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Society of anesthesia and sleep medicine: proceedings of 2012 annual meeting

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Abstract
Introduction We present the proceedings of the second annual meeting of the Society of Anesthesia and Sleep Medicine. The theme of the meeting was "Anesthesia and Sleep Medicine: What Every Health Professional Needs to Know."
Discussion While upper airway obstruction during sleep and anesthesia received concentrated attention, with particular regard to perioperative assessment and managment of obstuctive sleep apnea, a diversity of issues were raised including: the genetic basis for variations in ventilatory control; shared charactertics of sleep and anesthesia; hazards posed by narcotic use in patients with obstructive sleep apnea (OSA); the respiratory complication that follow surgery in such patients; who amongst them is suitable for ambulatory surgery; and the special circumstances that apply to anesthesia for children with OSA. How principles based on these considerations have been applied to protocol development at two major centers was presented towards the end of the meeting. The proceedings highlight issues discussed by each of the invited speakers but do not include the research abstracts discussed during the poster session.

Keywords Anesthesia · Sleep · Perioperative · Obstructive sleep apnea

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Introduction

The second annual meeting of the Society of Anesthesia and Sleep Medicine (SASM) took place on October 10–11, 2012 and preceded the annual American Society of Anesthesiology meeting in Washington D.C. The meeting was attended by anesthesiologists, sleep specialists, hospitalists, pulmonologists, and allied health professionals. It provided a forum for an overview of sleep-disordered breathing, perioperative complications associated with obstructive sleep apnea, the impact of sedatives and narcotics in the postoperative period, and a group discussion of practice pathways to screen, diagnose, and manage sleep-disordered breathing during the perioperative period. The purpose of this report is to provide a summary and highlights of the speakers' presentations.

Keynote issues

Genetic architecture of ventilatory traits

Kingman Strohl, MD was invited to summarize his work on respiratory rhythmogenesis, a term broadly descriptive of both the generation of a single breath as well as patterning of breathing over time. The phenotype of recurrent apneas, present in the C57BL/6 J mouse and absent in the A/J mouse, is a naturally occurring genetic model of abnormal rhythmogenesis, exhibiting spontaneous pauses during resting breathing and recurrent apneas in reoxygenation following brief exposure to hypoxia. The post-hypoxic pauses are enhanced by an inhibitor of neural nitric oxide synthase and mitigated by acetazolamide, buspirone as a 5-HT agonist and inhibitors of hydrogen sulfide production. Thus, several neurotransmitter systems might be candidates for gene discovery. Moving to mouse lines that permit genetic testing, Strohl et al. found an absence of the instability traits in the C57BL/6 J-Chr 1A/ NaJ chromosome substitution strain. Strohl et al. tested the feasibility of gene discovery for this abnormality through a genetic and phenotypic analysis of an intercross study between this strain and the C57BL/6 J strain [1, 2]. They discovered three quantitative trait loci (QTLs) on mouse chromosome 1, two of which had unexpectedly large phenotypic effects. An introgression of one QTL region back into the C57BL/6 J-Chr 1A/J/NaJ restored the trait and proved the genetic cause [3, 4]. Using mRNA expression analysis, they found no evidence for differential expression of genes in the neurotransmitter systems appeared to be in this pathway for abnormal rhythmogenesis. This work demonstrates the potential for mouse models to be a platform for identifying potentially novel candidate genes that sensitize (or desensitize) the control system in regard to ventilatory stability and for drug discovery.

Sleep and anesthesia: common mechanism of action

Mervyn Maze, MD discussed how many sedatives, in fact, produce a state with important differences to natural sleep while producing a state akin to "pharmacologically-induced sleep [5]." Notably, alpha-2 agonists produce a state that shares remarkable similarities with non-rapid eye movement (NREM) sleep: showing both spindles and delta waves. Spindles are a late phenomenon during GABAergic sedation as the thalamus is only deactivated at higher drug doses. Maze et al. attribute this to unperturbed noradrenergic signaling from the locus coeruleus during GABAergic sedation [6]. In contrast, alpha-2 agonists suppress noradrenergic signaling and thus reduce thalamic activity [7]. His group recently proposed that curtailing noradrenergic signaling during sedation is important to reduce connectedness to the environment (akin to lack of awareness of our surroundings in sleep where noradrenergic signaling is also blunted). GABAergic drugs suppress consciousness, but not connectedness, and thus patients are able to interact with their environment at reduced levels of consciousness. This produces an acute confusional state similar to sleep inertia, delirium. Sleep inertia is rare on arousal from REM sleep as the patients are conscious (dreaming) before they become connected to the external world. However, in contrast to abundant evidence for NREM patterns of neural activity during sedation, evidence for REM-like activity during sedation is rare. Physiological roles of REM sleep are therefore not fulfilled by sedation. Dr. Maze suggested that sedation should be aimed to reduce connectedness to the environment, limiting the unpleasant experience of critical illness and the ability to interact with the environment.

