Society for Pediatric Anesthesia

education • research • patient care

Volume 18 Number 1 | Winter 2005 | www.pedsanesthesia.org

Inside this Issue

Find it on the Web

- ONLINE Registration for the 2005 Annual Winter Meeting – Added Complimentary Workshops for Fellows and Junior Faculty (Limited Space)
  - Fellows Research Workshop
  - Junior Faculty Workshop "Success in Academics"
- Reviews & Commentary
- Letter to the Editor
- Peds Passport
- Committee Reports– Committee on International Education and Service
- SPA Supporters and Exhibitors

Society for Pediatric Anesthesia
education • research • patient care
2209 Dickens Road
P.O. Box 11086
Richmond, VA 23230-1086

Non-Profit Org.
U.S. Postage
PAID
Permit No. 956
Richmond, VA

Society for Pediatric Anesthesia
education • research • patient care

The Society for Pediatric Anesthesia (SPA) publishes the SPA Newsletter *four times a year. The information presented in the* SPA Newsletter *has been obtained by the Editors. Validity of opinions presented, drug dosages, accuracy and completeness of content are not guaranteed by SPA.*

Editor's Corner

Rita Agarwal, MD, FAAP

The ASA has come and gone so it's time for our annual ASA meeting review. The venue while interesting, did not prevent great attendance at all the sessions I attended.

As always we try to review a sampling of the panels, forums and abstract/poster presentations that were pediatrics oriented. I try to get as many of them reviewed as possible, but it often depends on whether members of the Communications Committee attended those sessions. Special Thanks to Drs. Helen Lauro and Shobha Malviya.

We will be trying several new things over the next year as a result of the recent SPA Member Survey. We will increase our printed newsletters from three to four times a year. We'll start some new sections such as "What Kids Like" and "What's New in Pediatric Anesthesia" (to be edited by Cheryl Gooden). If you have kids and would like to have their photographs included in our Kid's Section as well as a summary of their likes and dislikes (the goal is to better inform members who either don't have children or whose children are grown as to what's "hip" with our patients) please fell free to send them to me.

Thanks as always to all the assistant editors who make this newsletter possible.

As always SPA extends an "invitation" to members encouraging them to get involved by joining a committee. If you are interested in helping to shape the future direction of the society please feel free to send an email to spa@societyhq.com. Complete lists of Committees, chairs and their members are provided online on the SPA website at www.pedsanesthesia.org.

Rita Agarwal, MD, FAAP
Editor
The Children's Hospital/UCHSC
Denver, CO
Agarwal.Rita@tchden.org

Advance Registration Required

Complimentary Fellowship Seminar

At the Winter SPA meeting in Miami, FL, we will be conducting a 2.5 hour complementary session on Scientific Approaches to Anesthesia. This seminar is intended to provide fellows with an introduction to scientific methodology and statistics, study design, critical appraisal of the literature and grant/manuscript/abstract writing.

Depending on the interests of the attendees, Dr. A. Tait will focus the content of the session. Attendance will be limited as this will be an interactive session.

President's Message

Dear Friends and Colleagues,

This is my first communication in the SPA Newsletter as President. First, I would like to thank all of you for your help during the past years and would like to emphasize my increased dependency on your efforts and input as my job description changes. I am also particularly grateful to my predecessors and mentors in this role (as well as many other roles), including Peter Davis, Bill Greeley, Steve Hall, Aubrey Maze, Myron Yaster, Mark Rockoff, and Anne Lynn. I can only hope to approach their wisdom and achievements.

Because of the contributions and skills of the members and its past leadership, I take the helm of a Society that is quite strong in terms of membership, finances, and the quality of its educational offerings. Going forward, we aggressively seek to identify and implement new programs and activities that will serve your interests and needs. Our major goal is to increase the meaning and value to your belonging to this organization. Based largely upon your suggestions, derived from recent membership surveys and more informal conversations and emails, we have chosen to focus on several initiatives. Strategically, we want this organization and its members to become the recognized voice for the perioperative care of children in this country, and an important contributor to efforts elsewhere in the world. The reason for doing this is to improve our ability to advocate effectively on behalf of issues that are important to children and our members. We intend to increase the scope and relevance of the Society's educational efforts, including new products and media to help members meet their CME and lifelong-learning needs. Finally, we want to optimize the management of the Society's resources to facilitate meeting these and future goals. Your will be hearing more about these efforts in substantially greater detail in the coming months.

I cannot emphasize strongly enough the desire and necessity for members to contribute to the work of the Society. We need your suggestions, criticisms, ideas, and labor. We particularly need new people to get actively involved. This is sincere. One of the strengths of this society is that "term limits", turnover, and infusion of new blood into committee and leadership roles are mandated, both by philosophy and bylaw. Active and meaningful involvement is possible in many different ways, including committee participation, writing for the Newsletter, offering your services as a PBLD or workshop lecturer in an area of expertise, defining (and then working on) new areas of activity, etc. This is essentially a meritocracy—if you do the work, you get more to do. It is likely to require some degree of effort and persistence on your part, but I guarantee that these will be rewarded. I encourage you to contact me (francis.mcgowan@childrens.harvard.edu or 617-355-6225) or any of the other members of the Board of Directors (see back of this Newsletter or the SPA website at www.pedsanesthesia.org) with ideas, suggestions, and offers to participate. I also particularly want to know about it if we could be doing something better or if you feel that your concerns have gone unaddressed.

I firmly believe that the mission of this Society—improving the perioperative care of children through education and research—and what you do every day to carry this out—are important and noble tasks. We are unique, in part, because of this commitment to a shared and greater purpose. I have learned a tremendous amount participating SPA activities; I have also made some of my best and most enduring friendships. I encourage you to take similar advantage of the Society. Serving you and this organization in several capacities and now as your President is the greatest professional honor I can envision. Most of all, I am extremely proud to have all of you as colleagues, and look forward to being able to count more of you as friends.

Frank McGowan, MD
President

Top Ten Reasons NOT to become a Pediatric Anesthesiologist

Zulfiqar Ahmed, MD
Staff Anesthesiologist
Children's Hospital of Michigan

10: You don't have to decide whether the estranged real father or the abusive boy friend or addicted mother can be present at the child's induction!

9: You will not find yourself trying to guess where the crumbs on the child's shirt came from. Or what those little black spots are crawling on their pillow .

8: You will not be asked to provide an "organic" anesthetic for the child.

7: You won't be told "the baby was crying and hungry so I gave him a bottle, but he didn't have anything to eat".

6: You won't have to take care of a 2kg 12-week-old and a 200 kg 12-year-old on the same day

5: You don't have learn to change diapers in the OR.

4: You won't have to announce CODE BROWN while putting in a rectal probe (and if you ever do you have our sincere sympathy).

3: You rarely get kicked and punched by your patients prior to going to the operating room.

2: Parents will not ask "will the anesthetic make my child stupid"?

1: You may be able to have an intelligent conversation with your patients. Although I know a lot of children who are much more intelligent and mature than their parents!

I would like to extend a special thanks to Dr. Maria Zestos, for her help.

