Society for Pediatric Anesthesia
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SPA NEWS

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Steven Hall, Linda Mason and Zeev Kain enjoy an event at the SPA/APA Joint Annual Meeting in San Francisco in October.

Application for Subspecialty Certification in Pediatric Anesthesia Submitted to ABA

By Allison K. Ross, MD
SPA News Editor

The Society for Pediatric Anesthesia recently submitted an application to the American Board of Anesthesiology (ABA) for subspecialty certification in pediatric anesthesia. There have been ACGME-accredited fellowship training programs since 1997, but this training has not been accompanied by a subspecialty certificate issued by the ABA. Dr. Frank McGowan, the Immediate Past President of the SPA, has spearheaded the application process. If successful, pediatric anesthesiology will be one of four subspecialties in anesthesia to be recognized with a separate certification. The other subspecialties with separate board certification are Pain Medicine, Critical Care Medicine, and, shortly, Hospice and Palliative Care Medicine.

Dr. Steven Hall is immediate past-Secretary of the ABA and past-President of the SPA. According to Dr. Hall, the application is complete and several letters of support have been received. The ABA has forwarded the application to the leadership of the ASA, AUA, and SAAC/AAPD in case they wish to offer any comments. The ABA's Board of Directors meets four times per year and will review the submitted application in 2008.

The recognition of pediatric anesthesiology as a board-certified subspecialty is supported by the Board of Directors of the SPA and will help to define the specialty alongside those of the pediatric medicine and surgical professions to further improve the care of the patients that are served.

FROM THE EDITOR

What is a Pediatric Anesthesiologist?

I hope that everyone has had a chance to read the update on the application for subspecialty certification in pediatric anesthesia that has been submitted to the American Board of Anesthesiology. As pediatric anesthesiologists, we cannot help but believe that setting certain standards in our specialty will help us to take care of children in the safest manner possible. There remains an important question that accompanies this quest, "What is a pediatric anesthesiologist?"

If you are a member of SPA and have paid the dues to receive this newsletter, chances are you are a pediatric anesthesiologist. It is conceivable that you completed a fellowship in pediatric anesthesia as either part of your CA-3 year (for you old-timers), or as a CA-4 following your anesthesia residency. Some of you may even be double boarded in pediatrics and anesthesia, and therefore hold a golden ticket to the title.

However, does this mean that a lack of fellowship should exclude those individuals who spend a significant percentage of their career taking care of children for all types of procedures? Certainly not. But what is considered a significant percentage? If 50% of an individual's practice is involved with research, education, or administration, the other 50% may not be pediatric. This can result in exclusion of academicians who have positions that are not wholly within a children's hospital, despite teaching residents and delivering lectures on pediatric topics. It also excludes private practitioners with years of experience taking care of children who primarily manage adult patients. Exclusion should never be the intent of defining the title.

At my own institution, which is a pediatric center inside an adult environment, there are many faculty who are comfortable taking care of children, but they would never consider caring for the sick neonate. Are they pediatric anesthesiologists? According to the individual's institutional credentialing committee, they are probably credentialed to take care of children, but age limits are often the deciding cut-off factor. This results in a two or three tier system of pediatric providers, all of whom can call themselves pediatric anesthesiologists. Why not? It takes a special person to make a child feel comfortable in the perioperative environment and instill a sense of confidence that permeates the experience for the family. This gift is not limited to the fellowship-trained, lecture-giving pediatric anesthesiologists, nor is it the only part of the elusive definition.

This edition of the newsletter touches on being a pediatric anesthesiologist in several ways. The front page article is an update on the status of the application of the subspecialty certification. The Pro/Con stretches the limits by defining the roles of the pediatric anesthesiologist and how it can be further delineated. And, finally, the meat of this newsletter is in the field of pediatric anesthesia as reviewed in San Francisco. The reviewers of these sessions did a fabulous job for those of you who could not attend.

The question of how to define a pediatric anesthesiologist goes unanswered. There is so much more to consider on this topic, but I am on call, and I can promise you that when I get summoned at 3:00 am for a 700-gram baby with NEC, I am sure I will introduce myself to the family as a pediatric anesthesiologist…because I can.

Allison K. Ross, MD

TO THE EDITOR

In the Summer 2007 Newsletter cover story, Dr. Sparks describes his experience aboard the USNS Mercy during the disaster relief efforts in the wake of the 2004 tsunami in Southeast Asia.

Recently, the hospital ship USNS Comfort (T-AH-20) embarked on a similar four-month humanitarian mission to 12 Central and South American countries from June through October 2007. The USNS Comfort (T-AH-20) is the sister ship of the USNS Mercy (T-AH 19).

The goal of the 2007 mission, appropriately titled, "Partnership for the Americas", was to coordinate with host nations and non-governmental relief organizations (Project HOPE and Operation Smile) in providing medical, dental and other humanitarian assistance both ashore and afloat at mission sites in Belize, Guatemala, Panama, Nicaragua, El Salvador, Peru, Ecuador, Colombia, Haiti, Trinidad, Guyana, and Suriname.

During this mission, the department of anesthesiology consisted of two anesthesiologists – one a fellowship-trained pediatric anesthesiologist – and four certified registered nurse anesthetists with various levels of pediatric experience.

A variety of pediatric surgical procedures were performed during the mission although the vast majority of procedures were cleft lips and palates, oral rehabilitation, complex pediatric orthopedic repairs, tonsillectomies, hernia repairs, and circumcisions.

All told, the Comfort performed more than 400 surgical procedures on patients under 12 years of age. The desire to serve as many pediatric patients as possible, with a limited engagement at each mission site, was a challenge, as was balancing the surgical complexity and recovery with the time available at each mission site.

This humanitarian mission was similar in many aspects to the disaster relief mission that Dr. Sparks described. Both exemplify cooperation and teamwork in joining medical assets from multiple military, civilian and non-profit health care organizations. Also, in both cases, the dedicated cooperation of these agencies led to highly successful and impressive caseload outcomes, performed in environments of patient safety.

Philip Bailey, DO
Director, Pediatric Anesthesiology
Naval Medical Center Portsmouth

PRESIDENT'S MESSAGE

Jayant K. Deshpande, MD
Vanderbilt Children's Hospital,
Nashville, TN

The Society for Pediatric Anesthesia has had a very fruitful 21st year as an organization dedicated to the advancement of the practice of pediatric perioperative care. Our current membership totals over 1700 practicing anesthesiologists and 2300 resident members. Earlier this year, the Winter meeting – Pediatric Anesthesiology 2007 – was held in Phoenix, AZ, and was attended by nearly 600 registrants. The new Congenital Cardiac Anesthesia Society (CCAS; www.pedsanesthesia.org/ccas) was launched with an inaugural scientific and educational meeting which proved to be an overwhelming success.

The recent Fall Meeting in San Francisco was a joint meeting with the Association of Paediatric Anaesthetists of Great Britain and Ireland, with experts speaking on "Pediatric Anesthesia Developments and Outcomes" was the best attended Fall Meeting on record with nearly 500 registrants. The symposium was an excellent collection of scientific updates and clinical pearls. SPA members also actively contributed to the scientific and education sessions of the ASA Annual Meeting. The summaries presented in this edition of the *SPA Newsletter* provide further detail on these events

The upcoming **Pediatric Anesthesiology 2008** in San Diego will offer a cornucopia of educational opportunities (see the program announcement). The CCAS will host its second annual meeting and will feature updates on the science and art of the perioperative care of children with congenital heart disease. Attendees may elect to take the course in Pediatric Advance Life Support (PALS) and update their PALS certification. A broad range of workshops, refresher courses and PBLD's (problem based learning and discussions) complete the educational offerings. Alternately, you may want to select the all-day update on MH hosted by the Malignant Hyperthermia Association of the United States (MHAUS). Details of the upcoming meeting can be found on the SPA website www.pedsanesthesia.org.

The Education Committee and the workgroup on enduring materials works hard to post monthly continuing medical education (CME) opportunities on the Society's website, www.pedsanesthesia.org, as a member benefit. The Society is actively pursuing continuing quality improvement initiatives. The Pediatric Regional Anesthesia Network (PRAN) is a coalition of members sharing their experiences through a registry of information on regional anesthesia in children. The quality improvement work group has been working on the "Wake Up Safe" initiative to define a process to review and learn from perioperative adverse events and near-miss situations in order to improve how we deliver patient care.

The stewardship of the Finance Committee and the SPA Board has produced a sound financial footing for the Society, allowing us to continue to provide and expand member benefits. Thanks to all of the members who have made their charitable contributions, the SPA Education and Research Fund has continued to grow. You can make your contribution to the fund on-line at www.pedsanesthesia.org.

The SPA Board is committed to a culture of inclusiveness and involvement by all member practitioners of pediatric perioperative care. I encourage you to actively participate in the Society through one of the working committees. To volunteer, you can contact the committee chair or me. I also encourage you to send me your thoughts and ideas on how the Society can serve you better.

I wish you and your families a peaceful and happy New Year.

Jayant K. Deshpande, MD
jay.deshpande@vanderbilt.edu

BOOK CORNER

By: Helen V. Lauro, MD, FAAP

Pain in Neonates and Infants, editors K. J. S. Anand, MBBS, DPhil, B.J. Stevens, R.N., PhD, and Patrick J. McGrath, OC, PhD, FRSC., 329 pages, $100.00, ISBN 0444520619, New York, N.Y., Elsevier, 2007.

Without a doubt the only thing better than listening to K.J.S. ("Sunny") Anand speak on neurobiology of acute pain in children, is reading his newly released textbook, co-authored with B.J. Stevens and Patrick J. McGrath.

