

Message from the President



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There is plenty to report to you since our last newsletter. Many of us met at our inaugural Annual Scientific Meeting (ASM) in Chicago in October. This meeting was a great success with an interesting and varied scientific program with invited lectures complemented by a high standard of poster presentations and excellent organisational backup. Feedback has been very positive from attendees, our sponsors and the American Society of Anesthesiologists (ASA) itself. ***This success is encouraging and affirming, and provides a strong platform for the next steps in developing our organisation and extending its influence.***

The inaugural Board, which took over from the steering committee at the October ASM first formally met immediately after it. Among its first activities was to agree to now empanel a Clinical and Research committee to further clinical practice standards and develop a research agenda for our fields of interest. Roop Kaw will chair this committee. We envisage several subcommittees under this committee including: a teaching and training committee to assist ongoing

education of anesthesiologists and other health professionals in obstructive sleep apnea OSA and other sleep-related issues; and an OSA database committee to encourage developments in the epidemiology of OSA and perioperative medicine. These committees are currently being activated to undertake these substantial tasks.

Another matter discussed by the Board was the need to now employ dedicated office staff to ensure that we continue to service the needs of our growing membership promptly and to help with expansion of our activities. Full time assistance will require a growth in our income base and we are currently examining ways of doing this though increased sponsorship. We are also looking at ways of working with senior societies, such as the ASA, to offset these expenses. These issues are being actively pursued and will determine the future shape of SASM. I will keep you informed of developments.

Our Conference and Education committee, led by Frances Chung and Babak Mokhlesi, has been very active in developing a program for our

Washington 2012 meeting. This is taking shape rapidly and promises to build on the success of Chicago. It will incorporate an extra half-day “advanced course” component to add a specific educational component to the overall content. We think this will prove very popular with trainees particularly.

We are very keen to provide our members with ongoing professional sustenance between these annual meetings. This newsletter is an important element in this, as is our website which Norman Bolden has so assiduously guided and developed. As you will see from John Loadman’s newsletter article, we are now also establishing an email discussion group. We are also aware of the need to embrace social media to ensure that we maximise our communication opportunities. Face Book and Twitter do require a hands-on approach and we would be very interested if any of our members had sufficient passion for this to think about administering these accounts for us as part of the Membership committee’s activities.

We are pleased to report that the IRS has approved our application for not-for-profit tax exemption for fees and donations and our finances remain in healthy shape under the watchful eye of Peter Gay.

These are exciting months for this new Society: October success was very gratifying, but sets the bar high for the future. Our job is to now meet the expectations we all have that the Society takes a leading role in facilitating expansion of knowledge and clinical practice standards in matters related to anesthesia and sleep.



Editor's File

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SASM Starts With a Bang: More Exciting Times Ahead

It is no surprise that the membership of the Society of Anesthesia and Sleep Medicine (SASM) is growing exponentially. SASM fills up a significant void by providing interactions between the disciplines of anesthesia and sleep medicine. Furthermore, in a very short period, SASM has been able to develop multiple avenues to achieve its goals, including the annual meeting, web-based open discussion, and a newsletter, to mention a few.

The inaugural annual meeting of SASM, "OSA, Anesthesia and Sleep: The Common Ground," held on October 14, in Chicago was a great success with nearly 250 registrants (70% anesthesiologists, 20% sleep medicine specialists, and 10% from other disciplines) and 35 poster presentations. Conference Directors Frances Chung, MBBS and Babak Mokhlesi, MD must be congratulated for organizing this excellent conference.

SASM now provides a discussion forum that represents another avenue for sharing clinical and research ideas relevant to anesthesia and sleep medicine (*please see the article by John Loadsman*). Although some concerns regarding a potential for abuse remain, particularly as this discussion site will not be moderated,

I believe the potential benefits from a lively discussion can be significant. I strongly encourage all the members to participate and contribute with the ultimate aim of advancing patient care and safety.

The articles included in this newsletter represent current clinical challenges and controversies as well as provide some insight into the future of anesthesia and sleep medicine. Atul Malhotra presents current knowledge (*or lack thereof*) regarding several clinical and research questions related to sleep, anesthesia and sedation in the intensive care unit. Similarly, Satya Krishna Ramachandran discusses the limitations of current modalities for monitoring postoperative respiratory depression as well as presents the challenges in achieving the best cost-effective practice that will allow early identification and treatment of postoperative respiratory depression.