SPA 18th Annual Meeting Review

Las Vegas, Nevada • October 22, 2004

Reviewed by: Helen V. Lauro, MD, FAAP
Long Island College Hospital
Brooklyn, NY

The 18th Annual Meeting for the Society of Pediatric Anesthesia was held October 22 at the Las Vegas Hilton in Las Vegas, NV.

Program Chair, **Maurice S. Zwass, MD** (University of California, San Francisco, CA) and outgoing President, **Anne M. Lynn, MD** (Children's Hospital, Seattle, WA) provided welcoming remarks. The results of the SPA strategic planning survey, sent electronically to board officers, active members, and dropped members, were announced. Overall survey response rate was 45%, board/member responses were equivalent to the board responses. The vision of the SPA for the next three to five years will include being a voice to improve perioperative care for infants and children, developing a body of knowledge for people caring for children, and helping to shape the perioperative environment and educating parents. **Francis X. McGowan, Jr., MD** (Boston Children's, Boston, MA) was then welcomed as the incoming SPA president.

Maurice S. Zwass, MD (University of California, San Francisco, CA) moderated the morning session, focused on molecular genetics. **Philip Morgan, MD** (Case Western, Cleveland, OH) discussed a primer on genomics. He opened with the fact that despite 99.9% DNA homology, humans have apparent genetic differences. Not all humans have the same minimum alveolar concentration (MAC). Examples included redheads versus brunettes, patients with mitochondrial disease. He elaborated the language of molecular genetics, including the processes of the central dogma (transcription, translation and protein synthesis), splicing (missplicing, alternate splicing), mutation (random and targeted), gene mapping (linked genes), single nucleotide polymorphisms (SNPs), gene arrays and proteomics (allows identifying the expression and interactions of proteins. Missplicing can be involved in many diseases, such as cystic fibrosis with an incidence of 20%. Most of pediatric diseases are very complicated, and cannot be evaluated by the traditional one-gene one-function Mendelian genetics.

Jeffrey Balser, MD, PhD (Vanderbilt University, Nashville, TN) spoke on the future of pharmacogenomics (PG). Case studies in drug induced arrhythmia syndromes of 1) polymorphic ventricular tachycardia (torsades) and 2) ventricular fibrillation in setting of myocardial ischemia and drug therapy (sudden death) illustrated how PG will impact our medical practice. These rare genetic syndromes shed light on drug related syndromes. *Drosophila*, *Caenorhabditis elegans*, and mice are commonly utilized in genetic research. Real time video footage of the *Caenorhabditis elegans* (nematode) model was shown and illustrated the equivalence of the worm pharynx to the human heart in terms of genes. Thus, a worm "seizure" would be akin to a ventricular arrhythmia. Nematode gene products can bind to suspected drug channels. In the future, gene variants may predict those at risk for acquired long QT syndrome, and a DNA chip might allow prescreening. He stressed the importance of encouraging our medical colleagues and students to become involved with PG as it reinvigorates academic medicine.

John Belmont, MD (Texas Children's, Houston, TX) discussed the genetic disorders of pain sensation and the genetics of pain. Pain sensitivity and inhibition vary among people. Many families with pediatric pain syndromes are evaluated by pedigree analysis, and many inborn errors of development and metabolism are involved in pediatric pain disorders, such as Hereditary Sensory and Autonomic Neuropathies (HSAN). Genetic contributions to pain may include low functioning met/met catechol-o-methyltransferase (COMT) leading to increased activity of dopaminergic system, and a decrease in opioid transmission due to decreased enkephalin. Nerve growth factor can be pro-inflammatory, modulate pain fibers and be involved in disease.

Francis X. McGowan, Jr., MD (Boston Children's, Boston, MA) offered a fascinating presentation on genetics, sepsis, inflammation and coagulation. He elaborated the role of genetic approaches to understand complex diseases. Most diseases such as diabetes, atherosclerosis, CPB, response to sepsis and severe trauma are complex multifactorial diseases that cannot be attributed to a single gene. Polymorphisms occur in 1-5% of the population, and while not sufficent to cause a particular disease such as sickle cell disease, they can be used as surrogate markers and be involved in expression and severity of disease. He summarized case control genetic association study designs, which search for variants and polymorphisms between unrelated patient cases and controls. An example from association studies and thromboembolism was provided. Thromboembolism (TE) requires one or more coagulation gene polymorphisms (Factor V Leiden/APCR (G1991A), Prothrombin G20210A) +/- environmental factors such as oral contraceptives, smoking, surgery/trauma, indwelling catheters. Study of such polymorphisms may eventually allow diagnosis and clinical therapy for those at risk. Similarly, concerning sepsis and trauma, variability occurs secondary to polymorphisms in genes regulating inflammatory mediator production and response. Many inflammatory gene polymorphisms in sepsis influence disease severity as well as outcome and mortality. Tumor Necrosis Factor (TNF) levels have been found to correlate with severity and death. Potential treatments via an anti-TNF effect may benefit the sickest patients and those in upper 25% of TNF levels. The potential applications of functional genomics and proteomics were discussed and illustrated via Zyomyx® protein microassay chips to allow looking at many substances in the setting of sepsis and trauma.

The second morning session was moderated by **Randall P. Flick, MD** (Mayo Clinic, Rochester, MN) and addressed two pro-con panels on anesthetic management. The first panel concerned anesthesia for the patient with neuromuscular disease. **Julianne Bacsik, MD** (Boston Children's, Boston, MA) led the case discussion of a nine-year-old patient with Duchenne's Muscular Dystrophy (DMD) for emergent appendectomy. She enumerated the respiratory and cardiac considerations of the disease. Case reports of cardiac arrest in DMD patients receiving succinylcholine (SUX) have been reported. Further, inhalation agent use is controversial, as case reports have described myoglobinuria with increased creatine kinase and cardiac arrest in DMD patients receiving inhalation agent without SUX. Such complications may occur after completion of uneventful GA. While the mechanism is not malignant hyperthermia (MH) which involves the ryantodine receptor, it is proposed that there may be a common

final pathway to MH, with cardiac arrest secondary to high serum potassium leading to high myocyte intracellular calcium, rhabdomyolysis, and leaky membranes. Anesthetic management is directed toward regional anesthesia, but when general anesthesia is required, difficult intravenous access, possible difficult intubation, use of a nontriggering agent for maintenance and postoperative respiratory support should be considered. Washed red blood cells or fresh packed red cells should be utilized to prevent further increase in serum potassium. **Barbara W. Brandom, MD** (Children's Hospital Pittsburgh, Pittsburgh, PA) addressed the case report, in the pro position for inhalation use. Her considerations included that anesthetics should not be restricted to total intravenous anesthesia (TIVA) in view of the metabolic acidosis and abnormal fatty acid metabolism with propofol use and a 1/660 incidence of asystole with propofol. She favors management in this scenario with inhalation anesthetic utilizing an arterial line for intravascular monitoring blood pressure, good intravenous access, foley, and frequent blood work intraoperatively.