Upper airway structure and function

Pathogenesis of upper airway obstruction during sleep: implications for sedative management

Alan Schwartz, MD presented his concepts on how upper airway function can be modeled as a simple collapsible conduit or Starling resistor [8]. Quantitative differences in critical pressures, reflecting differences in pharyngeal collapsibility, differentiate between groups with varying degrees of upper airway obstruction during sleep, clinically ranging from normal breathing through snoring and flow limitation to frank obstruction. Studies by his group and others have documented a structural/anatomic predisposition to upper airway obstruction in apneic patients compared to normal patients, characterized by elevations in passive Pcrit [9]. Passive Pcrit increases with male gender, obesity, and position (e.g., mouth opening, mandibular retrusion, neck flexion, and lying supine rather than lateral). In patients with obstructive sleep apnea (OSA), neuromuscular responses are disturbed, related to a loss of tonic (expiratory) pharyngeal neuromuscular activity [10]. This leads to a failure to relieve obstruction, compounding the problems posed by the structural predisposition to obstructive events. This "two hit" combination provides unfavorable circumstances for administration of sedatives given their capacity for muscle relaxation and arousal suppression.

Cannot intubate, cannot ventilate, can we eliminate?

Yandong Jiang, MD addressed the relative value of face mask vs nasal ventilation. He pointed out that each year in the USA, about 250,000 cases of cardiac arrest occur outside and more than 370,000 cases in hospitals. Further, about 21 million surgical cases are performed under general anesthesia (GA) and most require mask ventilation during induction. Considering that need for emergent ventilation can occur anytime and anywhere including public places and at home, the ability of medical personnel and the lay public to perform adequate emergent ventilation (almost always provided using a full-face mask) is far from satisfactory. Jiang et al. recently demonstrated that applying ventilation through both the mouth and nose was less effective than through the nose alone, and that ventilation occurs primarily through the nasal route even when both routes are used [11, 12]. They also reported that direct mouth-to-nose breathing is more effective than mouth-to-mouth breathing in unconsciousness apneic adult subjects. Mechanisms of upper airway obstruction in unconscious victims are not fully understood; however, they share many similarities with OSA. Three major components appear to contribute to airway obstruction in the OSA patient: (1) muscle relaxation of the pharyngeal dilators; (2) gravity pulling tongue and soft palate down when supine; and (3) lung volume (FRC) reduction. These factors also quite likely play a vital role in development of upper airway obstruction in patients under GA. According to Jiang et al., because nasal continuous positive airway pressure (CPAP)_ overcomes the effects of the three attributors in patients with OSA, it should be effective in minimizing the airway obstruction and maintain airway patent during induction of anesthesia. In addition, CPAP via nasal mask (nCPAP) is more effective maintaining airway patency than a full face mask in OSA patients. Induction with nCPAP may reduce the incidence of difficult mask ventilation, even if it cannot complete eliminate it.

Nasal or oral ventilation in anesthetized subjects?

Isono et al. recently tested a hypothesis that optimal ventilation route varies depending on the maneuvers used for airway maintenance. They found no differences in the tidal volume when the head and mandible was maintained in the neutral position and when the head was extended [13]. In fact, with mandibular advancement, the tidal volume was smaller during nasal ventilation than oronasal and oral ventilation. Their results are in line with their previous finding that mandible advancement failed to improve nasal airway patency in obese subjects and the finding by Safar et al. that mouth-to-nose ventilation failed particularly in obese subjects. Isono et al. also systematically examined influences of muscle relaxants on ventilation efficacy and contribution of nasal and oral routes to ventilation in anesthetized subjects receiving positive pressure ventilation in the neutral head and mandible position. They found that rocuronium administration did not change the ventilation efficacy and ventilation partitioning between the airway routes. In contrast, succinylcholine administration improved the ventilation efficacy by 30 % primarily because of increase of oral ventilation partition. Isono et al. endoscopically observed oral airway dilation at the isthmus of the fauces during succinylcholine-induced fasciculation. Their results do not support advantage of nasal ventilation but rather support either oral or oronasal ventilation during anesthesia induction particularly with succinylcholine. In their series of human studies under GA, collapsibility of the retropalatal airway region was significantly higher than that of the retroglossal region in both apneic and non-apneic subjects even during airway-improving maneuvers, suggesting an advantage to oral ventilation by avoiding the most collapsible airway route. This, however, is speculative since the airway at the isthmus of the fauces, possibly the narrowest and most collapsible region along the oral airway route, was not assessed and compared with the retropalatal airway in these studies. Furthermore, airway collapsibility was assessed under static conditions (no airflow) in these studies and dynamic pharyngeal airway behavior during mechanical ventilation may be different.