Their new third edition on pediatric pain is comprised of 23 chapters featuring international contributors from United States, Canada, United Kingdom, the Netherlands, South Africa and Australia and New Zealand. The authors emphasize in the preface their decision to modify the title from prior editions to reflect emphasis not only on neonates but also older infants, an area frequently neglected by other pediatric pain textbooks. Brand new chapters include long-term consequences of neonatal and infant pain from animal models, pharmacogenetics and pharmacodynamics of analgesic drugs, central and peripheral regional analgesia and anesthesia, fetal pain and surgery, vulnerable populations and palliative care, infant pain in the home and community, developing countries, health policy and health economics related to neonatal pain, complementary and alternative approaches to pain in infancy and future directions.

The text offers utility for students, researchers and clinicians with an overview of pain in neonates and infants and development and pathways of pain processing, the latest research advances in neonatal and infant pain, and evidence-based practices. The chapter on assessment of pain in neonates and infants is noteworthy, summarizing in clear shadow boxed tables all of the composite pain measures in infants. Figures are clearly drawn and tables are neatly formatted, all black and white.

Overall a "must-have."

Sickle Cell Disease – Defining Our Understanding

By Tae W. Kim, MD
Assistant Professor, Texas Children's Hospital

According to the Centers for Disease Control, there are more than 70,000 people who suffer from sickle cell disease in the United States. One in 500 African-Americans has sickle cell disease and 1 in 12 has sickle cell trait. In addition, 1 in 1,000 to 1,400 Hispanic Americans has sickle cell disease, representing the fastest growing segment of the American population. The growing prevalence of sickle cell disease from 1989 to 1993 resulted in 75,000 hospitalizations at a cost of $475 million.

Sickle cell disease encompasses many variants of hemoglobin, from the mild condition of sickle cell trait, AS, to the severe form of sickle cell anemia, SS, and to the more exotic sickle thalassemias, such as Sβ°thal. The molecular origin of sickle cells involves the substitution of valine for glutamic acid on the β-globin chain of hemoglobin. This substitution results from a point mutation of thymine for adenine on chromosome 11.

This gene mutation creates a hemoglobin S molecule, which under conditions of hypoxemia and acidosis, will polymerize with other hemoglobin S molecules to form intracellular strands resulting in a sickle shape. However, the transformation alone is unable to explain the clinical manifestations of sickle cell disease.

Our understanding of the pathophysiology of sickle cell disease has been greatly broadened by the proposition of a complex interaction between sickled red blood cells and the vascular endothelium. Current theory incorporates the presence of "sticky" cells, sickle cells with disrupted cell membranes, which readily adhere to reactive vascular endothelium. Red blood cells as they circulate and deoxygenate are predisposed to sickling. The process of sickling requires more than one circulation time through the body, and therefore the red blood cells are able to return to the pulmonary circulation and become oxygenated prior to sickling. A small percentage of red blood cells of sickle cell patients undergoes a transient phase of sickling as they circulate through the body. These "reversible" cells transform as they acquire and lose oxygen as they transit the body. However, conformational changes are not unlimited and with each cycle the red blood cells lose this ability and eventually become "irreversibly"sickled. The cell membranes become fragile, prone to rupture and more predisposed to adhere to the vascular endothelium, "sticky" cells.

The integrity of the vascular endothelium becomes compromised as the sickle cells rupture and release hemoglobin and iron into the circulation and attach themselves. The release of hemoglobin results in the reduction of available nitric oxide which reduces the ability to regulate vascular tone. In addition, the presence of free iron has a direct effect on the endothelial cells causing an inflammatory response with release of mediators. The cascade of inflammatory response from the mechanical and oxidant stress predisposes to thrombus formation resulting in ischemia and end organ damage.

Blood transfusion therapy has been a focal point in the therapeutic management of sickle cell patients. Administration of normal red blood cells increases oxygen carrying capacity and decreases viscosity. The landmark Cooperative Study of Sickle Cell Disease (CSSCD) of 1995 addressed an important issue of whether an aggressive transfusion regimen held any advantage over a simple transfusion. Vichinsky et al conducted a prospective randomized multicenter study involving 551 patients for a total of 604 operations. The patients were randomly assigned to one of two groups, aggressive transfusion or simple transfusion. The aggressive transfusion was designed to reduce the hemoglobin S level to less than 30% and the conservative regimen was designed to increase the hemoglobin level to 10 g/dl. The findings of the study showed the perioperative complication rate was the same for both groups, however there were two deaths and twice as many transfusion-related complications in the aggressive group. The authors concluded simple transfusion was more beneficial than aggressive transfusion.

Further analysis of the data from the CSSCD helped define the morbidity and mortality associated with surgery and sickle cell disease. Koshy et al reviewed the course and outcome of 1,079 surgical procedures performed on 717 patients. The incidence of sickle-cell and non-sickle cell related complications varied greatly with the anesthetic technique, the procedure and blood transfusion status. The most common sickle-cell related complication among the groups was a painful crisis. Notably, the use of regional anesthesia in the moderate risk group experienced a higher complication rate for both non-sickle cell related and sickle-cell related complications. However, the authors attributed the higher incidence to the higher complication rates observed in obstetrical procedures. The overall mortality rate was 0.3%, representing 3 deaths in patients 14 years of age and over.

Koshy et al were unable to demonstrate any significant benefit of a blood transfusion in SS patients, except in low risk operations whereas in SC patients, the benefits of transfusion were seen at all surgical risk levels. A study by Haberkern et al looked at the effects of transfusion and surgical method on perioperative outcome in patients undergoing a cholecystectomy. Three hundred and sixty-four patients were assigned to 4 groups based on their transfusion status: aggressive transfusion, conservative transfusion, nonrandomized nontranfusion, nonrandomized transfusion.

The total complication rate was 39% with sickle cell events representing 19%. The nonrandomized nontransfused group had the highest incidence of sickle cell events and 5 deaths, while there was only 1 other reported death. However, the authors cautioned that the nonrandomized nontransfused group represented a small number of patients.

Waldron et al studied 136 patients undergoing tonsillectomy and/or adenoidectomy and 29 patients undergoing myringotomy. Patients were assigned to the aforementioned 4 groups based on transfusion status. The randomized groups showed no differences in the frequency of complications. The study concluded that simple transfusions were appropriate and tonsillectomy and/or adenoidectomy surgery was associated with a high frequency of sickle cell-related complications and excessive blood loss. In a more recent study on 28 children with Hb SS by Fu et al, preoperative blood transfusions were not necessary for minor elective surgical procedures. The findings of the study showed a 15% incidence of minor post-operative complications with no perioperative transfusion given in 85% of the cases.

Vichinsky et al conducted a prospective randomized study of 118 patients undergoing 138 orthopedic surgeries. Patients were assigned to the 4 groups based on transfusion status. Their find-

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Joint Annual Meeting with APA well received

By Helen V. Lauro, M.D., F.A.A.P.
SUNY-Downstate Medical Center/The Long Island College Hospital
Brooklyn, N.Y.

This year's Society of Pediatric Anesthesia (SPA) meeting was the first joint meeting with its counterpart in United Kingdom, the Association of Paediatric Anaesthetists of Great Britain and Ireland (APA). Attendance was high this year at 530 registered attendees. **Jayant K. Deshpande, M.D., M.P.H.** (Vanderbilt University, Nashville TN) and **Valerie E. Armstead, M.D., F.A.A.P., C.R.C.P. (**Thomas Jefferson University, Philadelphia) provided welcoming remarks.

In the first morning session moderated by **Andrew Wolf, M.D.** (Bristol Royal Infirmary. Bristol, England), **Mervyn Maze** (Imperial College, London, UK) discussed anesthetic gases and the developing nervous system. Drug induced developmental apoptotic neurodegeneration (ANN) elucidated via animal models operates via blockage of NMDA-glutamate receptors. Ethanol induced ANN (operates via NMDA antagonism as well as GABA A mimetic agonism) is responsible for fetal alcohol syndrome. A myriad of anesthetics including barbiturates, benzodiazepines, propofol, etomidate, volatile agents, ketamine, PCP, nitrous oxide and xenon were described with regard to receptor binding and potential ANN effects. Volatile agents have been shown to cause ANN in vitro and in vivo in several species of neonates.

Time windows of vulnerability to neurotoxic effects in rat pups are 7 days old (equivalent to humans 6 months- 2 years old). He contrasted nitrous oxide, an NMDA antagonist which fails to provide analgesic effect in rat pups younger than 15-20 day old (equivalent to neonate 1-2 years old) secondary to lack of descending inhibitory pathways between supraspinal levels and spinal cord with xenon which does not cause ANN, and produces neuroprotection in isoflurane induced ANN postulated to lack of potentially neurotoxic dopamine relase. Dexmedetomidine (DEX) was mentioned as anti-apoptotic, with isoflurane neurotoxicity inhibited by DEX. **Charles Berde, M.D., Ph.D.** (Children's Hospital, Boston) spoke on the science of regional anesthesia in infants and children. He opened with selected topics of new research on sodium channels, in particular, local anesthetics do not block these pores but rather change stability of resting conformation of channel. Sodium channel subtypes with age related differences in peripheral nerves, sodium channels and local anesthetic action occur in pain disorders such as erythromalagia (SCN 9A channelopathy) which cause congenital inability to experience pain. New techniques and drugs available or in development such as local anesthetic microspheres were described. Importantly, challenges in pediatric epidural placement were discussed, Dr. Berde advocated ultrasound as the method to ensure safety and increase success rate with fluoroscopy restricted to difficult anatomy, need for precise level or when block needs to definitely work.