Roman Schumann presents an argument for minimizing or eliminating perioperative inflammatory response by optimizing perioperative care including appropriate preoperative preparation and selection as well as use of optimal surgical and anesthetic techniques and postoperative management. Taken together, these approaches may offer an opportunity

to improve patient outcome and reduce overall healthcare costs.

Carolyn D'Ambrosio addresses the current controversies regarding preoperative screening and testing for obstructive sleep apnea. She emphasizes the importance of formal in-laboratory overnight polysomnography and cites the limitations of home sleep tests. Ngozi Imasogie and Jean Wong summarize a presentation at the first SASM conference on the topic of perioperative anesthetic challenges in a child with obstructive sleep apnea undergoing adenotonsillectomy. It is clear from all the articles included in this issue that much work is necessary to fill the numerous unmet needs.

This is your Newsletter, so please let us know how you would like it shaped. We love to hear from you with any suggestions, no matter how trivial. Also, please encourage your friends and colleagues to join SASM, a rapidly expanding international multispecialty society that offers an opportunity to promote interdisciplinary communication, education and research in matters common to anesthesia and sleep. Finally, please plan to attend the next annual meeting of SASM that will be held on **October 11–12, 2012, in Washington, D.C.**

An Email Discussion Forum for SASM Members

A SASM member suggested that a forum for discussion of matters relevant to the Society's membership might be useful. As a result, the idea of a 'SASM' email discussion forum was floated with the organiser of one of the current incarnations of the GASNet discussion group, now running successfully for nearly 20 years and of which a number of you will be aware. A facility for use by SASM was subsequently created:

 <http://lists.gasnet2010.org/listinfo.cgi/sasm-gasnet2010.org>

The forum is a simple email-based discussion list. SASM members and other people with a shared interest in subjects relevant to SASM are welcome to subscribe. In order to do so, visit the website listed and submit your email address, after which you will be contacted to confirm your SASM membership or other bona fide reason for subscription. The forum is not intended to function as a 'patient support group' and patients will generally not be granted subscription for that reason. Once subscribed, you will receive an initial information

message that contains your subscription details and the email address to use to post messages to the list, as well as general list information regarding how to unsubscribe.

The primary purpose of the forum is to allow people to discuss research and clinical issues relevant to SASM, but other subjects are not necessarily precluded. Similarly, while not

intended as a means of social interaction, a degree of collegiality is important and that, too, can and probably should take place to a limited extent if the forum is to be productive and survive. A completely 'dry' forum is not likely to remain popular for long. In the end, however, it is an experiment that may or may not prove to be a useful service to the SASM community. Only you can determine that. Try it out! You can unsubscribe from the forum at any time if you don't find it useful and your email address will certainly not be used for anything else or passed to any third party. You should be aware, of course, that all other list-members would see your address should you post to the list.

And while the list is private, with both the member list and message archive protected by password, it is always wise to post only things that you would be happy for the general public to see, however unlikely that might be.

There are few hard and fast rules, although subscribers should be mindful of the usual email etiquette. Posting large attachments (pictures etc.) is generally not a good idea, for example. The list will not be moderated unless it becomes absolutely necessary for some reason. Messages to the list will therefore automatically be sent immediately to all subscribers. Moderation necessarily means substantial delays occur between posting and message distribution so people requiring urgent clinical advice, for example, cannot obtain it via the forum. It should go without saying that the forum is a community, like any other, so anything deemed to be antisocial would not be tolerated.

The list will only be a success if people make use of it. Sign on and contribute!



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OSA, Anesthesia, and Critical Care: Unresolved Issues

Obstructive sleep apnea (OSA) is a common disorder with major neuro-cognitive and cardiovascular sequelae.¹ Obesity is a major risk factor for OSA and is rising in epidemic proportions throughout the world.² The estimates are still that the majority of OSA remains undiagnosed and untreated. Obese patients with type 2 diabetes mellitus have a prevalence of OSA over 85% and yet the minority of these patients undergo therapy even when both the patients and their doctors are aware of the diagnosis.^{3,4} Thus, considerable work needs to be done to increase appreciation for the importance of OSA, across various disciplines including anesthesiologists. *Despite widespread acknowledgement that sleep education and awareness need to improve, a number of controversial issues remain which require further research to resolve.*

1. Does OSA therapy reduce perioperative complications?

While some, but not all data, support the concept that OSA is associated with perioperative complications, definitive data are currently lacking that OSA therapy with continuous positive airway pressure (CPAP) reduces perioperative complications.⁵ Such studies are difficult to perform, particularly because event rates are quite low and thus large sample sizes are required to obtain adequate statistical power. In addition, ethical and logistical issues exist regarding withholding CPAP from the control arm of a systematic study. Some

studies have focused on oxygen desaturation as an outcome, which is problematic since OSA would be predicted to increase the risk of desaturation by definition. Thus, further thoughtful research is required to resolve this controversy.⁶⁻¹⁰