Preoperative assessment of OSA

When can home sleep testing replace in-lab sleep testing?

Home sleep testing (HST) is a specific, focused diagnostic tool that can facilitate timely diagnosis of OSA in preoperative patients where appropriately used. Majority of HSTs performed in the USA utilize what are called either type 3 (minimum of four channels—respiratory effort, oral and nasal airflow, ECG/heart rate, and oxygen saturation) or type 4 devices (minimum of three channels, which includes oxygen saturation). Although type 3 devices have a sensitivity of 64–100 % and specificity of 48–100 % in the identification of moderate–severe OSA (apnea–hypopnea index (AHI)$\geq$15 events/h), there is greater disagreement in the AHI between the HST and in-lab polysomnography (PSG) with increasing severity of OSA. A negative HST result in a symptomatic patient should thus be followed by an in-lab PSG. An HST is best utilized in patient groups with a high pretest probability of moderate–severe OSA. Based on current AASM guidelines, HST should not be performed in patients with significant comorbid conditions such as moderate to severe pulmonary disease, neuromuscular disease, or congestive heart failure as these devices generally cannot evaluate for hypoventilation and may not be able to detect central or “complex” sleep apnea. According to Susheel Patil, MD, in the preoperative setting, one would most likely seek to minimize false-negative results for moderate sleep apnea at the expense of increased false-positive results. The clinician would therefore favor a screening process with higher sensitivity at the expense of specificity. A staged approach using a two tier testing strategy can facilitate this process where an initial survey instrument to assess sleep apnea risk, followed by HST, can identify patients with moderate–severe OSA.

STOP-Bang screening: how to make it work?

The association between STOP-Bang score and the probability of OSA provides a useful tool to stratify patients with unrecognized OSA undergoing elective surgery. In a series of 746 surgical patients, Chung et al. showed that for a STOP-

Bang score of 5, the odds ratios (OR) for moderate/severe and severe OSA was 4.8 and 10.4, respectively. And for a STOP-Bang 7 and 8, the OR for moderate/severe and severe OSA was 6.9 and 14.9, respectively [14]. As the STOP-Bang score increased from 0–2 to 7–8, the probability of having moderate/severe OSA, and severe OSA increased from 46 to 86 %, 18–60 %, and 4–38 %, respectively. Chung et al. propose, since a STOP-Bang score ≥3 demonstrated a very high sensitivity and NPV for moderate/severe OSA, this cut-off may be good for a surgical population with high OSA prevalence such as bariatric surgical patients. On the other hand, the patients with a STOP-Bang score of 5–8 have a high specificity to detect moderate and severe OSA. These scores may be useful in the general patient population which has a low OSA prevalence to reduce false-positive rate. It enables identification of those patients most in need of urgent evaluation.

Peri-/postoperative complications

Postoperative pulmonary complications among orthopedic/general surgical patients with OSA

Dr. Stavros Memtsoudis presented recent work in which his group found that OSA was associated with a significantly higher adjusted OR of developing pulmonary complications after both orthopedic and general surgical procedures, with the exception of pulmonary embolism (PE). Relevant OR for orthopedics and general surgery were (respectively): for aspiration pneumonia: 1.41 (1.35, 1.47) and 1.37 (1.33, 1.41); for ARDS: 2.39 (2.28, 2.51) and 1.58 (1.54, 1.62); for intubation/mechanical ventilation: 5.20 (5.05, 5.37) and 1.95 (1.91, 1.98) (all p values <0.0001) [15]. Comparatively, PE was more frequent in OSA patients after orthopedic procedures (0.51 vs 0.42 %, $p=0.0038$) but not after general surgical procedures (0.45 vs 0.49 %, $p=0.22$).