The second panel concerned anesthesia for the patient with upper respiratory tract (URI) infection. **Alan R. Tait, PhD** (University of Michigan, Ann Arbor, MI) presented the pro position for use of laryngeal mask airway in setting of patient with URI. Well known perioperative complications in children with URI were enumerated including cough, breath holding, laryngospasm, wheezing, bronchospasm, arterial oxygen desaturation, atelectasis. He elucidated the advantages of laryngeal mask airway (LMA) in this setting, including speed of insertion, hemodynamic stability, decreased coughing, sore throat and anesthetic requirements, and increased oxygen saturation on emergence. He described his research as well as numerous studies by Cohen, Tartari and Parnis enforcing the increased risk of complications with endotracheal tube versus LMA. He concluded that endotracheal tube is a risk factor for adverse perioperative events, and LMA is not contraindicated for procedures where it would be used. **Susan T. Verghese, MD** (Children's National Medical Center, Washington, D.C.) presented the con position for use of LMA in URI. She opened her discussion considering that despite the popularity the LMA enjoys even extending to repair of pediatric atrial septal defect, endotracheal intubation is the best and safest choice to secure the airway. The benefits of endotracheal tube use are clear in gastrointestinal reflux, copious secretions, and nonsupine position. In setting of URI endotracheal intubation decreases gastric insufflation pressures and risk of laryngospasm, and decreases work of breathing. On the other hand, the LMA does not prevent laryngospasm, is likely to be displaced in small children, does not protect against aspiration, and is not efficient route for bronchodilators. She concluded with her own acronym for LMA (L=laryngospasm, M=malpositioning, A=airway loss).

The afternoon session on improving health care and lifelong learning was moderated by **Jayant K. Deshpande, MD** (Vanderbilt University, Nashville, TN). He emphasized the importance of improving oneself through practice, improving patient care, and improving the place we work. **James M. Steven, MD** (Children's Hospital of Philadelphia, Philadelphia, PA) discussed lifelong learning. He gave an overview of the American Board of Anesthesiology (ABA) recertification process, including maintenance of certification (MOCA). MOCA which began with time limited certification in 2000, at a 10-year interval, is composed of professional standing, lifelong learning and self assessment, practice performance and cognitive examination. He described the relationship of board certification to outcomes. Approximately 67% of 11/230 studies of the American Board of Internal Medicine (ABIM) show some positive correlation between board certification and patient outcome. Of all methods of lifelong learning, interactive learning such as simulation, workshops, and problem-based learning discussions are most effective and have the best outcome with patient care. Cognitive based board certification generally has a positive relationship to outcomes. American Board of Medical Specialities plans to address this via a more robust maintenance of certification. Public preference is for primary board certification, and maintenance of certification, albeit more frequently, say every five years. Future directions include the specialty society role, to help us decide how we as members maintain our skills. Also to be considered are distributed access and outcome measurements.

Joan Wellman, MS, MIM (Joan Wellman & Associates, Bellevue, WA) discussed improving throughput/business systems models. The Toyota production system was described as a model for the current business backdrop of healthcare, with analogous features of scarce resources, an economy that cannot afford the traditional way of producing a service, and no clear models for how to reinvent the work. "Lean manufacturing" translates to "lean thinking" now utilized at Overlake Hospital, Peace Health, and Pittsburgh Regional Healthcare Initiative (Alcoa). "Lean thinking" practices include elimination of waste (processing, inventory wait time, search time, transportation, space and complexity), redesigning for continuous value flow, as well as striving for zero defects. Currently, there is no value flow in surgery. Many institutions have a 58-day wait time from patient being seen at surgeon's office to the operative date. Changes in value flow to value stream methodology are reflected in simple changes in time of registration to time of induction of anesthesia. Thus, patients may arrive at the hospital one hour, 15 minutes before surgery rather than two hours ahead.

Theodore Speroff, PhD (Vanderbilt University, Nashville, TN) discussed quality improvement-the VA model: what's important for pediatric anesthesia. The VA Model for quality improvement (QI) has been transformed from the traditional empowerment approach utilizing the processes of approval, resource allocation, communication, degrees of freedom with a system for QI with passive leadership, to a state-of-the-art enabling approach of strategic planning, connectivity and cross system partnership with active leadership. Critical enabling factors include modernization, information technology, measurement, people development and leadership. Applications for the SPA were stressed including development of command and innovation centers, information technology and connectiveness, indicator data registries, professionalism and competency, and leadership.

The final lecture of the day, on a lighter note, by **Dana Braner, MD** (Doernbecher Children's, Portland, OR) on "What are the odds? The practice of medicine and other games of chance." He described the intersection of medicine and games of chance. Medicine is a science of manipulating variables in the favor of the patient. Highly improbable events will occur if high numbers are involved. The odds of a fatal drug side effect such as occurred with sildenafil citrate can be high 15,000,000 doses/564 deaths=27000/1. In terms of language, the practice of medicine is akin to gambling, the "probability of cure", "chance of remission", "odds of recovery" and so forth. General anesthesia is safer now than 100 years ago, with estimates of current mortality 1/250,000, representing a 25 improvement in odds ratio from 1900). This is attributable to education, experience, communication, and technology. All of these parallel to "games of chance".

The conference was well received by the audience, who look forward to the Joint Winter Meeting of the SPA and AAP Anesthesia Section in Miami Beach, Florida.

Additional photos from the meeting are online at www.pedsanesthesia.org

Out and About the ASA

2004 Annual Meeting. Las Vegas, NV

Panel: Controversies in Pediatric Anesthesia

Reviewed by: Rita Agarwal, MD, FAAP

Dr. Steven Hall (Children's Memorial Hospital, Chicago) moderated this panel focusing on controversies in pediatric anesthesia. Dr. Anne Lynn (University of Washington Children's Hospital and Regional Medical Center) started the session by discussing the pros and cons of using nitrous oxide. She reviewed the complications and side effects of nitrous oxide, such as increased pulmonary vascular pressure, mild increase in MAP and possibly increased post-operative nausea and vomiting. There are a few studies that do show an increase in PONV with the use of Nitrous, including a study by Tramer, et al published in the *British Journal of Anesthesiology* that showed using nitrous had no effect on nausea, but may slightly increase late vomiting. Other short acting anesthestics may provide the benefits of nitrous such as speed of onset and offset without these side effects. Nitrous is an NMDA receptor inhibitor but its mechanism is incompletely understood. It does NOT seem to affect GABA activated currents. Its affects on the developing brain are now being investigated. Dr. Lynn concluded by pondering whether N20 had lost it's utility in modern pediatric anesthesia practice.

Dr. Susan Verghese (George Washington University) presented the latest literature concerning the use of cuffed and noncuffed endotracheal tubes (ETT). Several studies have shown that cuffed ETTs are useful even in very young children and don't seem to accompanied by all the complications we have feared, if they are used carefully and appropriately. Their major advantage is the decreased need to re-intubate the patient. It is important to use low-pressure high volume cuffs and to inflate the cuff carefully. If nitrous is used for the anesthetic, cuff pressures should be measured or nitrous can be used to inflate the cuff. Cuffed tubes have a smaller margin of error, when it comes to depth of placement. If the tube is too high the cuff can compress the cords causing ischemia and damage, if the ETT is too low main stem intubation can occur. Although the current tubes are not yet ideally designed for young children, research in this area is ongoing.