Tony Moriarty, M.D. (Birmingham Children's, Birmingham, UK) presented the United Kingdom database of regional anesthesia. The National Epidural Audit (NEA), devised by paediatric pain traveling club as a five year multicenter study in England, Ireland, Scotland and Wales. Their data-----10,400 epidurals placed over five years, 96 incidents, of which 56 were attributed to epidural anesthesia. Factors associated with complications including (1) frequency of epidural placement (doing more is safer), (2) site of entry (caudal is safer) (3) age (increased complications in neonates secondary to dosing errors) (4) total spinals (multiple insertion attempts) (5) compartment syndrome (6) infection in catheter (more than 72 hours) (7) pressure sores. No association with grade of operator, air/saline or drug utilized was found. His group is currently studying the complication rate of morphine infusions via epidural, as PICU admission in UK is strongly related to this. **Giovanni Cucchiaro, M.D.** (CHOP, Philadelphia, PA) countered with regional anesthesia in the US database. He stated that since retrospective databases have low utility due to lack of randomization, their group conducted a prospective study of 1448 patients who received peripheral nerve blocks with 1353 followed up by nursing (mean age 14 ± 3 years). Blocks included mainly femoral and sciatric blocks, with few plexus blocks. Complications (1) Failed blocks (10%) (2) prolonged numbness (2%) (single shot 2 days, catheter 19 days), (3) infection, (4) inability to remove catheter (5) dysesthesia, (6) possible overdose (7) postoperative nausea and vomiting (16%) with morphine greater than fentanyl.

The second morning session focused on Anesthesia effects on Children during Emergence & After: Does Anesthesia Make Kids Crazy….for A While? **Mike Sury, M.D.** (Great Ormond Street Hospital for Children, London, UK) enforced emergence agitation (EA) as a diagnosis of exclusion, with pediatric incidence of 20-25%, best measured by the PAED scale. While EA drops from 13% to 8% by 20 minutes postop, delayed agitation can present and midazolam may be implicated. Opioids are not always effective in blunting EA (demonstated by EA in non-painful procedures like MRI). Importantly, rapid recovery should probably not be implicated as children still have high EA even when volatile agents have been turned off for a while. He advocated flumazenil for paradoxical excitement in children, as well as small doses of ketamine, alpha 2 agonists and $5HT_3$ antagonists. **Zeev M. Kain** (Yale University, New Haven, CT) reviewed the constellation of maladaptive behaviors that present 1 day to one year postop, including bed wetting, nightmares, and failure to eat. He advocated actigraphy to quantitate the total length of sleep time, and number of night awakenings---advantages include objective assessment with high sensitivity, disadvantages include expensive challenging technology. Visual actigraphy samples were shown, in particular tracing returns to baseline at post op day 3. Prominent risk factors include (1) young age 1-4 years old (2) increased parental anxiety (3) increased child anxiety) (4) temperament issues; lower risk factors included (1) pain (2) previous surgery) (3) sibling day care (4) type of surgery (T&A, GU), and (5) one parent family.

In the first afternoon session moderated by **Rita Agarwal, M.D.**, (Denver Children's, Denver, CO), **David G. Nichols, M.D.** (John Hopkins, Baltimore, MD) lectured on evidence-based guidelines (EBG). Practice guidelines are value judgments (How should I apply the evidence to my patients?) based on systemic reviews (structured methodology) formed from extensive meta-analysis built on randomized controlled trials (RCT), case reports, cohort studies and case control studies. Problems with systemic reviews can include publication bias, non-uniform data collection, covert duplicate publication and variable control event rates. Failings in RCT may include

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Safe removal of LMA in children – at what BIS?

Sinah A and Sood J. *Pediatric Anesthesia* 2006; 16:1144-1147

Reviewed by: Hoshang J. Khambatta, M.D.
Columbia Presbyterian Medical Center, New York, NY

In this article the authors attempt to determine the optimum time for the removal of Laryngeal Mask Airway (LMA) in children using Bispectral Index Score (BIS) monitor as a guide. BIS is supposed to measure depth of anesthesia. It is a number from 0 to 100 with the lowest end representing deep anesthesia and 100 as complete consciousness. A BIS level of between 40 and 60 units is considered as surgical plane of anesthesia. One hundred and twenty children, 1-8 years old, ASA class I or II, undergoing lower abdominal or lower limb surgery made up the study population. Children with BMI > 30, respiratory tract disease, hearing defect, at risk of aspiration, on medication that might affect EEG, or anticipated difficult airway were excluded from the study. The children were divided into two groups. Group A: LMA removal accomplished in the awake plane of anesthesia, defined as return of airway reflexes, spontaneous activity and eye opening. Group B: LMA removal accomplished in the deep plane of anesthesia as when the airway reflexes were still depressed. The demographic profile of the two groups was similar. Size of the LMA used was determined by the manufacturer's guidelines. All LMAs were inserted partially deflated with lubricating jelly applied to the tips. Cases with difficult insertions were excluded from the study. Anesthesia was induced and maintained with oxygen, nitrous

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Sickle Cell Disease, from page 4

ings reinforced the concept that conservative transfusion regimens were as effective as aggressive regimens with fewer complications. However, the efficacy of no preoperative transfusion in orthopedic surgery could not be answered by this study.

The anesthetic management of sickle cell patients still remains a very active and evolving process. The studies previously cited describe a varied approach to the management of sickle cell patients with no standardization of anesthetic technique. A recent survey of Canadian pediatric anesthesiologists regarding outpatient surgery for an otherwise healthy sickle cell patient found 72% of the respondents would allow a cast change although 81% would not agree to proceed with tonsillectomy.

The scheduling of a sickle cell patient for surgery signals the beginning of a very coordinated effort by the hematologist, the surgeon and the anesthesiologist. The multidisciplinary approach to the management of the patient is essential for a successful outcome.

The preoperative preparation of the patient should include the hydration status. If a blood transfusion is warranted, then it should be ordered in a timely fashion as directed by the hematologist. If no blood transfusion is warranted, then the patient at a minimum should receive intravenous fluids to ensure that their volume status will not predispose them to sickling on induction. Many patients may have cardiac dysfunction associated with chronic anemia and pulmonary hypertension, as well as renal disease and therefore will require careful fluid hydration. The protocol developed by the CSSCD requires 8 hours of preoperative hydration. The type of crystalloid and rate of infusion should be addressed with the hematologist.

The intraoperative anesthetic management of sickle cell patients focuses on avoiding conditions which induce sickling: hypoxemia, hypotension, hypothermia, and hydrogen ion accumulation. Invasive monitoring such as an arterial line or central venous line may be warranted in those patients with coexisting cardiopulmonary disease or by the complexity of the surgery. The non-invasive blood pressure measurements should be adjusted to an acceptable time interval to reduce the tourniquet effect associated with inflation of the cuff. The use of surgical tourniquets remains controversial. Normothermia should be maintained with attention to operating room temperature and active warming devices. Positioning and padding are extremely important to minimize venous stasis and ischemia.

Postoperative care requirements must include vigilance for signs and symptoms of sickle cell related complications. The most common adverse event will be a vaso-occlusive crisis manifested as pain. The diagnosis of a painful crisis may be difficult, however if the pain level is disproportionate to the procedure and the amount of pain medications already administered, then painful crises may be evident. The conservative approach is to continue with pain medications as needed, supplemental oxygen and fluid therapy. Preoperative blood transfusions have been shown to reduce the incidence of postoperative pain crisis, however its use in the postoperative period as a first line treatment therapy is discouraged. Consultation with the patient's hematologist will aid in the diagnosis and treatment options.

Another more severe postoperative complication is acute chest syndrome with an incidence of 10-15% following intraabdominal or joint replacement surgery. The occurrence of acute chest syndrome is associated with pain, fever, respiratory distress and radiographic evidence of a new lobar infiltrate within the first 48 hours after surgery. Children younger than 10 years old present with mainly wheezing, cough and fever, whereas adults present with limb pain and dyspnea. Children between the ages of 2 and 4 years are at high risk. Postoperative therapy initially is supportive care with supplemental oxygen, fluid therapy, and analgesia. Incentive spirometry and bronchodilator therapy have been shown to be beneficial. Again, transfusion therapy is used as a last resort and managed in consultation with the patient's hematologist.

In summary, there is limited data to develop evidence-based guidelines for the perioperative anesthetic management of sickle cell patients. There are no large, randomized prospective studies looking at different aspects of anesthesia and sickle cell disease. However, the superior risk-benefit ratio of a simple transfusion versus an aggressive transfusion has been established in multiple studies. Low risk procedures in otherwise healthy patients may be done without a blood transfusion, however there has not been a definitive study comparing the outcomes between patients with and without a blood transfusion. Postoperative management should be guided by the same principles as intraoperative management. Supportive care with supplemental oxygen, fluid therapy and analgesia should be initiated, along with consultation with the patient's hematologist.

Literature Review, from page 6

oxide, and sevoflurane. Analgesia was obtained with intravenous fentanyl 1 mg/kg/min and caudal epidural block administered with 0.75mg/kg of 0.25% bupivacaine after induction of anesthesia and LMA placement. The BIS sensor was applied to the forehead of all patients. Intra operative endtidal sevoflurane was titrated to achieve BIS of 40-60 units. Additional monitoring included pulse oximetry, capnography, blood pressure, electrocardiogram, and temperature. On removal of LMA in the awake group mean oxygen saturation was 93% and in the deep anesthesia group 98%. Mean end tidal sevoflurane in the awake group was 0.20% and in the deep anesthesia group was 0.59%. The awake group had a median BIS of 79 units, and the deep anesthesia group had a median BIS of 60 units. There were two episodes of mild and three episodes of severe laryngospasm in the awake group and three episodes of mild and one of severe laryngospasm in the deep group. There were 10 episodes of oxygen desaturation below 95% in the awake group compared to none in the deep group. There were 6 episodes of excessive salivation in the awake group and none in the deep group. The authors claim that the best time to remove LMA is in the deep plane of anesthesia at the BIS value of about 60 units.

Comments: This study is a variation on the theme of removing an endotracheal tube either when the patient is awake or while still under deep anesthesia. There will always be two sides of this coin as there are anesthesiologists with different approaches. Personally I am in favor of removing an endotracheal tube or an LMA while the patient (child or adult) is still in the deep plane of anesthesia but then amongst my colleagues at the hospital I was in the minority. Now that a new monitoring device is available to indicate the depth of anesthesia, it is not surprising that we have a study using the same. There will probably be further studies on this theme. For now the authors have suggested that the LMAs be removed at a BIS of about 60 units, as the average BIS during surgery is between 40 and 60 units.