Postoperative complications in patients with OSA undergoing noncardiac surgery

In a recent case–control study of 471 patients by Kaw et al., presence of OSA was associated with higher incidence of ICU transfer (OR 4.43; $p=0.069$) and higher length of hospital stay and overall complications (OR=6.9; $p=0.003$) [16]. Neither AHI, nor use of home CPAP before surgery was associated with postoperative complications ($p=0.3$; 0.75, respectively) or length of stay ($p=0.97$; 0.21, respectively). More recently, a meta-analysis of 3,942 patients with OSA from the same group reported postoperative respiratory failure 1.96 vs 0.70 %, OR 2.43 (95 % CI 1.34–4.39), $p=0.003$ and a postoperative cardiac event rate 3.76 vs 1.69 %, OR 2.07 (95 % CI 1.23–3.50), $p=0.007$ [17]. Early reports from this group also show that the incidence of postoperative respiratory failure may be particularly high amongst patients with obesity hypoventilation syndrome, which is less likely to be recognized before elective noncardiac surgery.

Many patients and practioners view the workup for OSA as cumbersome, thus some may avoid the diagnosis of OSA recognizing that the eventual therapy in most cases is CPAP. Because anesthetic agents can compromise upper airway mechanics, the perioperative or post-extubation period represents a time of particular vulnerability for collapse and nasal CPAP therapy may be highly effective in preventing it.

Perioperative complications of obstructive sleep apnea

According to Atul Malhotra, MD, although a robust association between OSA and perioperative complications has been observed, the data showing that therapeutic intervention with CPAP prevents complications are more sparse. Several factors contribute to the challenge of showing benefits to perioperative CPAP. First, hard perioperative complications are relatively rare in most hospitals such that the ability of CPAP to lower event rates will be difficult to assess without a very large sample size. Second, randomized trials are difficult to blind since anesthesiologists can easily judge which patients may have difficult airways. Risk factors such as neck circumference and Mallampati score are used to assess intubation challenges but are also likely surrogates for OSA. Thus, anesthesiologists may already account for OSA risk based on well-established risk factors. Third, the Hawthorne effect describes a phenomenon whereby an outcome measure may be changed simply by measuring it. Thus, a well-designed study to assess whether CPAP prevents hard cardiovascular complications in the perioperative setting would be challenging.

Impact of postoperative sedatives/narcotics

Impact of sedatives/narcotics on sleep-disordered breathing

It is estimated that approximately 2.5 % of adults in the USA use prescription hypnotics, and a projected 201.9 million opioid prescriptions were dispensed in the USA in 2009. Relatively few nonselective benzodiazepines (BDZs) have been specifically evaluated in patients with OSA, while recent attention has been focused on the interaction of non-BDZs and OSA. Dr. Timothy Morganthaler summarized the clinically important conclusions from these studies as follows: (1) Midazolam is most reliably implicated for reducing upper airway tone, increasing upper airway resistance, and depressing ventilatory drive; and (2) there appears to be a greater safety margin with the use of non-BDZ hypnotics (zolpidem, zaleplon, zopiclone, and eszopiclone) in patients at risk for having OSA, but both BDZ and non-BDZ appear to have limited effects on insomnia symptoms. In certain phenotypes of patients with OSA, careful use of non-BDZ hypnotics may help stabilize ventilation by raising the arousal threshold, thereby decreasing sleep stage-related ventilatory overshoot. This is a promising area of therapeutic investigation. Most important conclusions from studies on opioids among patients with OSA are: (1) Acute opiate agonist administration may contribute to upper airway collapse and inhibit airway protective mechanisms and ventilatory drive leading to ventilatory emergencies in susceptible individuals. Currently, it is recommended that the risk for tendency to OSA and ventilatory suppression be assessed prior to use of opiate agonists and monitoring is advised if needed; and (2) Chronic opiate usage is associated with central and complex sleep apnea syndromes, and sleep-disordered breathing problems abate when opiate dosages are reduced or eliminated. The clinical implications of these syndromes are not entirely certain, but treatment often involves use of adaptive servoventilation.