Dr. William Denham (the Floating Hospital for Children) reviewed the literature on BIS monitoring in children, recognizing that the BIS is not a precise measurement of consciousness. Cortical excitement or depression can be influenced by noxious stimuli. In children less than six months – one year, the validity of BIS has not been established, however in two recently published, well done studies the incidence of awareness was found to be 5-8%! In many of these children the awareness occurred during difficult or multiple intubation attempts. The recent publicity surrounding the issuance of a JACHO Sentinel Event Alert regarding awareness under anesthesia, may force many hospitals and anesthesia departments to develop policies for prevention of awareness that may or may not include BIS monitoring.

The final speaker of the session was **Dr. Carolyn Bannister** (Emory University) who discussed the history and anesthetic management of minimally invasive surgery (MIS), including laparoscopy and thorascopy. The initial procedures in children were performed in the late 1970's, but were abandoned due to a high incidence of complications. With the advent of better equipment the popularity of MIS has soared and the complications dropped. The complication rate for the placement of VSD/ASD occluder devices was found to be 3.8% in one study versus 12% for sternotomy. The most common reasons for converting a MIS to an open procedure include: inability to accomplish the procedure, spillage of contaminated material, bleeding or inadvertent organ damage.

The question answer period at the end of this panel was lively and not unexpectedly focused on the issue of awareness in children. Many in the audience were unaware and quite surprised at the high incidence quoted in the presentation. There is a study underway at Children's Memorial investigating this, however results were not available.

Pediatric Clinical Forum: Tuesday October 26th

Reviewed by: Rita Agarwal, MD, FAAP

Moderator: **Nancy Glass, MD, FAAP, MBA** (Baylor College of Medicine, Houston)
Panelist: **Thomas Cox, MD** (St Louis Children's Hospital),
Aubrey Maze, MD (CEO Valley Anesthesiology Consultant, AZ)
Rita Agarwal, MD, FAAP (The Children's Hospital, Denver)

The cases discussed at the pediatric Clinical forum were the starting point for a lively, informative and entertaining session. The audience was a mix of community physicians, pediatric anesthesiologist and internationally famous academicians such as Drs. Bruno Bissonette, Linda Jo Mason, Mike Badgwell and Etsuro Motoyama.

Case #1 was a seven-year-old girl with Down's Syndrome scheduled for an ORIF of an open right femur fracture following an MVA. Her history was significant for a Tetralogy of Fallot repaired at 18 months. The child was last seen by her cardiologist at the age of five and still had a small residual VSD. At the time of presentation she had had flu-like symptoms for three days including a low-grade temperature, cough and poor appetite. P 110, RR 20, BP 90/50, Temp 38.5, weight 26 kg.

The topics discussed ranged from pre-operative evaluation and preparation (to Echo or not to Echo) intra-operative management and post-operative pain management. Questions focused on the need for further cardiac evaluation, need for rapid sequence induction, whether an LMA would be appropriate in this patient and use of an epidural or fascia iliaca compartment block for pain management. The majority of the audience and panelists agreed that an Echo was probably not necessary (and possibly not attainable, depending on time of the day that the procedure was being done). A good history and physical was mandatory, and an ECG may be useful if there were any concerns about right heart failure. Our issues discussed were concerning systems issues, such as whether or not it would be appropriate for this patient to be cared for at a community hospital and/or by a non-pediatric anesthesiologist.

Case # 2 was a four-year-old boy scheduled for a tonsillectomy and adenoidectomy, who weighed 32 kg and snored loudly at night. The mother thought that he sometimes had "pauses" while sleeping. He had a remote history of asthma, but was on no medications. He was extremely fearful and would not allow the nurse to check his BP.

There was almost unanimous agreement that despite his symptoms this child would benefit greatly from some sort of premedication. Choices included oral midazolam, intra-nasal midazolam, or ketamine. The audience and panelists agreed that this patient's symptoms were consistent with obstructive sleep apnea and that while a pre-operative sleep study would be nice, most would not require one. There was some discussion about using an LMA in this patient, but the majority seemed to agree that this patient might not be the ideal candidate!

Dr. Glass did a superb job engaging and involving the audience.

American Academy of Pediatrics Section on Anesthesiology: Breakfast Panel

Anesthetic Concerns for "Healthy" Kids

Reviewed by: Shobha Malviya, MD

Moderator: Juan Gutierrez, MD

Panel members Shobha Malviya MD, Navil Sethna MB, ChB, and Paul Samuels, MD discussed anesthetic concerns in children with no major co-morbidities. On behalf of the AAP, Dr. Connie Houck identified clinical situations that frequently present significant perioperative concerns in seemingly healthy children.

Dr. Shobha Malviya, Associate Professor of Anesthesiology at the University of Michigan Hospitals and Health Center, discussed the contentious issue of proceeding with anesthesia and surgery in an otherwise healthy child with an upper respiratory infection. She reported that 23 million days of school absence per year in the U.S. are attributed to URIs and that approximately 10-20% of children present for elective surgery with URI symptoms. After a brief discussion of the physiologic changes associated with a URI, Dr. Malviya reviewed the pertinent literature related to URI related complications including laryngospasm and hypoxemia. Differences in study design, varied definitions of URI and varied criteria for cancellation make it difficult to compare the results of most of the reported studies. Yet two recent large, prospective studies by Tait, et al and Parnis, et al identified several risk factors for complications including excessive secretions, nasal congestion, environmental tobacco smoke exposure and use of an endotracheal tube. Other predictors of URI-related complications included a history of snoring, prematurity, reactive airway disease, and non-reversal of muscle relaxants. Dr. Malviya then polled the audience about whether they would proceed with surgery in different case scenarios of children with URIs of varying severity. The audience demonstrated their ability to use the evidence presented to them by largely agreeing on the decision to proceed with or cancel surgery in these situations. The talk concluded with a brief discussion of optimal anesthetic management techniques in the presence of a URI.

The next speaker was **Dr. Navil Sethna**, an Associate Professor of Anesthesiology at the Children's Hospital in Boston and Harvard Medical School. He addressed the controversies of preoperative pregnancy screening tests in adolescents. He identified legal liability, fetal and maternal welfare, right to autonomy and privacy, ethical and moral obligations, and cost as sources of the controversy surrounding routine pregnancy screening tests. The policy at Dr. Sethna's institution is to perform a pregnancy test for females who are 12 years of age or older and all postmenarcheal adolescents prior to surgery. They provide a written copy of the policy to the patient and legal guardian. Dr. Sethna emphasized that at his institution, positive pregnancy test results are disclosed only to the patient since in the state of Massachusetts, a pregnant adolescent is considered an emancipated minor. The patient is then counseled regarding options for disclosure to her parents/guardians and offered social service assistance if needed. Dr. Sethna cautioned that identification of pregnancy in adolescents may be challenging due to their failure to provide a reliable menstrual history and reluctance to disclose sexual behavior. Three surveys that evaluated the practice of routine pregnancy testing prior to surgery found that 24-45% of institutions mandated such testing. Dr. Sethna went on to review two prospective and two retrospective studies that evaluated the value of routine pregnancy testing in all adolescents prior to surgery. These studies reported an incidence of 0-1.3% of positive pregnancy tests in teenagers who had either denied the possibility of being pregnant or stated that they were unsure of this possibility. Dr. Sethna ended his discussion with the recommendations made by the ASA Task Force on Pre-anesthesia Evaluation, and the ASA committees on Ethics and on Practice Parameters. The consensus of these groups is that preoperative pregnancy testing should be *offered* to patients but not *required* unless there is a compelling medical reason to know if the patient is pregnant and whether knowledge of the result would alter the patient's management.