Joint Annual Meeting, from page 5

lack of accounting for all patients at end of the study, not blinding or forming similar groups except for intervention being studied. EBG websites were reviewed—his favorite is http://www.guideline.gov with reasonable sensitivity and specificity. He concluded with the elements of guidelines (1) purpose, (2) identity, (3) evidence selection, (4) guideline consensus, and (5) post developmental plan—schemes for grading the evidence included SIGN level, GRADE level or CTFPHE level. While guidelines, clinical judgment and patient expectations are all involved in final treatment decisions, his take-home was that our response to EGD requires transparency and humility about judgments and assumptions.

Neil Morton, M.B., Ch.B., F.R.C.A. (University of Glasgow, Glasgow, Scotland) spoke on UK Progress in Evidenced-Based Guidelines. He opened that the UK was spurred to develop EBG because of concerns of poor practice, shortage of information for children and families, and requests from APA members. Their top three projects included (1) *APA Good Practice in Postop and Procedural Pain* (pain assessment, medical procedures, postop pain and review of analgesia), (2) *APA Consensus on Perioperative Fluid Management in Children* (oral fluid management prior to surgery, fluid deficit, maintenance, dextrose, and other losses) and (3) *Postop Nausea and Vomiting* (children and surgical procedures at high risk, anesthetic factors, and antiemetic administration). Future areas in development include family information project, national audit of epidural infusions, national audit of opioid infusions, thromboprophylaxis, difficult airway algorithm for pediatrics, difficult intravenous access, procedural sedation and analgesia, blood transfusions/cell storage, He stressed practical tools including websites, implementation guides, audit markers and research pointers. He concluded with his hope for eventual development of international core guidelines between APA and other societies.

The top five posters (1) Detecting Awareness in Children using an Auditory Intervention, (2) The Effects of Dexmedetomidine on Cardiac Electrophysiology in Children, (3) Safety and Operational Efficiency of Anesthesiology Directed Sedation for Pediatric Diagnostic Imaging, (4) Does High Body Mass Index Influence Resource Utilization in Children Resource Utilization in Children Undergoing Adeno-tonsillectomy?, (5) Granulocyte Colony-Stimulating Factor (GCSF) Protects Vulnerable Neonatal Brain Regions From Hypoxic Injury Following Brief, Repeated Apnea.) were awarded, followed by an interactive audience based discussion and critique.

Joseph D. Tobias, M.D. (University of Missouri, Columbia, MO) lectured on Dexmedetomidine (DEX) in Children. He opened with a brief review of basic principles, mechanisms of action, and pharmacokinetics of DEX, and delved into hemodynamic, respiratory and CNS effects. Of note, DEX decreases expression of caspase 3 and risk of apoptosis in neonates, and offers cerebral protection in ischemia. He emphasized clinical applications, and contrasted benefits (intraoperative, component of balanced general anesthesia, opioid withdrawal, emergence agitation, postoperative shivering, sedation on mechanical ventilator and procedural sedation) and drawbacks (decreased efficacy in younger pediatric patients, limited efficacy for painful procedures such as upper GI endoscopy or cardiac catheterization, unproven amnesia, limited pediatric experience and higher cost.)

PD Markus Weiss, M.D. (University Children's Hospital, Zurich, Switzerland) concluded the afternoon session with dilemmas of uncuffed versus cuffed endotracheal tubes (ETT). He focused on traditional cuff tube concerns of elevated cuff pressures, too long cuffs, absent or unreliable depth marks, variable outer diameters and lack of size recommendations--- the ideal pediatric cuffed ETT would be distally placed, short with anterior based depth marks. Recent literature was presented to provide evidence of the safety of cuffed ETT with the caveat of cuff pressure monitoring—a European prospective multicenter study of children from birth through age 5 revealed reduced tube exchange and stridor with cuffed versus uncuffed tubes; American Heart Association (AHA) 2005 recommendations state that except for newborns, cuffed ETT have equivalent safety with uncuffed tubes. Future technology will include slotted cuffed ETT (ID 2.9 is equivalent to 2.5) which will cause less pressure injury.

The conference was well received by the audience, who now look forward to the Joint Winter Meeting of the SPA and AAP Section on Anesthesiology and Pain Medicine in San Diego, CA.

ASA 2007 Review of Sessions

Saturday, October 13, 2007

PANEL: Anesthetic Agents for Pediatric Patients: Hidden Dangers, New Possibilities

Reviewed by **Elizabeth Yun MD**
University of Wisconsin Hospital and Clinics

This Panel, moderated by **Dr. Linda J. Mason** (Loma Linda University), profiled four drugs, sevoflurane, ketamine, sugammadex and remifentanil and focused on the new uses and potential issues with each drug. This review provides brief summaries of each of these lectures.

The first speaker**, Dr. Bruno Bissonnette** (Hospital for Sick Children, Toronto), presented the topic**, "Sevoflurane Ten Years Later: Lessons We've Learned".**

Sevoflurane has improved the safety and the quality of mask induction in children, as shown by a sharp decrease in cardiovascular depression and disturbances. However, new concerns with this drug have also arisen over the past ten years. The loss of consciousness during a mask induction has not been accompanied by a decrease in nociception, causing patients to react to painful stimuli. Upper airway collapse occurs with sevoflurane in a dose dependent manner, an observation that can impact a spontaneously breathing patient receiving sevoflurane. Airway resistance, especially in the asthmatic patient is not necessarily decreased with sevoflurane. Epileptiform activity, noted in patients receiving sevoflurane is not associated with muscle activity. However this activity increases with a sevoflurane concentration at 5%. Depth of anesthesia is another issue with sevoflurane. The BIS monitor appears to monitor depth of anesthesia in a similar fashion in adults and children. However, for children under the age of one, the data is less convincing. Sevoflurane may have some impact on the developing brain. At this time rat studies show blockage of normal neural development and increased signs of apoptosis. Finally, the increased popularity of sevoflurane has led to the elimination of halothane production in the world leaving developing countries without access to an affordable and safe inhalational agent for children.

The second speaker**, Dr. Sabine Kost-Byerly** (Johns Hopkins Hospital) discussed**, "Ketamine Have New Indications Resurrected an Old Drug?"**

Ketamine has been used in the past for sedation and induction in the uncooperative patient, the trauma patient and the patient with congenital heart disease because of its cardiac stability and limited respiratory depression. In the past its side effects of increased ICP, IOP and emergence flashbacks have limited its widespread use. However, new insights on the mechanism of pain show that pain may increase neural sensitivity after an injury leading to a central sensitization. Because ketamine is a noncompetitive NMDA receptor antagonist for receptors in the brain and spinal cord, it may decrease surgery induced hyperalgesia and pain. Taking this theory and applying it to potential clinical situations is complicated. For instance, giving ketamine as a perioperative analgesic may prevent the sensitization of the CNS to surgical pain, however, studies have not conclusively showed a decrease in pain score and opioid use. Another potential use for ketamine is for epidural analgesia. Even though there may be no definitive evidence demonstrating the advantage of the epidural route versus the intravenous route, some studies have shown decreased pain for longer periods time when the epidural route was utilized. A third indication may be ketamine for the chronic pain patient needing multi modal therapy. At this time ketamine appears to have a variable opioid sparing effect for patients receiving low does infusions. These new possible uses for ketamine show great promise but more research needs to be done to answer the questions of optimal dose, duration and mode of administration, safety in long term administration and the patient population that might benefit the most from this drug.

The third speaker on this panel, **Dr. Jeffrey Galinkin** (University of Colorado at Denver) presented a talk on,

"Muscle Relaxants: Will Sugammadex Change the Way We Practice?"

Sugammadex is the new drug that acts directly on the NMBD to reverse neuromuscular blockade, in contrast to anticholinesterases. It is a modified gamma- cyclodextran, a type of chelating agent. In the plasma, the structure attracts and encapsulates the NMBD that is in equilibrium with the receptor. Once this complex is formed, the equilibrium shifts and favors the movement of the NMBD off the receptor. The complex is then renally excreted. Because of this mechanism of action, sugammadex can reverse profound blockade. Unfortunately there is no data for sugammadex use in children. Since it is a biologically inactive drug, it appears to be well tolerated. Reported side effects include hypotension, cough, nausea and vomiting and movement. Sugammadex works best with rocuronium followed by vecuronium and then pancuronium. At this time, in those patients with decreased renal function, there may be slower excretion of the sugammadex complex. A few studies have shown that reversing rocuronium with sugammadex was more rapid than recovery from succinylcholine. This finding could potentially lead to the replacement of succinylcholine in various clinical situations such as treatment for laryngospasm. More research, especially in pediatric patients, needs to be done.

The final speaker in the panel, **Dr. Allison Kinder Ross** (Duke University Medical Center) finished with, "**Opioids: Has Remifentanil Been the Answer?"**

Remifentanil is a synthetic opioid that came out in 1996 and its rapid metabolism by nonspecific esterases made it an interesting drug to use in children. Pharmacokinetic studies showed that children have a large volume of distribution; the half life is the same in all age groups and a higher clearance in the youngest age group. Over the years, the challenge has been to find situations where remifentanil provides a benefit. Although remifentanil does have a slight time advantage compared to fentanyl for early extubation of patients, it appears to be less effective in infants less than one week old. Remifentanil has been compared to isoflurane, desflurane, alfentanil and propofol for various procedures and has not shown any particular advantage over these drugs. In cardiac surgery, remifentanil may help to decrease the stress response in the prebypass stage but only at higher infusion rates. In the neurosurgical patient, remifentanil may blunt the effect of stimuli like endotracheal suction on intracranial pressure and does not interfere with SSEP monitoring. Another situation where remifentanil might be helpful is intubating a patient without a muscle relaxant, however high doses are needed to create ideal conditions. There

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are several issues to watch for with remifentanil. It may cause a self limited hypotension and/or bradycardia that is not necessarily prevented by administration of atropine. Spontaneously breathing patients receiving remifentanil for short procedures need to be watched closely for respiratory depression. Another concern is the possible acute opioid tolerance after using it in a general anesthesia, although not all studies show this development. This finding limits its use in procedures with high postoperative pain. Therefore, remifentanil is best used for short procedures, total intravenous anesthetics, intubations when muscle relaxants need to be avoided, and procedures with minimal postoperative pain. While remifentanil has a role in clinical practice, it is not a substitute for all opioids.