Opioids and OSA: monitoring miracles and mishaps

Undetected respiratory depression in patients receiving opioids on medical surgical floors with intermittent monitoring continues to be a major source of preventable morbidity and mortality in hospitals. Keys to reducing these tragic outcomes are increased awareness and education on the dangers of opioids and sedatives in this population and deployment of improved continuous electronic monitoring technologies to reduce associated risk. Speaking at the occasion, Frank Overdyk, MD highlighted recent monitoring strategies to address patient safety as proposed by organizations including the Joint Commission and the Anesthesia Patient Safety Foundation (APSF). The APSF 2011 recommendations suggest continuous monitoring of oxygenation and ventilation with oximetry and capnography if postoperative opioids are used. Oximetry alone is inadequate, particularly where oxygen therapy is used.

Using OSA near misses (and catastrophes) as teaching tools

Following a catastrophic event in 1999, MetroHealth Medical Center in Cleveland implemented an OSA protocol to improve safety when managing patients with OSA after surgery. Dr. Norman Bolden reviewed data for an 18-month period after implementing their protocol. They found that despite some of these patients having very significant episodes of hypoxemia and apnea monitoring, these patients in designated beds for OSA patients led to an extremely low rate of urgent/emergent transfer to intensive care settings compared to rates of transfer noted in other reports of postoperative OSA. Bolden et al. compiled a list of adverse events occurring in OSA patients at their center and use these cases to educate medical providers regarding OSA management issues. According to Bolden et al., many providers incorrectly believe that patients who have undergone surgery to correct OSA (such as uvulopalatopharyngoplasty) are necessarily "cured," and those who have lost considerable weight following bariatric surgery are similarly "cured."

Clinical pathways and practice

OSA Patients for ambulatory surgery: SAMBA guidelines

Dr. Girish Joshi described a systematic review of published literature conducted by his group evaluating the perioperative complications in OSA patients undergoing ambulatory surgery. A total of 1,491 OSA patients, 2,036 low-risk OSA patients, and 2,095 non-OSA patients were included among seven selected studies. The Society for Ambulatory Anesthesia (SAMBA) consensus statement recommends the use of the STOP-Bang criteria for preoperative OSA screening [18, 19]. Patients with a presumed diagnosis of OSA, based on screening tools, can be considered for most types of ambulatory surgery, if postoperative pain relief can be provided predominantly with non-opioid analgesic techniques. Patients on preoperative CPAP should be advised to use their CPAP device for several days postoperatively, as the potential risks can last for several days after surgery. Patients who are unable or unwilling to use CPAP after discharge may not be appropriate for ambulatory surgery. No guidance can be provided for OSA patients undergoing upper airway surgery due to limited evidence.

Perioperative OSA protocols: Mayo Clinic experience

Doctors Peter Gay and Bhargavi Ghali described the development of perioperative OSA protocols at the Mayo Clinic. First, a clinical practice initiative was developed, utilizing an existing tool to screen patients, and a post anesthesia care unit (PACU) assessment of immediate postoperative respiratory status. The screening tool used was the sleep apnea clinical score (SACS), developed by Flemons et al. The PACU assessment looked for recurrent episodes of: (1) apnea; (2) bradypnea; (3) desaturation; and (4) pain-sedation mismatch. The authors then moved to a prospective cohort study utilizing screening with the SACS, and the developed PACU respiratory assessment. They were able to identify patients at higher risk of postoperative respiratory complications with both tools, with highest sensitivity (odds ratio near 20) utilizing both the preoperative and postoperative evaluations [20]. Based on these findings, efforts began to screen all patients undergoing inpatient surgery with the SACS. The PACU respiratory assessment became part of the electronic charting system to ensure this was done for all patients. Patients who are at high risk by preoperative screening or PACU criteria receive remote oximetry for 24–48 h postoperatively [21]. If positive airway pressure (PAP) is necessary, then patients go to a higher level of care; a step-down unit or an intensive care unit. Patients who require PAP postoperatively that are presumed to have undiagnosed OSA are seen by a sleep consult service prior to discharge allowing planning for management after discharge and follow-up recommendations. Attempts have been made to provide "just in time" hospital introduction of autoadjusting positive airway pressure (APAP) use in undiagnosed patients who prove to be at high risk for OSA based on a previously verified (SACS) questionnaire. Patients after elective total knee or hip arthroplasty and also considered as high risk for OSA were randomized to receive standard care plus postoperative APAP or standard care, while low-risk patients received standard care alone. There were no significant differences in complication rates or length of stay ($p=0.65$) for the high-risk randomized groups, but patients with an AHI of≥15 randomized to APAP actually had a 1-day median longer postoperative stay ($p=0.02$) possibly due to more sleep deprivation or reduced mobility [22]. Although probably underpowered for the endpoints, this study still could not show any benefit to empiric postoperative use of APAP in first-time users at high risk for OSA. Currently, Dr. Gay's group uses a systematic approach in hospitalized surgical and medical patients called obstructive apnea systematic intervention strategy guided by their sleep specialists who now spend half a day in the hospital seeing patients with observed/suspected OSA.