2. Is sleep the same as anesthesia?

While many respiratory physiologists have drawn parallels between sleep and anesthesia, uncertainty exists regarding the neurobiology of these two states.^{11,12} Some data have shown that anesthesia is associated with activation of brain centers important in sleep (e.g. ventrolateral pre-optic area [VLPO] of the hypothalamus – sleep center).^{13,14} However, the question remains whether these sleep centers are mechanistically important in the anesthetic state. Some recent data support the notion that VLPO-lesioned animals are not protected from anesthetics, suggesting that other pathways may be important in mediating the observed effects. Thus, further research will be required to determine the mechanism underlying effects of various anesthetics and whether the neurobiological states of sleep and sedation/anesthesia are reliant on similar pathways.¹⁵

3. Is extubation failure in the critically ill an upper airway disease?

A number of studies in critically ill have shown that patients at high risk of reintubation benefit from the application of non-invasive ventilation.¹⁶ The reason for this benefit is unclear, but leads to speculation that the positive pressure

may be working to preserve upper airway patency.¹⁷ A number of studies have shown that agents such as sedatives (or low dose muscle relaxants) can compromise upper airway dilator muscle function.¹⁸ These muscles are critical to the maintenance of upper airway patency. Hypoglossal nerve palsies have been reported post-extubation, but more subtle forms of upper airway dysfunction are also likely to occur. Michaud et al. (unpublished results) performed computed tomography (CT) scans of patients post-extubation and observed that the patients who had the smallest pharyngeal airways were more likely to be reintubated than patients who had large pharyngeal airways. Further studies are required but are difficult to perform due to increased use of early tracheostomy and relatively low rates or reintubation. *However, a systematic assessment of upper airway caliber post-extubation in a large cohort of ICU patients would likely be informative.*

4. Is sleep in the intensive care unit important?

A long-standing debate has occurred regarding the importance of sleep in the intensive care unit (ICU).^{19,20} While considerable data suggest that sleep quality is quite poor in critically ill, no definitive data suggest that measures to improve sleep are effective in improving clinical outcome. Some of the controversy comes from the inability to distinguish sedation

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Postoperative Monitoring for Respiratory Depression: Where are we Headed?

Respiratory depression (RD) and sudden unanticipated death are two of the feared complications in the early postoperative period that continue to garner a significant amount of clinical and research interest. The Anesthesia Patient Safety Foundation (APSF) recently published an expert statement, “No Patient Shall Be Harmed By Opioid-induced Respiratory Depression”, which details the essential monitoring strategies to detect significant drug-induced respiratory depression in the postoperative period.¹ The overwhelming majority of stakeholders present at the discussion supported the use of continuous monitoring with a minimum of a single channel (*pulse oximetry*) to detect RD, and displayed significant interest for development of multiple channel monitors in the future. While this overall goal of the APSF reflects the ideal end-point, there are several aspects of monitoring that need further research and clarity.

Continuous postoperative monitoring is limited only to hospital patients (excluding outpatients) and current protocols often do not cover the highest risk period for postoperative desaturation, namely the 3rd postoperative night. There are significant costs involved with a nation-wide shift to mandatory continuous monitoring for all postoperative patients. Even greater costs are involved in installing decision support or surveillance systems based

on continuous monitor data. There is urgent need for cost effectiveness research of such monitoring to guide further steps in postoperative monitoring techniques. Yet, intuitively, these levels of progressively intense monitoring are expected to make patient care safer. On a practical level, several concerns exist:

- A. Definition and duration of a true RD event: Literature reviews on RD report an extremely large spectrum of definitions as listed below.² This lack of homogeneity in definition has major clinical and legal implications. Theoretically, RD can be defined as inadequate respiratory responses to a known respiratory stimulus (hypoxia or hypercapnia). On a practical level, this definition does not stipulate the duration or frequency of the inadequate response.
 - a. SpO₂ values <93%, <90%, <85%, or <80%
 - b. Respiratory rate/minute of <10, <8 or <6
 - c. End tidal carbon dioxide values of >45 mmHg or >50 mm Hg
- B. Determination of therapeutic ceilings: The frequency and duration of desaturation epochs that indicate need to institute changes in opioid therapy are unclear in the literature.