FORUM: ASA – Pediatric Anesthesia Clinical Forum

Reviewed by Cheryl K. Gooden, MD, FAAP
Mount Sinai Medical Center

The Saturday morning clinical forum moderated by **Richard Kaplan, MD** (Children's National Medical Center, Washington, DC) provided an overview of recent advances in the care of the pediatric patient in the areas of blood safety and major blood loss, regional anesthesia, and thorascopic procedures. The first speaker **Eugenie Heitmiller, MD** (The Johns Hopkins Hospital) presented "Intraoperative Management of an Infant with Major Blood Loss During Craniosynostosis Repair." The infant was an otherwise healthy nine-month-old. She posed ten questions to the audience related to blood transfusion considerations and options, blood conservation and salvaging techniques. Although the majority of Dr. Heitmiller's questions dealt with the intraoperative management of blood loss in this patient, she also highlighted preoperative considerations. Some of her questions included: 1) would you use preoperative erythropoietin?, 2) would you suggest directed blood donation?, 3) would you request irradiated blood products?, and 4) would you use recombinant factor VIIa in the face of life-threatening microvascular bleeding if all else fails? The anesthesia management of the pediatric patient undergoing craniosynostosis repair can be quite challenging. This is particularly evident in terms of managing the blood loss associated with this surgery.

Arjunan Ganesh, MBBS (The Children's Hospital of Philadelphia) presented "Recent Advances in Pediatric Regional Anesthesia." Dr. Ganesh elaborated on this topic through the case presentation of a shoulder arthroscopy and Bankhart repair in a 16-year-old female (131.7 kg, BMI 44) with a history of asthma as a "day surgery" procedure. He discussed the various options in terms of prescribing opioids for example "prn vs. scheduled vs. PCA." Dr. Ganesh recommended the use of an interscalene block for the patient presented in this case. The technique, choice of local anesthetic and complications of an interscalene block were reviewed.

The final speaker in this forum was **Gregory Hammer, MD** (Lucile Packard Children's Hospital at Stanford) who presented "Thorascopic Procedures in Children." Dr. Hammer provided the opportunity for an interactive case discussion involving the anesthesia management of a three-year-old boy with an empyema. A decision tree was utilized to highlight the overall probable management of the patient. The techniques of single lung ventilation (SLV) were reviewed. In addition, Dr. Hammer discussed the advantages and disadvantages of SLV with a single lumen endotracheal tube compared with bronchial blockers.

Luncheon Panel: Intravenous versus Regional Techniques for Postoperative Analgesia in the Pediatric Patient

Reviewed by Sean H. Flack, MBChB FCA(SA)
Children's Hospital and Regional Medical Center, Seattle

Dr. Myron Yaster (Johns Hopkins Hospital) moderated a luncheon panel on Saturday entitled, "Regional versus intravenous techniques for postoperative analgesia in the pediatric patient". Two cases were presented for which **Dr. Santhanam Suresh** (Children's Memorial, Chicago) proposed regional anesthesia while **Dr. Elliot Krane** (Lucile Packard Children's at Stanford) was asked to advocate for intravenous analgesia.

The first patient was a young man with pectus excavatum presenting for a Nuss procedure. Dr. Krane led off by arguing that intravenous analgesia posed no risk for neurological injury, was simple and required little in the way of advanced technical skill. He highlighted the fact that families sometimes refuse regional techniques. A poll of the audience suggested an even distribution between those who would choose PCA morphine versus hydromorphone in this setting.

Dr. Yaster proposed the placement of a T5/6 epidural while the patient was awake. He argued that this would cause less somnolence while allowing better pulmonary toilet and more rapid recovery. He mentioned the use of a thoracic paravertebral block as an alternative regional technique. A note of caution was expressed at this suggestion by a member of the audience who had witnessed two cases of Brown-Sequard Syndrome following paravertebral blocks in his institution.

The panel unanimously recommended the use of adjuvant agents in this case. These included benzodiazepines for muscle spasms and anxiolysis, NSAIDS such as ketorolac or celecoxib. The use of gabapentin was also mentioned. We can expect to hear more about the perioperative use of this agent. Comments from the audience included concerns for, as well as experience of, postoperative bleeding with NSAIDS following this surgery. Experience with the use of methadone as a bridge to weaning from epidural to oral analgesia was also discussed.

The audience's attention was drawn to a pertinent article in which Liu and Wu (Anesth Analg 105:789-808) describe two meta-analyses comparing epidural analgesia to intravenous analgesia for mixed surgical populations. Both meta-analyses showed statistically superior analgesia following epidural analgesia, both at rest and with activity. Clinically appreciable superiority was only shown with activity and only through post-operative day one.

The conclusion drawn by the panel was that there is no evidence regarding the superiority of one analgesic regime over another for children undergoing the Nuss procedure.

The second case was a one year old girl undergoing a unilateral inguinal hernia repair. Dr. Krane challenged the audience with the question, "Do we need a general anesthetic for this patient?" and

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All Anesthetics in Children with Congenital Heart Disease Sh

It is not uncommon for a chart to arrive in the operating room with a young child who has congenital heart disease for a general pediatric sur cardiac anesthesiologist. I therefore submit to you that there is debate on this topic and have asked two experts to provide the proverbial two s

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Laura K. Diaz M.D.
Division of Cardiothoracic Anesthesia
The Cardiac Center at The Children's Hospital of Philadelphia
Assistant Professor of Anesthesiology and Critical Care Medicine
University of Pennsylvania School of Medicine

The population of patients with congenital heart disease (CHD) surviving to adulthood continues to grow yearly, with more than 95% of infants with CHD surviving to adulthood[1], resulting in an increasing number of patients with a wide spectrum of both age and pathophysiology who will require future cardiac and non-cardiac surgeries. With the possible exception of those patients who have undergone ligation of a patent ductus arteriosus or uneventful closure of a secundum atrial septal defect, the great majority of children with CHD have residua or sequelae that result in varying degrees of physiologic derangement and fragility when compared to their peers. Additionally, within each category of cardiac lesion there exists a spectrum of severity which can necessitate significant differences in treatment plans for children who technically bear the same underlying diagnosis. As stated by deSouza and Baum recently, no other area of anesthesiology has a patient population encompassing such a diversity of age, diagnoses, and physical status[2]. The question facing us as pediatric anesthesiologists is who can best care for these patients?

> *"Just as pediatric cardiologists have recognized the need for specialized training to care for adults with congenital heart disease, so too it is time for us as pediatric anesthesiologists to acknowledge the advantages of dedicated pediatric cardiac anesthesiologists to care for this very heterogeneous group of neonates, children and adults."*

Although most centers have a dedicated group of pediatric anesthesiologists providing care for patients with CHD for open or closed cardiothoracic procedures, it is often less clear who should care for them when diagnostic or interventional cardiology procedures or non-cardiac surgeries are required. A question worth considering is "Why do we as pediatric cardiac anesthesiologists anesthetize patients for cardiothoracic surgical procedures?" I believe the answer lies in our understanding of the pathophysiology of these special patients, which allows us to effectively plan anesthetic interventions as well as anticipate the results of surgical interventions. It is therefore appropriate for pediatric cardiac anesthesiologists to provide the same level of expertise and care for patients with CHD undergoing non-cardiac surgery as we would in the cardiac operating room. The anesthetic implications of the cardiac physiology remain constant regardless of the surgical procedure, cardiac or non-cardiac. This is particularly true for patients whose CHD results in significant physiologic derangements, such as patients with persistent arrhythmias, congestive heart failure, pulmonary hypertension or single ventricle physiology.

Several factors contribute to make these patients uniquely challenging. Although evidence is currently lacking to support or refute a relationship between the utilization of pediatric cardiac anesthesiologists caring for all cardiac patients and improved patient outcomes, data demonstrating a greater anesthetic risk and a difference in outcome for these patients does exist. In addition to CHD they often combine additional risk factors known to be associated with increased anesthetic-related morbidity and mortality such as age less than one year, ASA Physical Status (PS) 3-5, the presence of co-morbidities, and emergent need for surgery.[3,4] In the most recent findings published by the Pediatric Perioperative Cardiac Arrest (POCA) Registry, of the 26 perioperative cardiovascular arrests in which an exact cause could not be determined, 21 of the 26 occurred in patients who were ASA PS 3-5, 9 of whom had CHD.[5] Flick et al examined the incidence and outcome of perioperative cardiac arrest in 92,881 pediatric patients, finding that regardless of the procedure type, cardiac or non-cardiac, most patients who experienced a perioperative cardiac arrest (88%) had CHD.[6] It therefore makes sense for the most experienced group of anesthesiologists to deliver anesthetic care to this patient group. Additionally, the surgical treatment of most CHD lesions has dramatically evolved over the past several decades, requiring the anesthesiologist to be familiar with a multitude of procedures (many of them frequently referred to only by their eponyms) and a variety of associated post-surgical outcomes and complications, many with significant anesthetic implications. Anatomic variations are the norm, such that a group of patients with the same lesion may display vastly different outcomes and physiologic derangements. The ever-increasing group of patients with single ventricle physiology necessitates clear understanding of a novel circulation, along with the increased risks posed by hypovolemia, increased pulmonary vascular resistance, and arrhythmias.