Perioperative OSA protocols: Northwestern experience

Doctors Meltem Yilmaz and Lisa Wolfe then described the Northwestern experience. Prior to surgery, single channel home testing (oximetry) was offered to those on CPAP to confirm the accuracy of current CPAP settings. For others with suspected OSA, full home portable testing (4 channels) was performed within 5 days of surgery. Among patients with known OSA on treatment, those with AHI>5, SpO_2< 90 % for <10 % of the time and CPAP compliance <4 h/night were offered repeat testing by PSG. PAP therapy is more successful in reducing perioperative complications when introduced at home, with sufficient time and support to assure comfort and compliance. The authors pragmatically agreed to allow patients with neuromuscular disease, primary central apnea or complex apnea to bring their home equipment as necessary. Patients were encouraged to bring their home masks to ensure best fit although they ensure a variety of masks are available including nasal pillows, nasal masks, and full face masks. For hospital PAP devices, they chose to obtain bi-level auto devices, as these allowed them to use many modes which would be available in that device (CPAP, bi-level (S), auto bi-level). The group developed an "NMH standard" for auto settings (EPAP min=5, inspiratory positive airway pressure (IPAP) max=15, PSmax=4). This was developed so that physicians' unfamiliar with the technology have a credible starting place. They kept IPAP max low to reduce the risk of: (1) central apnea; (2) runaway pressure due to mask leak; (3) aerophagia; and (4) pressure intolerance. Hospital monitoring of PAP therapy included telemetry pulse oximetry as well as PAP downloads, made available in real time through the computer network, which facilitated sleep consultation when needed.

Anesthesia for children with obstructive sleep apnea

Pediatric OSA mainly occurs between the ages of 2 and 6 years. Clinical manifestations include partial or complete upper airway obstruction during sleep, restless sleep, morning headaches, behavioral disturbances, and daytime somnolence. Diagnosis of OSA is mainly by clinical characteristics. PSG may be performed to confirm the diagnosis, and is mainly recommended in children with comorbidities, such as obesity, trisomy 21, craniofacial abnormalities, neuromuscular disorders, sickle cell disease, or mucopolysaccharidosis. The most common and effective therapy for pediatric OSA is adenotonsillectomy, which alleviates symptoms in most children, but some may continue to demonstrate OSA patterns into adulthood. It is not unusual to have some children desaturate into the low 50s or 60s. This is useful as a baseline marker, giving the anesthesiologist an idea of underlying severity. According to Dr. Ronald Litman, some anesthesiologists will reduce the dose of preoperative sedative, to avert life-threatening upper airway obstruction in an unmonitored environment. During induction of general anesthesia, virtually all children with untreated OSA will exhibit partial or complete upper airway obstruction. Insertion of an artificial oral airway device after loss of consciousness will bypass the obstruction and allow easy bag-mask ventilation. In the immediate postoperative period following adenotonsillectomy, the incidence of airway obstruction is higher in children with OSA when compared with those who undergo adenotonsillectomy for recurrent infections. Therefore, children with significant OSA, especially if >4 years old, should be hospitalized overnight following the procedure. Chronic hypoxemia in childhood may result in upregulation of central opioid receptors hence some children with severe OSA may have decreased analgesic requirements. Even some time after adenotonsillectomy, a predisposition toward upper airway obstruction during sleep or sedation may persist because of the aforementioned neurological abnormalities. It remains unclear what patient risk factors predict postoperative complications after tonsillectomy and which patients with OSA are eligible for ambulatory surgery, or need ICU observation.

Conclusions

Evident from these presentations is the substantial recent growth in understanding of the shared mechanisms of sleep and anesthesia and the problems these states pose for maintenance of airway patency. The increasing quantity and quality of epidemiological data demonstrating the perioperative risks for patients with OSA was also clearly apparent as were the now well-informed efforts to create protocols to circumvent perioperative problems posed by sedation and narcotic analgesia. The interest in these issues has prompted the theme for the next SASM annual meeting: "Opioids, Respiratory Depression, and Sleep Disordered Breathing: Perioperative Implications."

Conflict of interest The authors declare no conflict of interest.

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