home is appropriate when discharge criteria are met using the Post Anesthetic Recovery Scoring System (PAS)/Modified Aldrete Scoring System.

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Table 1: Selection criteria at ambulatory surgery centers

Candidates for ambulatory surgery centers

- Age: Minimum age is 2.5 years for adenoidectomy alone is 2.5 years and 3.5 years for tonsillectomy
- Polysomnography: AHI = 0 to 23, End tidal $CO_2 \leq 55$, and O_2 saturation nadir ≥ 90%

Candidates assessed on a case to case basis

- Developmental delays
- Hypotonia
- Genetic disorders
- Limited ability to cooperate
- Body Mass Index: Before adolescence>99^{th} or < 10^{th} percentile
- Polysomnography: AHI 0-23; End tidal $CO_2 \leq 55$, but O_2 saturation nadir 85-89%

Not candidates for ambulatory surgery centers

- Polysomngraphy: AHI ≥ 24, End tidal $CO_2 > 55$, O_2 saturation nadir < 85%
- Down Syndrome
- Craniofacial Syndromes (Apert, Crouzon, Pierre-Robin, Treacher Collins, Pfeiffer)
- Body Mass Index: After adolescence > 35

AHI = Apnea Hypopnea Index, CO2 = Carbon dioxide, O2 = Oxygen

Is it Time for Capnography Monitoring of Inpatients on IV Opioids? Comment on the Prediction of Opioid Induced Respiratory Depression on Inpatient Wards Using Continuous Capnography and Oximetry (PRODIGY) Trial

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Currently, many institutions utilize intermittent (every 2-4 hours) measurements of oxygen saturation (SpO_2) to assess the respiratory status of hospitalized patients receiving opioid therapy; with more frequent, but not continuous monitoring, for patients on IV patient controlled analgesia (PCA).[1] It has been reported that with this type of monitoring, up to 90% of post-operative hypoxemic episodes (SpO_2<90% for 1 hour) are missed.[2] Furthermore, prolonged hypoxemic episodes are common after noncardiac surgery and can be extreme; one study found that 37% had SpO_2<90% for at least 1 hour; 11% had an SpO_2<90% for ≥ 6 hours, and 3% had SpO_2<80% for at least 30 minutes.[2] "Respiratory Depression"(RD) events associated with opioid use can lead to significant harm (i.e. brain damage, death) and occur mostly within 24 hours after surgery.[3] Many postoperative RD events are preventable; analysis of a closed claims database revealed that in patients receiving opioids postoperatively who had experienced a RD event, 16% had been seen by a nurse within 15 minutes and 42% within 2 hours of the RD event.[3]

Monitoring pulse oximetry continuously will improve the detection of oxygen desaturations and may lead to less unintended transfers to the intensive care unit (ICU) in postoperative patients cared for on the general surgical floor.[4] Whether continuous pulse oximetry monitoring decreases activation of rapid response teams or leads to improved mortality in postoperative patients is uncertain at this time.[5] In addition, pulse oximetry monitoring as a lone measure for RD event detection has some limitations. For example, patients who breathe inadequately during sleep can maintain normal range SpO_2 after they are awakened; normal range SpO_2 can be maintained even with a lower respiratory rate in the early stages of RD, thus delaying diagnosis[1]; and SpO_2 can be deceptively normal when supplemental oxygen is administered, masking clinically significant hypoventilation.

In postsurgical patients being treated with PCA, improved detection of RD events has been found with the use of capnography monitoring when compared to pulse oximetry monitoring.[1,5] Continuous capnography monitoring has also been reported to detect RD before oxygen desaturation occurs, especially in patients on supplemental oxygen.[5] Based on these observations, a large prospective observational study was designed to assess if continuous capnography and pulse oximetry monitoring could help predict opioid-induced RD events in hospitalized patients; the PRediction of Opioid-induced respiratory Depression In patients monitored by capnoGraphY (PRODIGY) study.[6] The primary objective of the study was to derive and validate a risk assessment tool from a combination of continuous respiratory monitoring and clinical data that could identify hospitalized patients at greatest risk for RD when receiving parental opioid therapy.

The PRODIGY study analyzed 1,335 hospitalized adult patients receiving parenteral opioid therapy for pain control from 16 centers in the US, Europe and Asia. Only patients on general care floors with an expected length of stay of more than 24 hours were enrolled, and each patient was followed for approximately 30 days after discharge. Capnographic, pulse oximetry monitoring device data, and clinical event data related to RD were collected for up to 48 hours: the first 24 hours after enrollment; the second night (12 hours); and the 3rd night (12 hours). A RD event was defined as any of the following: $etCO_2$ ≤ 15 or ≥ 60 mmHg for ≥ 3 minutes; respiratory rate (RR) ≤ 5 breaths for ≥ 3 minutes; SpO_2 ≤ 85% for ≥ 3 minutes; apnea episode lasting > 30 seconds; or any respiratory Opioid-Related Adverse Event (rORADE). Caregivers and patients were blinded to the capnography and oximetry monitoring, and the alarms on the monitoring device were turned off. Patients receiving intrathecal opioids, patients with an American Society of Anesthesiologists physical status (ASA PS) V or higher, patients with DNR status or receiving end of life therapy and ventilated or

>> Capnography Monitoring of Inpatients continues on next page

intubated patients were excluded from the investigation.