The pediatric cardiac anesthesiologist is the most qualified perioperative physician to evaluate these patients preoperatively, ascertaining the need for a more recent evaluation by a cardiologist,

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hould be Managed by Pediatric Cardiac Anesthesiologists

rgical procedure, and within that chart is the recommendation by the cardiologist that the child's anesthetic should be managed by a pediatric sides to every story. (The Editor)

Con

Warwick "Wads" Ames, MB
Assistant Professor,
Division of General and Cardiac Pediatric Anesthesia
Duke University Medical Center

As a 'pediatric cardiac anesthesiologist' I feel well prepared with a large syringe of fentanyl and a cardiopulmonary bypass machine bubbling quietly in the corner. Congenital heart disease (CHD) however does not exist in a vacuum and patients with abnormal cardiac anatomy do require anesthesia in alternative locations. In response to the statement "All Children with Congenital Heart Disease should be managed by Pediatric Cardiac Anesthesiologists", I respectfully submit the 'con' argument.

> *"The proposal is ill defined, unrealistic and unsupported by the data. As professionals it is more important that we recognize our individual limitations and seek assistance when confronted with a new or unfamiliar challenge."*

Any argument such as this should begin with breaking down the key elements of the proposal. 'All children with congenital heart disease' includes an enormously diverse group of lesions from a small patent ductus arteriosus to the single ventricle pathophysiology of the hypoplastic left heart. Some lesions may go undetected by the patient, in terms of symptoms, or by the attending physician, in terms of clinical signs. Generally however with improved screening and antenatal health care, congenital heart disease (CHD) is being detected earlier. Improvements then in both surgical and anesthetic techniques, and in cardiopulmonary bypass and myocardial protection, have led to better results in pediatric cardiac surgery. Long-term survival rate are excellent, even for the more complex variants of CHD[1]. For example, the arterial switch operation for transposition of the great vessels is routinely performed in the newborn with near zero mortality[2]. Even palliative procedures for lesions that cannot be corrected are now performed earlier with improved survival and outcomes. In general, we are creating a population of robust children with CHD that are surviving and thriving into adulthood.

What then determines a 'pediatric' from a 'pediatric cardiac' anesthesiologist? It seems there is no accepted definition. I could find no reference as to a minimum caseload requirement. The Congenital Cardiac Anesthesia Society (CCAS) was only recently established (December 2005) and does not attempt to define a pediatric cardiac anesthesiologist. It simply promotes 'individuals and societies who share mutual interests in advancing the quality of care and knowledge in congenital cardiac anesthesia'[3].

Furthermore, as discussed in a recent editorial in Pediatric Anesthesia, minimum standards for training and experience have yet to be established[4]. The Accreditation Council for Graduate Medical Education (ACGME) in 1997 recognized fellowship training in pediatric anesthesiology but not specifically for pediatric cardiac. There are some institutions that do offer fellowship programs in pediatric cardiac anesthesia, but these are not ACGME recognized. Most fellowships instead have a rotation through cardiac anesthesia. In terms of training then one could argue that the fellowship trained pediatric anesthesiologist has the same training as their pediatric cardiac counterpart.

Despite this, I suspect the 'pro' argument will suggest that a cyanotic infant with congestive cardiac failure and of advancing ASA status is beyond the abilities of a general pediatric anesthesiologist. Understanding the pathophysiology of CHD (before or after palliation) is, in my opinion, well within the remit of a competent pediatric anesthesiologist. Not only that but a pediatric anesthesiologist has an enhanced appreciation of the fragility of critically ill neonates and infants, regardless of a concomitant cardiac lesion. They understand drug dosing and fluid requirements and have the required technical skills including establishing vascular access and the management of the pediatric airway. In fact, the procedural knowledge of a pediatric anesthesiologist for certain surgical subspecialties is probably superior to that a dedicated pediatric cardiac anesthesiologist who may infrequently visit the realms of other anesthesia subspecialties.

I now address the issue of supply and demand. In the United States, approximately 25,000 children are born annually with some type of CHD[5]. These children may have other non cardiac congenital anomalies or associated syndromes where surgical intervention may be required, in addition to the typical childhood ailments and maladies. Interventional cardiology and diagnostic techniques, such as MRI, are increasing the demand for anesthesia services. Furthermore, improvements in surgical management of these cardiac defects have resulted in more children with CHD surviving into older childhood, adolescence, and adulthood. In the United States alone, an estimated 500,000 to 600,000 adults currently have CHD[5].

At the same time, there is a shortage of pediatric anesthesiologists in the United States. Although there are 45 pediatric anesthesiology training programs that are certified by the ACGME, only 126 pediatric anesthesiology fellows graduated in 2006. Even fewer are 'dedicated' pediatric cardiac anesthesiologists. This is far short of the approximately 250-300 positions for pediatric anesthesiologists nationwide (personal communication). In addition, smaller programs may have only one or two dedicated pediatric cardiac anesthesiologists, creating

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suggested that a single shot caudal with 1ml/kg 0.375% bupivacaine would suffice. Other anesthetic techniques suggested by the panel included a general anesthetic with an LMA and either a caudal or an ilio-inguinal nerve block. One of the panel members had personal experience of an inguinal hernia repair and remarked that it "really wasn't that painful afterwards".

Much of the discussion around this case concerned the choice of oral analgesia for post-operative pain. Dr. Krane emphasized that the combination of hydrocodone (0.15mg/kg) with acetaminophen is far superior to the commonly-prescribed acetaminophen with codeine. This is because 30% of children are non-metabolizers of codeine, a pro-drug which requires metabolization to its active compound, morphine. Furthermore, the latter combination typically results in a sub-therapeutic dose of acetaminophen. This was a most valuable message for participants to take back to their home institutions.

There appeared to be unanimous consent that this luncheon panel was both entertaining as well as informative. Much work needs to be done by way of high quality clinical trials to address the original question posed by the panel: "Regional versus intravenous techniques for postoperative analgesia in the pediatric patient?"

Sunday, October 14, 2007

Panel: Update on Management Issues in the Peri-operative Care of the Neonate

Reviewed by Toyin Olutoye, MD
Texas Children's Hospital

Sunday afternoon's pediatric panel, moderated by SPA president, **Jay Deshpande MD** (Vanderbilt) covered a wide span of topics.

The first speaker, **Claire Brett MD** from Vanderbilt reviewed the pitfalls in the pre-operative evaluation of the ex-premature child. She emphasized that the diagnosis of "Ex-preemie" should be considered a life-long diagnosis. With an increase in the survival rate for very low birth weight (1-1.5kg) and extremely low birth weight (500-999g) premature infants as 90% and 70% respectively, more of these survivors are presenting to the operating room for surgery as they grow older. As a result, their history in infancy plays a significant role in assessing them for surgery. In general, the diagnosis of ex-premature infant should be more specific, i.e. the post conceptual age and current age needs to be considered when assessing them for surgery. Her talk focused on chronic lung disease beyond infancy and developmental deficits.

In discussing chronic lung disease, the literature relating to spirometric values in neonates with bronchopulmonary dysplasia (BPD) was reviewed. These neonates tend have a decrease in their spirometric values compared to those without the diagnosis of BPD. In addition, neonates with BPD exhibited a diurnal variation in the peak expiratory flows which begs the question: Does the time of day (morning versus evening) play a role in the ventilation patterns of these children, even when they present for surgery? Children with a past diagnosis of BPD were also found to be more responsive to histamine and less so to beta agonists. Two studies looking at the long term follow up of ex-premature infants found a decrease in lung volumes: one found a decrease in residual lung volume while the other, which studied ex-premature infants 8-9 years later found a decrease in forced vital capacity (FVC) and forced expiratory volume (FEV) amongst those who had a diagnosis of BPD compared with those who did not. In addition, this study also found that ex-preemies have underlying wheezing baseline.

She concluded that a history of prematurity is associated with adverse respiratory events in children, particularly those presenting with upper respiratory tract infections (URI's). A former premature infant, now 3 years old with a URI for the past two days is at risk for increased adverse events peri-operatively. This patient deserves special and different peri-operative considerations from a 3 year old delivered at term, with a two day history of URI.

Suggestions for peri-operative management of former premature infants:

If symptoms of BPD are present on day of surgery, consider ventilation strategies intra-operatively, prepare to treat bronchospasm, coordinate care with the primary care physician and have a low threshold for considering intensive care monitoring post operatively. If no apparent residual symptoms of BPD are observed at time of surgery, we are encouraged to have increased respect for any ongoing respiratory tract infection and be wary of proceeding with scheduled surgery.

Regarding developmental deficits, Dr. Brett stated that adolescents delivered prematurely have been found to have structural abnormalities which persist late into adolescence and adulthood and may also exhibit permanent maldevelopment. What are the implications for peri-operative care? These patients (adolescent, former premature infants), may be mentally younger than they appear and may require premedication. Post operative pain control in some instances may also require special consideration due to delays in cognitive level which may be present.

Lynn Martin MD from Seattle Children's Hospital updated us on the new controversies in peri-operative neonatal care with emphasis on oxygen toxicity. The issue of oxygen toxicity was described as a paradox as health care practitioners intuitively think more oxygen is better but over the past decade, increased oxygen exposure or even short exposure to increased oxygen concentrations could be dangerous. He reviewed a number of papers which described oxygen as the most commonly prescribed drug to neonates, studies which compared newborn resuscitation following delivery with room air versus 100% oxygen. Interestingly, in the latter study, those resuscitated with air had decreased time to their first cry and had a shorter duration of positive pressure ventilation in the course of their hospital stay. A Cochrane systemic review also showed a decrease in mortality rate in infants resuscitated with air compared to oxygen; however there was insufficient evidence to recommend air over oxygen for resuscitation because most of the studies included in the analysis utilized 40% oxygen with air instead of air only.