The panel concluded with a presentation on "The Healthy Child with Obesity" made by **Dr. Paul J. Samuels**, Associate Professor of Pediatrics and Anesthesiology at Cincinatti Children's Hospital. Dr. Samuels described obesity as the major public health issue affecting 64% of Americans. He identified sedentary lifestyle and an abundance of high fat/calorie foods as factors contributing to the obesity epidemic in the 20th and 21st centuries. He went on to describe the measurement of obesity and its classification based on Body Mass Index. Furthermore, he noted that 5-10% of overweight adolescents have a BMI greater than 40 and that obesity is more common than cystic fibrosis, juvenile diabetes, HIV and childhood cancers *combined.* Dr. Samuels demonstrated disturbing graphics of increasing distribution and severity of obesity from 1986 through 2002. Another sobering fact is that 90-95% of those who lose weight return to their previous state of obesity. The medical risks associated with pediatric obesity are similar to those in an adult and include: hypertension, left ventricular hypertrophy, insulin resistance and diabetes, and obstructive sleep apnea. Additionally, obese children are at risk for depression, lack of self esteem, and orthopedic conditions including slipped capital femoral epiphysis and Blount's disease. The good news is that weight loss significantly reduces the risk of diabetes and effectively lowers blood pressure. The reversibility of cardiac disease including left ventricular hypertrophy, vasculopathy and coronary artery disease, however, are currently under investigation. After an in-depth discussion of the public health issues related to obesity, Dr. Samuels enumerated the perioperative concerns in these children including: the risks of co-morbidities, obstructive sleep apnea, potential for difficult airway management, caution related to appropriate drug dosing, post-operative analgesia and the need for early ambulation. He predicted that anesthesiologists would be involved with more procedures including bariatric surgery in obese children. Dr. Samuels concluded his talk by emphasizing the need for prevention of obesity and an aggressive approach to weight loss.

POINT/COUNTERPOINT

Parental Presence or Not

By Thomas J. Mancuso, MD, FAAP

This commentary is written from personal experience. In the interest of full disclosure, I must acknowledge that I was an attending anesthesiologist at Egleston Children's Hospital at Emory University and practiced there with Dr. Brosius for many years. As he describes, parental presence at the induction of anesthesia was a rare event. I think that the children under our anesthetic care were served very well without PPI as a routine part of that care. I also must acknowledge that for the past seven years I have been an attending anesthesiologist at Children's Hospital in Boston where, with the help and advice of Dr. Redd and some of my other partners, I have become quite comfortable and proficient at PPI.

Dr. Mancuso with his favorite son.

As Dr. Redd mentions, parental presence at the induction of anesthesia for elective and even emergent procedures is becoming more and more the norm. It is an example of the increased role that patients and families have in directing their care. While I certainly support increased involvement of parents in the care of their children, there are certain preop interviews when I find myself wondering whether the parents are more involved in the care of their child or more involved in their own needs and feelings about their child's planned procedure. The child, after all, is the person who is scheduled to undergo the procedure and the person who should be the primary focus of all concerned. I find myself resisting allowing parental presence when the parents admit that their wish to be present is based largely on their own needs.

I think that both commentators would agree that the provision of a safe, controlled induction of anesthesia is by far the most important goal. Parental presence may, in rare cases, actually help achieve that goal. In most cases parental presence, if properly managed, will certainly not interfere with achieving that goal. This brings me to an important point about PPI. Parental presence at the induction of anesthesia is not a simple matter of dressing a parent in an OR gown and walking him or her back to an OR with their little darling. The entire OR staff must be aware of and involved in the practice. Educational efforts must precede the institution of the practice in order to avoid problems. This was obvious to me when I joined the staff at Children's. Surgeons are certainly aware of the practice here but, in their discussions with families preop, mention to the parents that decisions regarding anesthetic care are left to the anesthesiologist. The RN's in the preop area discuss the practice with families but do not promise it, again leaving the decision to the anesthesiologist. Operating room RN's and assistants all help the parent navigate the OR, help with positioning the child and parent and, importantly, help the parent leave the OR once the induction is complete. In the event of trouble during the induction, the OR RN's are particularly helpful in removing the parent quickly and efficiently so that all can focus efforts on the care of the child.

There is one, somewhat subversive advantage to PPI, enhanced status of the anesthesiologist. At Children's Hospital, I see many a mother or father leaving the OR after participating in a PPI area blinking and dabbing their eyes with a tissue. Many parents who participate in PPI, despite preop education, are often quite surprised by the appearance of their precious child as the induction proceeds. It seems that they are expecting the child to simply "fall asleep" as they might do at home lying on the sofa. When the parents see how different the unconscious state is compared to normal sleep, they come to appreciate the importance of the anesthesiologist in the care of their child.

I think that increased involvement of patients and families in medical care and decision-making is an improvement in the quality of that care. Parental presence at the induction of anesthesia is likely to become more and more the norm and we, as pediatric anesthesiologists should become more comfortable with the practice. It is unlikely, in my opinion, that there will be convincing evidence of the superiority of PPI compared with premedication in allaying anxiety in children, it is even more unlikely that parental presence at induction will be shown to have a detrimental effect on the perioperative care of children.

PPIA: Exposing the Myth

Keith K. Brosius, MD
Assistant Professor of Anesthesiology and Pediatrics
Emory University School of Medicine
Atlanta, GA

Keith K. Brosius, MD

It would seem both artificial and disingenuous to offer an argument opposing an idea and practice that enjoys wide popularity among families of pediatric patients and contributes to overall customer satisfaction. Surveys of parental attitudes consistently reveal that greater than 80% of parents would prefer to accompany their child into the operating room if allowed to do so. Survey results obtained as part of one of many studies on this topic by Kain, *et al.*[1] indicate that more than 90% of parents who accompany their child to the OR believe that they are helpful to the child, and 68% believe that their presence makes the job of the anesthesiologist easier. Parents who attend their children during anesthetic induction not only express greater satisfaction with the separation process, but also with the overall functioning of the operating room and hospital.[2] Not surprisingly, the utilization of Parental Presence at Induction of Anesthesia (PPIA) as a preoperative intervention has increased significantly since the initial report of its prevalence by Kain in 1995.[3] That said, it is important to understand what PPIA does and does not accomplish, and to whom the perceived benefit is conferred. In an excellent editorial on the subject of PPIA published in the April 2000 edition of *Anesthesiology*, Dr. Jerrold Lerman writes: "To suggest that institutions that do not allow parents to accompany children during induction of anesthesia are abrogating their responsibility to the child and fostering substandard care is unfounded. To suggest that institutions that encourage parents to accompany their child during induction of anesthesia provide better care is equally unfounded."