- C. Patient selection for monitoring: One view is to extend continuous monitoring to all patients irrespective of risk type.¹ However, it is clear that some patients are at greater risk of developing or worsening RD with use of opioids. These may be patients with severe COPD and obese patients with elevated serum bicarbonate levels >27 mEq/L indicating increased likelihood of obesity hypoventilation syndrome. It is unclear if all patients with obstructive sleep apnea have increased opioid sensitivity.
- D. Determination of the value of multiple channel monitoring. Based on Overdyk's data,³ there is a significant frequency of respiratory rate based RD using capnography. Taenzer suggests that capnography may be unreliable, and further studies are warranted.⁴

There is unanimous agreement among experts that continuous pulse oximetry is superior to intermittent monitoring. However, there is a significant knowledge gap on the clinical significance of episodic postoperative hypoxemia. It is clear that episodic postoperative desaturation occurs in patients with and without sleep apnea during opioid analgesic therapy. Previous work by Moller,⁵ Pederson⁶ and Ochroch⁷ failed to

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Respiratory Depression

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demonstrate any improvement in perioperative respiratory morbidity with continuous pulse oximetry monitoring alone. Electronic patient surveillance systems provide a qualitatively superior method of continuous monitoring by delivering alert pages to nurses notifying desaturation, low pulse rate and high pulse rate.

Taenzer and colleagues used a before-after study design and demonstrated that a continuous oximetry based patient surveillance system helped reduce rescue events from 3.4 (1.89-4.85) to 1.2 (0.53-1.88) per 1,000 patient discharges and intensive care unit transfers from 5.6 (3.7-7.4) to 2.9 (1.4-4.3) per 1,000 patient days⁴. It must be noted that not all rescue events were purely respiratory in nature, and the improved success with the surveillance system may be related to the wider outcome definitions, improved technology and unmeasured nurse training factors. As such, electronic patient surveillance systems have greater chance of success when combined with rigorous nurse education, training and retraining. It should also be noted that such patient surveillance systems could hinder patient care by way of false positive alerts (nuisance alarms). The differences in definition of RD carry significant implications for patient surveillance systems using such thresholds.

Taenzer and colleagues used thresholds of <80% SpO₂ for >30 seconds to reduce the risk of nuisance alarms that could divert nurse attention away from other active clinical care on the floor. Unfortunately, there are no data on patient surveillance systems' false negative rates (*i.e.*, true desaturation events that do not trigger a paging alert) or outcome benefit with higher SpO₂ thresholds, both of which are critically important for evaluating their safety and reliability. The evidence for other modalities of continuous monitoring including capnography, acoustic respiratory monitoring, and desaturation pattern recognition algorithms are sparse and difficult to comment on. There is widespread belief that use of more than one continuous respiratory monitor will reduce the likelihood of severe respiratory morbidity related to respiratory depression. However, rigorous evidence for such beliefs is lacking and the risks of technological intensification may indeed be greater than the potential benefits of combined monitoring methods at the current time.

Supplemental oxygen therapy is an important consideration in postoperative patients, especially in the context of evolving RD. It is possible to mask ongoing RD by use of modest levels of supplemental oxygen. Based on the alveolar gas equation, increasing the inspired oxygen fraction from 0.21 to 0.28 would mask an alveolar (and

arterial) carbon dioxide value of >80 mm Hg. This tiny increase in inspired oxygen fraction is easily achieved with moderate flows through nasal cannula or facemask. Since oxygen therapy is a central aspect of the management of hypoxia, there is poor understanding of the best method of monitoring patients who need oxygen during opioid analgesic therapy. In addition, the positive predictive value of SpO₂ for sudden unanticipated death is expected to be extremely low, given the rarity of this event during the early postoperative period. There are some theories that patterns of episodic desaturation may indeed carry improved predictive value, but further research needs to be done before determining its place in postoperative monitoring strategies. In summary, although significant interest and importance has been placed on continuous postoperative monitoring, several practical challenges remain. **Technological developments will provide a larger spectrum of continuous monitoring and patient surveillance system solutions that may impact patient safety in the next few years.** There is need for robust and responsible research to evaluate the cost effectiveness of these modalities and their value in the wider context of patient safety and health care expenditure.



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Obstructive Sleep Apnea, Obesity and Anesthesia: Is Inflammation a Link Offering Targets for Perioperative Outcome Improvement?