Studies have shown that resuscitation of infants with 100% oxygen can result in increased mortality, myocardial and kidney injury as well as a delay in recovery. The anti-oxidant system is also compromised in prematurity and marked oxidative stress increases in premature infants at approximately 28 days. We were reminded of neonatal respiratory mechanics which include: decreased FRC, increase in closing volume and unstable alveoli resulting in 20% reduction in dynamic compliance and dependent atelectasis. Deni-

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trogenation is associated with FRC loss and VQ mismatch effects which resolve with recruitment maneuvers. Therefore positive end-expiratory pressure (PEEP) is always recommended in the respiratory management of neonates. Evidence suggests that recruitment efforts are more beneficial if less than 100% oxygen is used.

Lung volume loss has been noted to occur during induction, maintenance and emergence. Therefore he posed the question, "Is it wise to continue giving 100% oxygen during these phases?"

Briefly discussing retinopathy of prematurity (ROP), Dr. Martin noted that the incidence has not changed over the last 15 years despite attempts to decrease oxygen exposure the premature population. Instead, the incidence of ROP in infants less than 1.2 kg has increased in the last decade independent of the increase in survival.

In summary, newborns are at increased risk for oxidative stress secondary to 100% oxygen and he charged us as pediatric anesthesiologists, to study the use of oxygen in our individual practices. Questions to ponder on include the following: "Is it possible to identify children at risk for oxidative stress?", "How long are they at risk for oxidative injury", and "Can strategies be developed to minimize the risk?".

The third speaker, **Lucinda Everett MD**, at Mass General Hospital Boston, reviewed apnea of prematurity, post operative apnea, the use of caffeine and considerations for discharge in premature infants following surgery. Apnea is defined as pauses of 20 seconds or of 10 seconds when associated with a decrease in heart rate or oxygen saturations. It is still unproven if there is benefit in intervention or if apnea of prematurity affects neurodevelopmental outcomes later in life. On reviewing the literature on post operative apnea she cautioned one should keep in mind the patient population studied, anesthesia techniques used, type of monitoring used as well as definition of apnea in these studies. Letty Liu et al. purported that anesthetic agents may unmask a defect in the ventilatory control of premature infants less than 41-46 weeks. A study by Cote et al. stated that the risk of apnea is NOT less than 1% until a post conceptual age (PCA) less than 56 weeks at a gestational age (GA) of 32 and PCA of 54weeks at GA of 35 weeks is attained. In general, many hospitals choose a uniform time for post operative observation in the hospital between 50-60 weeks. Interestingly, two studies in the pediatric surgery literature have stated that outpatient inguinal herniorrhaphy can be performed in former premature infants with minimal morbidity and mortality, however in these studies Dr. Everett noted that patients were not monitored at home.

Is there benefit in the use of caffeine in former preemies coming in for surgery? A study by Schmidt et al randomized low birth weight infants to receive placebo or caffeine. A fewer number of patients in the caffeine group needed supplemental oxygen and those who required positive airway pressure ventilation in the caffeine group were discharged approximately 1 week earlier than the equivalent group of patients in the placebo group. Welborne also investigated the use of caffeine versus placebo and found that the caffeine group had no significant apnea or bradycardia episodes while in the placebo group, 81% developed prolonged apnea 4-6 hours post operatively and 50% had decreased oxygen saturations. The Cochrane review on this topic showed that premature infants who received intra-operative caffeine had fewer episodes of apnea and bradycardia than the control group. However, these studies had small number of patients leaving an uncertainty regarding the clinical significance.

What is the effect of anesthetic technique on the incidence of post anesthetic apnea? Studies on general anesthesia (GA) compared desflurane with other agents and found that patients who received desflurane either were extubated earlier or awakened faster following surgery. Welborn also studied regional anesthesia versus GA in premature infants and it appeared regional anesthesia was better tolerated in these patients. The Cochrane review also examined the regional versus GA debate and on review of 4 trials found, there was no overall difference in the incidence of post anesthetic apnea.

Is the duration of surgery and consequently anesthesia, a factor in the development of post operative apnea? A study by our pediatric surgery colleagues examined infants undergoing unilateral inguinal herniorrhaphy and concluded that routine contralateral exploration in preterm infants is not justified in unilateral hernia.

In conclusion, the challenges facing us on the prevention and management of post operative apnea in premature infants is the lack of large studies to identify which population is at risk and the lack of uniform population in these studies. The take home points were: 1.We should always remember the variability in the population we are dealing with. 2. Consider the use of shorter acting agents. 3. Caffeine may decrease risk of apnea and 4. Post operative monitoring is still recommended.

The final talk of the afternoon, "Successful venous access in expremature infants: New Insights." was given by **Susan Varghese MD**., National Children's Hospital, DC. She presented the DIVA scal: **D**ifficult **I**ntra **V**enous **A**ccess. In this scale, the highest point of 3 is awarded to premature infants, less than 1 year of age scores 2 points, 1 point if age is between 1 to 2 years, and 2 points if no palpation of veins after tourniquet application. She mentioned various methods utilized to make veins more visible such as tapping, stroking, and warming the extremity, and elaborated on specific techniques as follows:

1. Cutaneous drugs to warm the surface and/or alleviate pain:
   a. EMLA cream: When used in conjunction with glyceryl trinitrate, and compared to plain EMLA, a randomized trial showed that the hand with both EMLA and glyceryl trinitrate was chosen majority of the time. However, EMLA in general, has the disadvantage of vasoconstriction if left too long on the surface.
   b. Synera patch: This is also a local anesthetic patch but has an additional controlled heating pad. She cautioned that success with this patch requires the use of a clean contact and 20 minutes should be allowed from placement to actual attempt at placing intravenous access.
2. Transillumination: A study showed that the use of cool, light transillumination was associated with 40% efficacy in viewing the vein with cannulation success in 39 out of 40 attempts. Side effects of transilllumination devices include a report of an outbreak of purpuric papules and vesicles following use of a faulty transillumination device.
3. Vein viewer: This is an optical system that enhances the contrast between veins and surrounding structures. A trial studying use of this device found there is decreased visibility in young babies with chubby hands. So it appears fatty tissue or abnormal contours present difficulty.

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4. Ultra sound guided venous access placement: This is very useful for subclavian access although patient positioning for optimal success of placement differs from conventional positioning i.e. midline head positioning *without* shoulder roll placement is recommended. Also, in younger children (around1 year of age), recommended positioning of the probe is parallel to the clavicle while in older children (around 9 years of age); a slight turn to the probe is recommended. She also stated that while ultrasound use can be technically challenging, its use decreases the incidence of carotid artery punctures as well as the number of attempts in general. The visual ultrasound probe was recommended over the audible one for central venous cannulation. The visual ultrasound is also recommended for cannulation of the internal jugular vein as the vein is easily collapsible, and its visibility is increased by diameter changes with respiration and the valsalva maneuver. Neonates with congenital diaphragmatic hernias have been noted to have smaller internal jugular veins and ex-premature infants may have thrombi in the IJ. Specific difficulties with IJ cannulation include occasional valves and this was demonstrated to us on video of an ultrasound IJ cannulation.
5. In addition to intravenous cannulation, the ultrasound is also helpful in arterial cannulation. She pointed out training tools to help improve expertise on the use of ultrasound for venous cannulation an example of which is the Blue phantom Ultrasound training modules.

In all it was a very lively and informative afternoon session, with each of the speakers generating a lot of questions which were taken at the end of the presentations collectively.

Tuesday, October 16, 2007

Luncheon Panel
PACU Dilemmas: Old Problems with New Solutions

Reviewed by David Polaner, MD, FAAP
The Children's Hospital, Denver

The Tuesday pediatric luncheon panel at the ASA was titled "PACU Dilemmas: Old Problems with New Solutions" and discussed three common recovery problems in pediatric anesthesia practice. It was ably moderated by **Dr. Steven Hall** (Children's Memorial Hospital and Northwestern University, Chicago).

Dr. Ira Todd Cohen (Children's National Medical Center, Washington, DC) began the session, ironically appropriate for a luncheon meeting, by discussing nausea and vomiting (PONV). There are numerous risk factors for PONV, several of which are beyond the control of the anesthesiologist, including the type and length of surgery and history of PONV and motion sickness. The use of N2O, volatile anesthetics and opioids are associated with increased risk. Many factors impact the incidence of PONV, including those that are hard to quantify such as emotion, memory, fear, smell, anticipation and vision. The physiology is complex, and is influenced by input from the area postrema, the chemoreceptor trigger zone, the nucleus tractus solitarius and the vomiting center, all located caudad to the pons and anterior to the IV ventricle. Many chemotactic factors, including encephalins, opioids, dopamine seratonin and neurokinin1 affect the chemoreceptor trigger zone, while humoral factors such as histamine, encephalins, and cholinergic and muscarinic input through the nucleus tractus solitarius trigger nausea and vomiting. Gastrointestinal hormones, including cholecystokinin, secretin, leptin vasopressin, VIP, seratonin and others also play a role.

There have been many studies that have evaluated the efficacy of prophylactic agents for PONV. Patients can be stratified into low, intermediate and high risk depending on the factors described above, and from there be treated with either no prophylaxis, an anti-5HT3 agent plus dexamethasone, or those plus an additional anti-emetic drug of a third class. Therapy for breakthrough PONV after prophylaxis can consist of a different receptor antagonist type, a different agent of the same class, or the addition of non-pharmacololgic therapies including acupuncture or acupressure (these have been used for prophylaxis as well). With all agents and treatment schemes the incidence of late onset nausea and vomiting, as well as vomiting in the PACU, must be considered.

Older agents such as metoclopramide, droperidol, promethazine, scopolamine, dimendydramate and prochlorperazine are still in use and have been recently revisited. Promethazine is contraindicated in children less than 2 years of age and cautioned in older children due to the increased potential for life-threatening respiratory depression. Although the use of droperidol plummeted following the "black box" warnings regarding QT prolongation, many of its commonly used replacements, including ondansetron, also can prolong the QT interval. Droperidol is currently contraindicated in patients with known prolonged QT and should be used only with extreme caution in patients at risk. Aprepitant, a new agent, more effectively reduced both the early and late incidence of PONV in adult women compared to ondansetron.