With respect to the paramount individual entrusted to our care, the patient, available evidence indicates that PPIA does not reliably reduce perioperative anxiety or contribute to better compliance during anesthetic induction.[2,4] When compared to an unpremedicated control group whose members were not accompanied to induction by a parent, assessed anxiety in unpremedicated children participating in PPIA was not diminished.[4] Only within a small select subset of unpremedicated patients does parental presence actually confer any anxiolytic effect.[1] In direct contrast to PPIA, effective sedative premedication in the form of oral midazolam (0.5 mg/kg) has been convincingly demonstrated to attenuate the escalating anxiety experienced by most children during the immediate preoperative period.[4] PPIA provides no additive anxiolytic benefit and does not improve compliance during induction in these premedicated patients.[2]

Does PPIA possibly benefit the anesthesia care provider? When surveyed, Yale University anesthesiologists did not share the parents' self-assessed belief that their presence is both beneficial to their child and to the medical personnel caring for their child. Only 12% of anesthesiologists rated parental presence as helpful to the child. 38% felt that the parent had no effect on their ability to perform their job, and fully 21% felt that the presence of a parent made the job more difficult.[1] It is important to point out that these opinions were elicited within the context of ASA I and II patients undergoing elective outpatient surgery. Given more challenging patients and/or procedures, it is reasonable to surmise that the potential for a parent to distract providers from their primary focus would result in an even more negative appraisal of the parent's contribution.

Empirical evidence fails to support a clear benefit of PPIA to the patient, and anesthesiologists' attitudes are at best equivocal regarding parental presence. To what should we then attribute the growing popularity of this practice? The answer lies in the benefit, real or perceived, to the parents themselves. The fundamental driving force behind PPIA is a natural parental instinct to protect their child and a desire to exert some measure of constancy and control in a threatening and unfamiliar environment. But even considering the benefit to parents, exclusive of any benefit to the child or care providers, the available evidence is equivocal. Compared to parents not participating in PPIA, the self-reported anxiety of parents accompanying their child to the OR has been variably reported by the same investigator to be either reduced[2] or unaltered.[4] Physiologic measurements, however, suggest that parental self-assessment is unreliable. Relative to a control group, parents participating in PPIA experience significant increases in HR and skin conductance level, both of which are modulated by emotional stress.[5] Kain, *et al*. make the specific point that the parents evaluated in this study had a mean age in the 30's and 71% were women. The possibility for the development of significant dysrhythmia or ischemia in older fathers present during the induction of sicker children cannot be discounted. Again, borrowing a quote from Dr. Lerman, "When the potential for serious cardiac events is combined with the potential for other injuries, the liability from PPIA may be greater than previously appreciated."

Recommendations based upon the available data can be very simply summarized. If the goal is a reduction in patient anxiety and improved compliance with anesthetic induction, sedative premedication is the treatment. If the goal is a self-perceived reduction in parental anxiety and enhancement of customer satisfaction, PPIA is the answer. In our role as pediatric practitioners, we have a duty not only to treat the patient but also to formulate policies and practices that consider the needs of the entire family. Neither PPIA nor sedative premedication excludes concurrent use of the other. Our current institutional policies prohibit the presence of parents within our main operating rooms primarily due to infrastructure constraints. We do, however, allow and encourage parental involvement at all ancillary anesthetizing locations. Given a conducive physical plant, I'm confident that we too would succumb to current trends and permit PPIA for the vast majority of procedures. I feel it is important to understand why we engage in this practice and who we are actually "treating" with PPIA. We must remember that our first duty is to the patient. For any specific set of circumstances, if in our best judgment parental presence might reasonably be expected to interfere with this duty, then its use requires selective suspension.

1. Kain ZN, Mayes LC, Caramico LA, et al. Parental Presence During Induction of Anesthesia: A Randomized Controlled Trial. *Anesthesiology* 1996; 84(5): 1060-67.
2. Kain ZN, Mayes LC, Wang S, et al. Parental Presence and a Sedative Premedicant for Children Undergoing Surgery: A Hierarchical Study. *Anesthesiology* 2000; 92(4): 939-46.
3. Kain ZN, Caldwell-Andrews AA, Krivutza DM, et al. Trends in the Practice of Parental Presence During Induction of Anesthesia and the Use of Preoperative Sedative Premedication in the United States, 1995-2002: Results of a Follow-Up National Survey. *Anesth Analg* 2004: 98(5): 1252-59.
4. Kain ZN, Mayes LC, Wang S, et al. Parental Presence During Induction of Anesthesia versus Sedative Premedication: Which Intervention is More Effective? *Anesthesiology* 1998; 89:1147-56.
5. Kain ZN, Caldwell-Andrews AA, Mayes LC, et al. Parental Presence During Induction of Anesthesia: Physiological Effects on Parents. *Anesthesiology* 2003; 98(1): 58-64.

Parent Present Inductions-Advantages

Sharon L. Redd, MD
Senior Associate in Anesthesia
Boston Children's Hospital
Boston, MA

Three of Dr. Redd's most notable accomplishments

The practice of Parent Present Inductions (PPI) is certainly more common in the new millenium, than it was even in the nineties, but still remains a bit controversial.

The specific events that led to the practice of PPI are not clear but more than likely stem from the liberalization of parents visiting rights, as well as the recognition by many child psychiatrists of the adverse impact of separation from parents on the hospitalized child. This had been confirmed by early reports most notably Dr. Shulman (1967) study revealing how a child may depend on the support of a parent when encountering unfamiliar routines or a threatening environment.

It is believed that Parent Present Induction was introduced into clinical practice in 1961. A formal Parent Present Induction program was established in 1989 at Children's Hospital in Boston, allowing a parent to be present at the start of anesthesia when it is considered beneficial for the child. One of the catalysts for developing this program grew out of the interest and concerns of a hospital parent advisory group. The experience of some parents, nurses and doctors, who specifically requested to be present at the start of anesthesia and later described their experience negatively secondary to lack of preparation….not knowing what their role was in the process or what to expect, was another.

Continued on page 10

Point/Counterpoint

Continued from page 9

Certainly, the induction of anesthesia can be accomplished in many ways. There are a variety of medications that may be administered in the preoperative holding area in the presence of a parent. The medications can be effective in eliminating the distress of separation and the beginning of anesthesia. When preoperative medications are not necessary or are contraindicated, a parent accompanying a child into the operating room can be an option for easing separation, separation anxiety and facilitating an anesthesia induction for the child.

The decision to offer a parent present induction is individualized recognizing the child's age, developmental stage, emotional status, degree of anxiety and willingness to cooperate. A child who might benefit from having a parent present for the start of anesthesia is generally between the ages of one and nine years. Another factor that is considered is the comfort of the parent in his or her prospective role.

Parental preparation is an integral part of a successful Parent Present Induction program.

Educating parents with regards to their role while in the operating room and to what they might expect is paramount to ensuring the supportive and safe presence of a parent. This teaching is offered by designated nurses and a child life specialist who specialist who specifically works with our children preoperatively.

There are several advantages of having a Parent Present Induction program available.