Obstructive sleep apnea (OSA) is associated with a measurable increase in certain pro-inflammatory cytokines. These cytokines are often the same as those associated with other chronic pro-inflammatory disease states, such as morbid obesity, but their role for either condition continues to be debated. For example, several studies have investigated tumor necrosis factor alpha (TNF- α), interleukin-6 (IL-6) and c-reactive protein (CRP) in both, OSA and obesity.

Recently, Steiropoulos et al.¹ investigated age and body mass index (BMI) matched obese OSA versus obese OSA-free patients. TNF- α was significantly elevated in the OSA group and correlated with apnea hypnea index (AHI), oxygen desaturation index (ODI) and neck circumference. Serum IL-6 appears to be important for sleep architecture and quality as demonstrated even in non-obese OSA free individuals.² Exhaled IL-6 isoprostane is elevated in OSA patients compared to both, OSA free obese subjects and non-obese controls. The IL-6 also correlated with neck circumference and AHI.³ A small study comparing individuals with moderate to severe OSA, otherwise disease free, with BMI and age matched OSA free controls, CRP levels were significantly elevated in the OSA group.⁴

It is now well accepted that there appears to be a correlation between OSA, obesity and pro-inflammatory physiologic modulation, which lead

to endocrine and cardiovascular sequelae over time. However, the degree to which this propensity for subclinical inflammation is affected by the acute phase reaction to surgical interventions has not been well studied. Nevertheless, the possibility of ameliorating the pro-inflammatory physiologic state in the perioperative period and influencing long-term outcomes has gained momentum. For example, continuous positive airway pressure (CPAP) is able to improve TNF- α , IL-6 and CRP levels in OSA patients, and understanding the timing and intensity of perioperative CPAP will undoubtedly advance in the near future.^{5,6} Different anesthetics and anesthetic techniques have recently been recognized to potentially be important for long-term cancer outcomes, most likely via immune modulation.⁷ Likewise, anesthetics can have specific effects on perioperative cytokine profiles of patients undergoing a variety of procedures.⁸⁻¹⁰ Evidence has emerged in supporting important anti-inflammatory properties of the intravenous anesthetics ketamine and propofol, as well as several others.¹¹⁻¹²

How to optimally tailor an anesthetic to reduce the perioperative effects of surgery and anesthesia on sleep architecture and severity of postoperative OSA, as well as how to possibly reduce the overall inflammatory response to surgery and improve outcomes are important questions, worth further exploration

and research. Clearly these questions require interdisciplinary collaboration to overcome the obstacles that recent research has uncovered. Namely, standardized cytokine measurement has not been established, and methods of cytokine level determination are different between studies. Results of cytokine research in the context of OSA and obesity are sometimes still contradictory. The importance of timing of specimen collection and storage is unclear. Finally, which cytokines are truly important for a certain condition and why? Which one should we measure and how will its modulation improve outcome?

In summary, minimization of perioperative inflammatory response by optimizing preoperative patient preparation, intraoperative anesthetic and surgical care and postoperative management has received increasing interest in recent years. This subject area offers abundant opportunity for a multi-specialty society such as Society of Anesthesia and Sleep Medicine (SASM) to fill the unmet need of research concerning the effects of the perioperative inflammatory response on normal sleep as well as the role of inflammation in sleep disordered breathing in the perioperative period and other related topics.

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Preoperative Screening for Obstructive Sleep Apnea: What are the Controversies?

Preoperative management of patients with obstructive sleep apnea (OSA) can be challenging. These patients tend to be obese as well as can have craniofacial abnormalities and loss of normal protective upper airway dilator reflexes that predispose them to airway obstruction. Furthermore, 60-70% of patients with OSA remain undiagnosed. Therefore, many healthcare providers in both sleep medicine and anesthesiology have wondered if routine preoperative testing of OSA patients is necessary. If these tests were as easy as an ECG, then perhaps there would be no discussion. However, the gold standard for testing for OSA, overnight in-laboratory polysomnography, is difficult to perform and thus is expensive and not always accessible.

Most practitioners recognize that a patient, who is morbidly obese, has a large neck circumference, snores and is sleepy during the day, is most likely to have OSA. Testing such patients for OSA is important as preoperative diagnosis and CPAP use may reduce the risk of perioperative complications. However, more research is needed to make such determination. In contrast, a patient who does not obviously have OSA on the initial evaluation may be screened for OSA using questionnaires. The Epworth Sleepiness Scale (EPS) is a questionnaire that

includes 8 questions such as the likelihood of the patient to fall asleep in different setting (e.g., watching television). These responses are graded on a scale of 0 (unlikely) to 3 (very likely) for each of the eight scenarios. A score of 10 or more is considered "sleepy," but does not predict OSA! Instead, an abnormal score on the EPS should prompt the healthcare provider to ask further questions about the patient's sleep such as 1) do you snore most nights of the week, 2) do you wake yourself up from snoring or choking, 3) do you feel refreshed when you wake up in the morning, 4) do you sweat at night, and 5) do you have to urinate at night. An elevated score on the EPS combined with positive answers on some of these questions should increase the suspicion for OSA.