The study found 1or more RD episodes in 614 (46%) of the 1,335 general care floor patients with adequate data for analysis who had undergone continuous monitoring for 24 hours.[7] Those experiencing a RD event had an average hospital length of stay that was 3 days longer than those without a RD.[7] In addition, patients with ≥1 RD episode were more likely to experience an adverse event (AE) that required action, with a relative risk of 2.46 (95% CI: 1.73-3.50, p<0.001) for the AE requiring rescue, including rapid response team activation, as compared to patients without a RD event.[7] Of 46 AE requiring rescue action, 30 occurred in patients with ≥1 RD episode.[7] The most common capnography and pulse oximetry alarms defining RD events were for apnea, low respiratory rate, and low $etCO_2$.[7] The low rate of alarms for hypoxemia in the study was likely due to the high rate (62%) of the patients on supplemental oxygen during monitoring.[7] Interestingly, no high $etCO_2$ cases were observed.[7]

A multivariate RD prediction model was developed using five independent variables: age ≥60 (in decades), male gender, opioid naivety, sleep disorders (primarily obstructive sleep apnea), and chronic heart failure. This multivariate model had an area under the curve (AUC) of 0.76 for RD, and an optimism of 0.02.[7] A PRODIGY score was developed from this model, resulting from the sum of points for each individual predictor. This risk prediction score showed significant separation between patients with or without RD (p<0.001), and an odds ratio of 6.07 (95% CI: 4.44-8.30, p<0.001) between the high and low risk groups.[7]

The results of the PRODIGY trial shed light on the high rate of RD that can occur in patients receiving treatment with IV opioids in unmonitored settings. Furthermore, the study highlights the added benefit of $etCO_2$ monitoring in detecting RD, particularly in patients on supplemental oxygen where desaturations may not occur. Perhaps most importantly, the risk scoring tool developed by the PRODIGY study can serve as a guide to determine which general care floor patients would benefit most from enhanced respiratory monitoring, with the goals of preventing respiratory compromise, improving patient safety on the general care floor, and decreasing the burden of unplanned ICU admissions.

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Undiagnosed Obstructive Sleep Apnea and Cardiovascular Disease the Importance in the COVID Era: Featured Article

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Prevalence of Undiagnosed Obstructive Sleep Apnea Among Patients Hospitalized for Cardiovascular Disease and Associated In-Hospital Outcomes: A Scoping Review.

Suen C, Wong J, Ryan CM, Goh S, Got T, Chaudhry R, Lee DS, Chung F
J Clin Med. 2020 Apr 2;9(4).

The Coronavirus induced disease (COVID) pandemic is sweeping the globe. To date, there is no evidence linking obstructive sleep apnea (OSA) with increased coronavirus risk or complications. Nonetheless, two significant factors related to OSA are also linked to higher risk for serious complications from COVID-19: chronic health conditions, such as cardiovascular disease (CVD), and age. Because this new coronavirus is particularly dangerous for older people, as well as those with pre-existing conditions, patients with sleep apnea need to know more about their possible risk factors in order to calibrate their activities and protect themselves during the pandemic.

OSA is associated with long-term cardiovascular morbidity and is highly prevalent in patients with cardiovascular disease (CVD). Suen and colleagues performed a scoping review to determine the prevalence of OSA inpatients hospitalized for CVD and to map the range of in-hospital outcomes associated with OSA. After the screening of 4,642 articles, 26 studies were included for qualitative synthesis. The scoping review identified that OSA is a common comorbid condition with an estimated pooled prevalence of 48% among patients hospitalized with cardiovascular disease. The data suggest that OSA is highly prevalent in hospitalized patients with cardiovascular disease.

In summary, several hospital outcomes associated with OSA were identified: mortality, length of stay, composite cardiovascular complications, left ventricular ejection fraction, peak troponin levels, and peak BNP levels. The study showed conflicting data regarding mortality and cardiovascular morbidity among cardiovascular inpatients with OSA.

The findings from this review serve to inform further areas of research on the management of OSA among patients with COVID-19. While there is still a lack of data linking OSA and complications from COVID-19, the association of OSA and other comorbidities make it imperative that more studies are performed and that these findings are publicly disseminated so that OSA patients are aware of their comorbidities.

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