1. Typically the hospital environment in itself is enough to produce anxiety and stress and we know that children depend on their parents for support in most instances. It should not be surprising that if a child did not have to anticipate being separated from a parent that one might see **improved behavior and attitude** on the part of the child and less anxiety from the parent.
2. PPI can **minimize the need for heavy sedation**, which can be beneficial, especially prior to an expected short procedure in an ambulatory setting or if a chid is not a candidate for preoperative sedatives.
3. This practice can **enhance the efficiency of the operating room** since one does not have to predict surgical starting times to determine when a premedicant can be given. It prevents surgical delays while one waits for the desired effect and obviates the need to wait for recovery enabling earlier discharge.
4. Parents are and should be encouraged to be proactive. They are seeking **different means to facilitate induction** of anesthesia for their child/ren. PPI can be that other option in the anesthetic plan that they are seeking.

Currently, greater than 70% of elective anesthesia inductions in children, ages one to nine years, are performed with a parent present. Many of our families request that we consider this technique. Having a Parent Present Induction program with parental preparation included and an assistant available to escort the parent from our busy operating room makes this very easy. Rigid policies concerning parents in the operating room are unlikely to be universally accepted. A flexible approach is probably best since there haven't been any minor or major complications attributed to the presence of parents during induction of anesthesia. We are in the business of caring for children and parents.

References:

Shulman JL, et al. *Pediatric*, V39, No 1, Jan. 1967
Yemen TA, et al. *Anesthesiology*, V77, No 3A, 1992
Kain ZN, et al. *Anesthesiology*, V84, 1996

Literature Reviews

The effect of nitrous oxide on cerebral blood flow velocity in children anaesthetised with sevoflurane.

Rowney DA, Fairgrieve R, Bissonnette B. *Anaesthesia*. 2004 Jan;59(1):10-4.

Reviewed by: Zulfiqar Ahmed, MD
Children's Hospital of Michigan
Detroit, MI

In this article investigators measured the effects of nitrous oxide on cerebral blood flow velocity (CBFV). These measurements were done in ASA I-II children undergoing elective urologic surgery with caudal/general anesthesia. A constant fraction of 30% inspired oxygen and sevoflurane anesthesia was maintained, with addition and removal of nitrous oxide. The patients were divided in two groups. The first group received nitrous oxide-air-nitrous oxide and the second group received air-nitrous oxide-air. The article showed that nitrous oxide increases the CBFV in these children.

The difference in cerebral blood flow with and without nitrous oxide was statistically significant. The article did not present a tabulated form of the data but showed the changes in a graph.

Later in the discussion section, the authors mention that sevoflurane has favorable cerebral hemodynamics compared to nitrous oxide. It causes less intrinsic cerebral vasodilatation and preserves dynamic cerebral auto-regulation. It has already been shown that sevoflurane/50% N2O in children decreases the cerebral vasoconstrictive effects on hypocapnia. This study shows that addition of nitrous oxide to 1.0 MAC of sevoflurane increases cerebral blood flow in children.

This article reinforces the potent vasodilatory effects of nitrous oxide on cerebral blood flow described by Lam AM, *Anesth Analg*. 1994 Mar;78(3):462-8.

The pharmacokinetics of the intravenous formulation of fentanyl citrate administered orally in children undergoing general anesthesia

Wheeler M, Birmingham P, Lugo R, Heffner C, Coté C. *Anesthesia & Analgesia* 2004;99:1347-51.

Reviewed by: Cheryl K. Gooden, MD, FAAP
Mount Sinai Medical Center
New York, NY

Review: The goal of the study was to determine whether administering an oral fentanyl solution to children would result in similar fentanyl plasma concentrations and pharmacokinetic variables as administering comparable doses of oral transmucosal fentanyl citrate (OTFC). The investigators of this study evaluated several variables, and these included: (1) time to minimum effective concentration, (2) peak concentration, (3) terminal elimination half-life, (4) area under the plasma concentration time curve, (5) apparent oral fentanyl clearance, and (6) apparent oral volume of distribution at steady state. This pilot study consisted of 10 patients, aged five – 11 yrs. American Society of Anesthesiologists physical status I or II, and scheduled for elective surgical procedures that had minimal anticipated blood loss, required overnight hospitalization, and were anticipated to require postoperative analgesia. Exclusion criteria for this study included children younger than five years because these children would be unable to reliably perform a "swish and swallow" of water after receiving the liquid

fentanyl. Each patient received the undiluted IV formulation of fentanyl citrate in a dose of approximately 10 – 15 mcg/kg (maximum dose 400 mcg), in the pre-operative period.

An inhalation induction consisting of sevoflurane in oxygen and nitrous oxide was the technique of choice. After induction, an intravenous (IV) catheter was inserted, and all blood samples were obtained from this site, 15 to 600 minutes after fentanyl ingestion. Anesthesia maintenance consisted of isoflurane with oxygen and nitrous oxide. A nondepolarizing muscle relaxant of either pancuronium or rocuronium was administered to each patient. The decision to provide additional analgesia was at the sole discretion of the anesthesiologist. All patients received some form of analgesia in addition to the fentanyl. The additional analgesia consisted of ketorolac, a field block placed by the surgeon, a caudal block, or morphine. The duration of anesthetic time was 100 – 454 minutes.

During the course of this study, 134 blood samples were collected. Seven samples were below the limits of detection, and therefore 127 samples were analyzed. The data was compared with the data obtained by the same group of investigators from two of their previous studies of children who received OTFC.

Following final analysis of the data, this study showed that only two variables, namely, the time to reach peak concentration and the apparent oral volume of distribution at steady state were statistically different between the current study and the two previous studies. The time to reach peak concentration after orally administered fentanyl occurred significantly later than with OTFC. The fentanyl concentrations reached after administration of both formulations were comparable.

Comments: This study is one in a series by these investigators to evaluate the pharmacokinetics of fentanyl. However, unlike their previous two studies involving OTFC, their current study looks at the use of the IV formulation of fentanyl administered orally. There have been several concerns associated with the use of the OTFC in children and these include chewing of the Fentanyl Oralet®, variability in the time to consume, and patient refusal to completely consume it. So, an oral solution of fentanyl would be ideal. Although the concept of using IV fentanyl by an oral route may seem appealing, there can be problems associated with its use. This is no surprise to anyone. The results of this pilot study, suggest that this method of administration should be used with caution. Further studies are required, before drawing any conclusions.

Routine morphine infusion in preterm newborns who received ventilatory support

Simons, *JAMA*, 2003; 290: 2419-2427

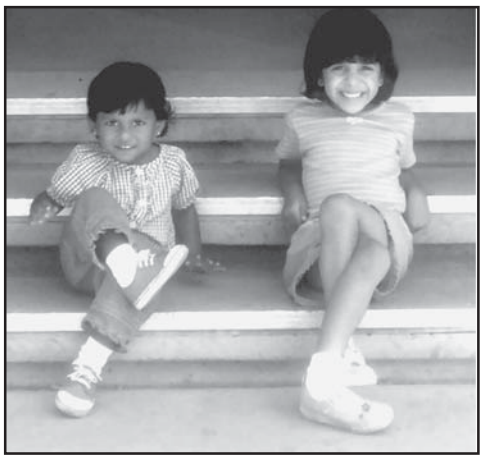
Reviewed by: Michael J. Williams, MD
Jefferson Medical College
Thomas Jefferson University
Philadelphia, PA

Since its publication in 1987, most pediatric anesthesiologists have quoted Anand's paper on the use of narcotics in preterm infants, showing the necessity of analgesic therapy in these patients. In my experience, Anand's article has been used, rightly or wrongly, to justify the use of morphine infusions in these patients while on ECMO, for postoperative pain control and sedation, and for general sedation while requiring ventilatory support. Recently, Mr. Simons and others look at the use of morphine infusions in preterm newborns that required only ventilatory support to determine if there was any benefit of morphine infusion in these patients.