Another questionnaire that is commonly used is the Berlin Questionnaire, which has 10 questions including history of snoring, tiredness and systemic hypertension. The patient is given some options for each question and those answers are then weighted to give a total score. The Berlin Questionnaire is easy to administer and has reasonable sensitivity, but is cumbersome to score. Importantly, sleepiness and snoring alone do not provide a complete picture. Certainly, body mass index (BMI), particularly truncal obesity, plays an important

role in OSA. In addition, neck circumference and history of hypertension or heart disease are suggestive of OSA. These risk factors are utilized in a commonly used preoperative screening tool for OSA known as the STOP-BANG questionnaire (S=Snoring, T=Tiredness (daytime somnolence), O=Observed apnea, P=Pressure (systemic hypertension), B=BMI >35, A=Age >50 years, N=Neck circumference >40cm, and G=Gender male (Chung F et al: *Anesthesiology* 2008; 108: 812-821). This questionnaire is easy to use as the first four indicators are asked of the patient and the next four can be obtained from the physical examination. It is most sensitive when all the components of "BANG" are positive and at least two of the STOP are positive.

As with many tools in clinical practice, these questionnaires have to be taken into context with the patient's characteristics. For example, a patient may have only snoring and tiredness but have a severe overbite or craniofacial abnormalities, particularly retrognathia, that increase the risk of OSA. Therefore, I recommend using these questionnaires (Berlin questionnaire, STOP-BANG or the ASA checklist) to raise your suspicion for possible OSA and then evaluate the patient's physical characteristics that suggest OSA.

Once OSA is suspected, further testing should be done, although there is no good evidence that suggests that this reduces perioperative complications. The next question is which test is appropriate? For patients at high risk of OSA (e.g. those with several risk factors and body habitus), a home sleep test may be adequate. An in-laboratory study provides more accurate data than any home study, so I would recommend doing an in-laboratory study, if possible.

When an in-laboratory study is not possible, then a home sleep test is acceptable; however, with one very important caveat: if a home sleep test is negative, it does NOT rule out OSA! If a home sleep test is negative and the healthcare provider suspects OSA, an in-laboratory polysomnogram is warranted. Unfortunately, these critical aspects have been overlooked presumably due to financial and access reasons.

In summary, it is important to identify the risk factors associated with OSA such as truncal obesity, large neck circumference, craniofacial abnormalities, male gender and a history of hypertension or cardiac disease and to correlate them with the patient's symptoms such as snoring and daytime tiredness. There are several screening tools available that can help predict the possibility of OSA, but none are absolute. Therefore, good clinical acumen as well as appropriate sleep testing in patients at risk are critical.

Obstructive Sleep Apnea, Obesity and Anesthesia *continued from page 7*

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Unresolved Issues

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from sleep with respect to electroencephalogram (EEG). For example, delta activity could represent slow wave sleep or could be indicative of encephalopathy. As such, interventions to improve sleep quality must focus on outcomes beyond the EEG. Because sleep deprivation and fragmentation have known effects on metabolic and neurocognitive function,^{21,22} measures to improve sleep should have demonstrable improvements in important outcomes. For example, a recent study showed diminished REM sleep is predictive of ICU delirium; therefore, studies to improve

sleep quality would be predicted to reduce the incidence of delirium.²³ However, ICU research which has focused on delirium has thus far paid minimal attention to the importance of sleep. Thus, further multidisciplinary efforts to define the importance of sleep in the ICU would be informative.

5. Is the arousal threshold a viable therapeutic target in OSA?

Considerable evidence suggests that the repetitive collapse of the pharyngeal airway during sleep occurs due to a combination of anatomical compromise coupled with inadequate protection of pharyngeal patency by upper airway dilator muscles.²⁴ These muscles, including the genioglossus, have robust activity

during wakefulness, but lose activity and responsiveness during sleep.²⁵ Important reflexes include the negative pressure reflex whereby the genioglossus has robust activation in response to sub-atmospheric pressure;²⁶ however, while this reflex is pronounced during wakefulness, it is attenuated during sleep. However, combinations of respiratory stimuli can activate the upper airway dilator muscles during stable sleep if the stimuli are of adequate magnitude and for sufficient duration.²⁷ In fact, most sleep apnea patients have spontaneous periods of stable breathing,²⁸ which are thought to be mediated by airway dilator muscle activity. Thus, in upper

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Toronto, Ontario

Adenotonsillectomy in a Child with Obstructive Sleep Apnea: Perioperative Anesthetic Challenges

Karen Brown, M.D., Professor of Anesthesia from McGill University Health Centre, Montreal, Canada presented “Perioperative management in adenotonsillectomy in a child with OSA” at the first Annual Meeting of the Society of Anesthesia and Sleep Medicine, in Chicago, Illinois on October 14, 2011. She discussed the outcomes, risks and perioperative management of children with severe sleep apnea syndrome (OSAS) undergoing tonsillectomy with or without adenoidectomy (T&A), with a focus on respiratory morbidity. Dr. Brown began with a review of the characteristics of OSAS in children. These features include loud snoring, episodic oxygen desaturation, hypercapnea, and repeated arousals from sleep. Primary benign snoring occurs in 5-27% of children; OSAS affects only 1-3% of children. However, this prevalence is similar to the prevalence of childhood asthma. Adenotonsillectomy is the mainstay of treatment for OSAS in children. There is evidence that children with severe OSAS have an increased risk of respiratory complications. Symptoms of OSAS in children include neurocognitive and behavioural disturbances, poor school performance, cardiovascular dysfunction, and pulmonary disease. Of note, T&A is one of the most frequently performed ambulatory pediatric surgical procedure in the

United States. *In 1970, the most common indication for T&A was infection (88%); today it is pharyngeal obstruction (77%). The risk of postoperative morbidity is higher if the indication is OSA.*

It was emphasized that compared to adults, children have twice the incidence of fatal respiratory complications in the postoperative period following T&A. Malpractice claims in the United States show that death/brain injury resulted from airway complications in up to 60% of lethal cases. The estimated mortality following T&A is 0.6 per 10,000, lethal hemorrhage accounting for less than one-third the overall mortality. Common postoperative airway complications include airway obstruction and respiratory arrest. Children with OSAS have a higher incidence of postoperative respiratory complications, including post-obstructive pulmonary edema, pneumonia, airway obstruction and respiratory failure. The severity of sleep apnea is an important determinant of this risk, therefore assessment of OSAS severity is important to the clinician.

In children, the apnea hypopnea index (AHI) or respiratory disturbance index (RDI) represents the gold standard for assessment of severity of OSAS. Children with sleep apnea may have an AHI of 1-100 events

per hour. An AHI of more than 10 per hour is associated with an increased risk of respiratory complications following T&A. Nocturnal oximetry has been used to predict the chances of a child having OSAS. The levels of severity are graded as McGill Oximetry Score 1, 2, and 3 identified by oxygen saturation nadirs of < 95%, <85%, and <80%, respectively.

Dr. Brown stressed that recurrent hypoxia below 80%, increases the risk of major medical interventions in the postoperative period. These children also show respiratory and analgesic sensitivity to opioids and demonstrate a blunted responsiveness to carbon dioxide. Severe OSAS is a multisystem disease associated with pulmonary and systemic hypertension, ventricular hypertrophy, and lower airway disease. The independent risk factors for respiratory complications following adenotonsillectomy include young age, and the presence of a medical co-morbidity, regardless of the nature of co-morbidity. The combination of young age, co-morbidity and severe OSAS identify a child at high risk of post adenotonsillectomy complications.

Obesity is both a cause and a consequence of OSAS; the prevalence of severe OSAS in obese children being 46%. However, Dr. Brown warned the severity of OSAS in obese children can only be determined by preoperative testing

as there is no evidence of a significant correlation between the degree of obesity and the severity of OSAS.

Data from a multinational retrospective study revealed that two-thirds of children with mild and moderate OSAS show complete resolution of their sleep-disordered breathing six weeks following adenotonsillectomy, while 25% of those with severe OSAS do not show complete resolution. Residual disease is more likely in obese children and children less than 7 years old. Dr. Brown cautioned that children with severe OSAS, altered ventilator control and heightened opioid sensitivity may be more vulnerable to respiratory depression during anesthesia and recovery. Anesthesia should therefore be tailored accordingly. She stated the criteria for admission following

adenotonsillectomy includes young age, co-morbidity, bleeding diathesis, excessive distance from the hospital, excessive pain, poor oral intake, postoperative vomiting and an oxygen saturation below 95% on room air. *Whereas young age and medical co-morbidity are easily identifiable risk factors, OSA is more difficult to diagnose in children in the absence of a pediatric sleep laboratory.* Severe OSAS may be identified using clinical criteria and preoperative questionnaires, but these only agree with polysomnography in 56% of cases. Anesthesia indicators of severe OSAS include difficult mask induction, excessive respiratory sensitivity to opioids, hypoventilation and apnea, and delayed emergence.