The study was performed in two level III NICUs in the Netherlands. The total study number was 150 newborns, who were less than three-days-old, postnatally, and had been ventilated less than eight hours before entry into the study. Exclusions included asphyxia, severe IVH, major congenital malformations, and administration of neuromuscular blockers. A total of 150 babies were enrolled. The patients were randomly assigned by double-blind methods to receive either IV morphine (100 mcg bolus and 10 mcg/kg/hour) or placebo bolus and infusion. The primary outcome measures were caregiver and researchers assessments of the infant's distress using the Neonatal Infant Pain Scale, VAS and the Premature Infant Pain Profile. The researchers also measured whether there was a difference in neurological outcome between the two groups by look at incidence IVH, death, and poor neurological outcome.

What I found interesting was that the research group found no difference in the assessed pain levels of either the study or placebo groups. In addition, they found no difference in neurological outcomes of premature infants who received morphine infusions during ventilatory support although the infusion of morphine did significantly decrease the incidence of IVH. What this study does suggest is that routine morphine infusions may not be required in patients requiring only ventilatory support and not experiencing more severe noxious stimuli from surgery, blood draws or other sources.

What Kid's Like



Emmen Ahmed (right) is eight years old. She likes sports, cooking and arts. Emmen likes gymnastics as well. She does not like getting into trouble or getting hurt. She is scared of the deep side of the swimming pool. Emmen plans on becoming a doctor.

Sabine Ahmed (left) is four years old. She likes to help Dad cook, likes to put clips in her hair, and to visit her aunt's house in Chicago. Sabine does not like to sleep during the day and doesn't like it when her mother gets mad at her. She also does not like her sister. Sabine wants to play games on the computer when she grows up.

The complete article is online at www.pedsanesthesia.org

Topic Review

Emergence delirium: Myth or Reality?

By: Helen V. Lauro, MD, FAAP

Emergence delirium (ED) has been described as a short-lived, acute organic mental state of uncertain etiology.[1] Once the pediatric patient is reunited with the parents, the diagnosis is one of exclusion from the usual etiologies of pediatric postoperative delirium. These include ventilatory issues (hypoxemia, hypercarbia), electrolyte abnormalities (hypoglycemia, hypocalcemia, hyponatremia, hyperkalemia), hypovolemia, elevated intracranial pressure, residual effects of anesthetics and/or excitatory effects of drugs such as meperidine and ketamine, and pain.[2] Many affected patients are healthy ASA 1 children presenting for routine outpatient surgery. Clinical manifestations include inconsolability with wild thrashing, kicking and screaming; sleepiness with sudden outbursts of crying, restlessness, confusion, agitation and combativeness; disinterest in drinking. The child appears to be in the excitement stage of general anesthesia, where every stimulus causes an exaggerated response of agitation.

The incidence of ED has been reported between 10-50% [3] and is highest in the one-nine-year-old age group. A prospective study involving 260 children requiring outpatient lower abdominal surgery concluded thirty percent of the children experienced a period of inconsolable crying or severe restlessness following anesthesia. The frequency of this behavior was greatest on arrival in the recovery room, but many children who arrived asleep in the recovery room later experienced a period of agitation or inconsolable crying.[3]

Despite multiple hypotheses, the etiology of ED remains unresolved. Rapid emergence is cited by many pediatric anesthesiologists as the "price paid" of the more rapid induction achieved by the newer volatile agents, such as sevoflurane, where the low blood gas partition coefficient induces a more rapid and turbulent awakening. [4,5] ED is more pronounced with sevoflurane and desflurane than with isoflurane or halothane. [6] However, agitation and disorientation are not necessarily associated with rapid return to a state of consciousness.

Other explanations given for this behavior are that it is really a response to pain. When the induction and emergence are so rapid with a volatile agent, there may not be time for postoperative analgesia to set in, and patients are responding to pain. [7-11] Proponents of this view offer support of the more comfortable and calmer emergence of pediatric patients given intraoperative analgesia. However, anxiolytic premedication and effective analgesia in pediatric patients does not necessarily prevent emergence delirium. Furthermore, many pediatric surgical procedures are short and not associated with significant postoperative pain. Many patients' reports confirm pain was not significant on emergence. [1]

Temporary neurologic dysfunction has been advocated as an alternative explanation for ED. Constant et al.[1] demonstrated that the EEG pattern in children anesthetized with sevoflurane differs from that of individuals anesthetized with halothane. These volatile anesthestics may have different central effects, which may explain the different emergence characteristics. To date, no investigations exploring the neuropsycho-pharmacological properties of sevoflurane or its metabolites and other inhaled anesthetics have been reported to explain the phenomenon. Studies examining the effect of sevoflurane anesthesia upon postoperative behavioral changes in pediatric patients have concluded there was no association between anesthetic agent and longstanding behavioral changes.[12]

Instruments to evaluate emergence delirium have included assessment tools using psychiatric terminology and technique, guided by Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) to evaluate pain, distress and delirium. In that study, 44% of children demonstrated altered behavior on emergence; 20% demonstrated complex symptoms with characteristics of delirium.[13] The Pediatric Anesthesia Emergence Delirium (PAED) scale[14] is comprised of five items (eye contact with caregiver, purposeful actions, awareness of surroundings, restlessness, inconsolability), and assigns an overall score to the patient. Scores correlated negatively with age, and time to awakening, and were greater after sevoflurane than halothane.

Intraoperative strategies directed at mitigation of ED have involved virtually every conceivable intravenous agent. These include intravenous morphine (0.05mg.kg) to facilitate sedation. Other possibilities include ketorolac,[15] fentanyl,[16,17] clonidine,[18] ketamine,[19] tramadol,[20] and dexmedetomidine.[21] Propofol and midazolam do not reduce the incidence of emergence agitation as reported in a randomized blinded prospective study of 69 children undergoing tonsilloadenoidectomy.[22] Oxycodone also does not reduce emergence agitation.[23] Intraoperative use of high concentrations of sevoflurane up until the end of the case, to delay emergence, cannot be relied on to avert this outcome. This method will only result in the patient entering "Stage 2" in the postanesthesia care unit, where hospital manpower may be limited in treating possible airway complications. Maintaining anesthesia with a different volatile drug such as desflurane, after sevoflurane induction, has also been ineffective in preventing ED.

The only really effective postoperative management of ED involves supportive care, minimizing external stimuli, but most of all, time. The child should be covered with a warm blanket on a stretcher or in a crib with padded side rails or bumpers, or alternatively, cradled in the parent's arms, and encouraged to fall asleep.

Complete references are available online at www.pedsanesthesia.org.