It was recommended nocturnal oximetry as a useful tool for detecting

severe OSAS in the preoperative period, as severity of nocturnal hypoxia allows exclusion of the high-risk child for ambulatory surgery.

Dr. Brown concluded her presentation with data from the Medical Liability Mutual Insurance Company in New York State. This data suggests that children experience a greater incidence of lethal respiratory events, than adults in the postoperative period following T&A. Overall mortality is low at 0.6/ 10,000. With the increasing incidence of OSAS worldwide, simple non-invasive preoperative diagnostic tests are needed to identify children at risk. Polysomnography is not widely available and an alternative such as nocturnal oximetry should be considered.

Unresolved Issues

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the data suggest that the genioglossus is both necessary and sufficient to stabilize breathing spontaneously during non-REM sleep.²⁹ As a result, the arousal threshold becomes a critical variable whereby a low arousal threshold (wake up easily) could lead to repetitive awakenings from sleep with insufficient time to accumulate respiratory stimuli during sleep.³⁰ On the other hand, a high arousal threshold could be advantageous as it would allow the accumulation of respiratory stimuli such as carbon dioxide and negative

pressure which could serve to activate the dilator muscles. On the other hand, a high arousal threshold could also be detrimental if it allowed profound hypoxemia and hypercapnia to develop yielding end organ consequences. Thus, therapies to manipulate the arousal threshold could theoretically be beneficial for some patients but problematic for others. Hypnotic drugs, which are free of myorelaxant properties, have been attempted as a treatment for sleep apnea with some success.^{31,32} Pharmacological manipulation of the arousal threshold may therefore be a viable therapeutic target in OSA

although combinations of therapies may well be required to eliminate apnea. In summary, *by its nature, the field of sleep medicine is multidisciplinary. Traditionally, the involvement of anesthesiologists in sleep-related issues has been modest, but with increasing data showing important interactions between these fields we believe that a strong scientific rationale exists for pursuing these issues discussed.* Through further efforts into the research issues outlined above, considerable advances in our knowledge could be anticipated and ultimately patient care should improve.

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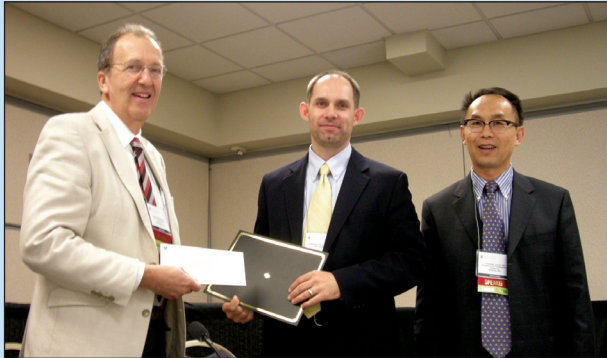
2011 Annual Conference Poster Winners

The SASM 2011 Annual Conference: "OSA, Anesthesia and Sleep. The Common Ground" was a huge success with well over 200 in attendance. There were 35 Poster presentations.

Best Basic Research Posters:

First Prize

The D1 dopamine receptor agonist chloro-APB induces emergence from isoflurane anesthesia.



Shown:(left to right) David Hillman, MD (President, SASM), Norman E. Taylor, MD, PhD (1st place winner), Yandong Jiang, MD, PhD (Chair, SASM Abstract Committee).

Second Prize

Experimental Pain and Analgesia Responses in Male Volunteers Suffering from Sleep-Disordered Breathing.



Anthony G. Doufas, MD (2nd place winner)

Best Clinical Research Posters:

First Prize

Randomized controlled trial (RCT) of Perioperative Auto-CPAP Treatment in OSA patient: a preliminary report.



Peter Liao, MD (1st place winner)

Second Prize

Does Self-titrating CPAP Therapy Improve Postoperative Outcome in Patients at Risk for Obstructive Sleep Apnea Syndrome? A Randomized Controlled Clinical Trial.



Timothy I. Morgenthaler, MD (2nd place winner)

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