Next, **Dr. Randall Flick** (Mayo, Rochester, MN) spoke about emergence agitation and delirium (EA). He noted that although this has received renewed attention due to the widespread use of sevoflurane, it is not a new problem and was first described by Eckenhoff in 1961 following ketamine anesthesia. Widely disparate incidence numbers are cited, from 10-80%, depending on definition, operation, anesthetic technique, age and gender. Emergence agitation occurs within 5 minutes of awakening and lasts for about 15-20 minutes, although it may rarely persist for longer. It prolongs discharge, intensifies the need for nursing care, and may result in injury of both patients and staff. Diagnosis and quantification remains problematic, as there are up to 16 different measurement scales used in the literature, most of which have not been formally validated, and which measure non-specific behaviors. The PAED (Pediatric Assessment of Emergence Delirium) is a validated scale and measures five parameters: eye contact, purposeful actions, awareness of surroundings, restlessness and inconsolability.

Several factors have been found to increase the risk of emergence agitaition. Age is a risk for EA; it is most common in preschoolers and toddlers. It is more common in boys. Preoperative anxiety has been cited as a risk in some studies, and Kain found that parental anxiety is associated. The surgical procedure influences EA. Ophthalmologic and ENT procedures are the worst for precipitating EA. Pain is clearly not causal, but may be associated with EA or may worsen its severity.

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The greatest association of EA is with the volatile anesthetics. There is consensus among most studies that EA is most common with sevoflurane, but may be equally or somewhat less common with desflurane. It is less likely to occur after isoflurane and is least common with halothane. There are conflicting reports as to whether switching to isoflurane after sevoflurane induction may reduce the incidence. Propofol in one study produced a zero incidence of EA. Dexmedetomidine may reduce EA, but delays emergence and discharge. Speed of emergence was associated with EA in some studies, but not in others, and the very low incidence with TIVA suggests that this may be a spurious finding. Stepwise decrease in sevoflurane during emergence makes no difference.

Can EA be prevented? Midazolam has been shown to either make no difference or even increase the incidence of EA, but may help following brief procedures. Ketamine, fentanyl, clonidine, melatonin all have been reported to reduce the risk, and most have been used in treatment as well. Parental presence (both preop and postop) may reduce the incidence of EA. Non-volatile maintenance of anesthesia appears to have the lowest risk. In summary, time, parents and sedation with agents like propofol or opioids are likely to be the most effective strategies once EA has occurred.

Dr. William McIlvaine (Children's Hospital of LA) concluded the panel with a discussion of discharge readiness. He spoke about both the clinical factors that must be considered and about the systems and design factors that impact patient flow through the PACU. There are scales (like the modified Aldrete socre) that assess readiness for discharge. The Aldrete score and its pediatric modifications consist of:

- Airway (cough or cry on command; maintain a good airway; airway requires maintenance)
- Vital signs (stable and age-appropriate, stable and not appropriate; unstable)
- Motor activity
- Consciousness (awake, arousable, unconscious)
- SpO2 on RA

PACUs are often poorly designed, with congestion resulting from one-way traffic flow through a single intersection. Outpatients and inpatients are mixed even though their routing is different. Ideally one never wants the pre- and post-operative patients to meet. Communications between the operating room PACU and discharge area can be facilitated with cellular phones, but the people who need to communicate must have the phones!

It is common to refer to the stages of patient flow through the PACU in three phases. In Phase 1, patients undergo emergence from anesthesia, especially if they are extubated deep, and exhibit the return of normal reflexes. In Phase 2, they recover coordination and physiological function, and in Phase 3, they return to pre-operative status and are discharged from the unit to home (inpatients usually are sent to the ward after Phase 1 recovery). Many PACUs have separate areas for Phase 1 and 2 recovery, which is best. "Fast-track" recovery bypasses phase 1. This requires an anesthetic technique and operation that facilitates rapid emergence and return to baseline physiological function, as well as postoperative analgesia techniques and PACU policies that also speed recovery. Avoidance of opioids, pre-emptive treatment for side effects such as PONV, early mobilization and feeding all can speed discharge.

Patient flow decisions from the OR to PACU are commonly made based on clinical judgment. Transition from Phase 1 to 2 is often based on the Aldrete or other score. If strategic plans are made in how cases are scheduled, the physician can be taken out of the loop reducing the need to make frequent decisions, and guidelines can enhance patient flow and efficiency. Reducing idiosyncratic behavior by individuals is important in both increasing efficiency and maintaining safety.

ASA Tuesday Afternoon Oral Abstract Presentations

Moderators: Rita Agarwal MD, FAAP The Children's Hospital, Denver; Shu-Ming Wang, Yale University School of Medicine

Reviewed by Rita Agarwal MD, FAAP
Abstracts may be directly accessed from the web-based newsletter.

The Tuesday afternoon oral presentation session was opened **by Dr Laura Torres MD** from Texas Children's Hospital, Houston who presented **Safety & Operational Efficiency of Anesthesiology Directed Sedation for Pediatric Diagnostic Imaging** by Laura Torres, M.D., Carol Lin, M.D., Danyalle Evans, R.N., Flora Enaje, R.N., Mehernoor Watcha, M.D. *Presented by Dr Torres.*

In 2005 the anesthesiology department at Texas Children's Hospital took over sedation services for children undergoing radiological procedures. The sedation service was staffed by 2.5 FTE physicians and 25.8 FTE nurses. Patients received sedation by nurses or physicians, based on their health status. The authors reviewed hospital databases to determine: adverse effects, radiology productivity and back log, and billing information. They found an increase in daily census of completed cases, a decrease in backlog, decreased incidence of hypoxemia and overall increased hospital billings. Interestingly, the physicians who provided sedation services included specifically accredited ICU attendings as well as anesthesiologist. This was done to resolve issues with manpower shortages. Although many of the audience members may not have agreed with the TCH model, most acknowledged that it appeared to have been successful, both in providing safe efficient sedation services and also in maintaining these services within the anesthesia department.

How Much Time Do We Spend in Preoperative Holding: Findings of a Video Capture System Jill E. MacLaren, Ph.D., Carrie Hammell, B.A., Cristina Novoa, B.A., Lauren Mednick, B.A., Zeev N. Kain, M.D., M.B.A. Anesthesiology, Yale University School of Medicine, New Haven, Connecticut

Dr. Zeev Kain presented this intriguing study was designed to evaluate who much time medical professionals (nurses, surgeons and anesthesiologist) spend talking with patients and parents. Sophisticated video capturing technology was used to record the amount and the quality of time each group spent with families, the percentage of time dedicated to connecting with the patient, versus the parent, and the percentage of time spent on non-medical talk. Surprisingly, while all groups spent very little time in the room with each family, the anesthesiologist spent the most, 3-5 minutes. Surgeons spent on average 3 and half minutes in the room

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with the families, 90% of which was spent in medical talk; nurses spent the least amount of time talking to the families. The majority of the time was spent in medical discussion with the parents. A very small percentage of the time was dedicated to talking to the child. Much of the discussion following the presentation centered around, could we or should we try and do better?

Prediction of Preoperative Anxiety in Children: Who Is Most Accurate? Inna Maranets, M.D., Jill E. MacLaren, Ph.D., Caitlin Thompson, B.A., Jason A. Chen, B.S., Zeev N. Kain, M.D., M.B.A.Anesthesiology, Yale School of Medicine, New Haven, Connecticut

Dr. Zeev Kain presented this fascinating study exploring the ability of parents, nurses or anesthesiologists in correctly predicting a child's anxiety at induction. Nurses, Parents and anesthesiologist were asked to predict how anxious a child would be on induction using a visual analog scale for anxiety. Patients were then scored using the as well the YPAS in the holding area and on entry into the Operating Room. Anesthesiologist were significantly better at predicating a child's anxiety at OR entry than either the nurses or parents. The admitting nurses were better than parents. AS one audience pointed out " we may spend very little time with the patients, but we make very good use of the time we do spend!".

Pediatric Cardiopulmonary Arrest Management in the Operating Room – Results of a National Survey Kristen L. Nelson, M.D., Donald H. Shaffner, M.D., Elizabeth A. Hunt, M.D., M.P.H., Myron Yaster, M.D., Eugenie Heitmiller, M.D. Anesthesiology and Critical Care Medicine, Johns Hopkins School of Medicine, Baltimore, Maryland. *Presented by Dr Nelson.*

Dr. Nelson and her associates sent out a national survey on the SPA website, assessing practicing pediatric anesthesiologists' experience and knowledge with intra-operative cardiopulmonary arrest. They had a response of 34% (304 respondants). Forty five % of respondents state that they had to perform chest compressions in the operating room at least once in the past year, and 24% had to perform defibrillation. While many of the patients had congenital heart disease, the majority of these events occurred during non-cardiac surgery. They also found that while the majority of respondents were knowledgeable about doses of resuscitation medications, they did not know the correct sequence, dosing or treatment for several commonly taught PALS algorithms. Most respondents knew what type of defibrillator was available in their institutions, but the majority had not received any formal instructions in its use. Forty nine % of respondents had not taken PALS In the past 2 years and 13 % had never taken PALS. The authors and the audience concluded that this was definitely an area in which there appeared to be significant education deficits.

At What Age Is Ambulatory Surgery Safe in Infants? A Survey of Pediatric Anesthesiology Programs. Pilar E. Castro, M.D., Dorothea A. Markakis, M.D., F.A.A.P. Anesthesiology and Critical Care Medicine, Cleveland Clinic, Children's Hospital, Cleveland, Ohio. *Presented by Dr Castro*

This purpose of this survey was to discover what age if any, programs allow outpatient anesthesia on former premature infants. A survey was distributed to the Program Directors of all ACGME approved pediatric anesthesiology programs. Questions included: PCA age requirement for outpatient anesthesia; routine checking of hemoglobin; age requirement for full term infants; post-operative monitoring requirements etc. The authors had a response rate of 82%. They found a wide range of minimal post conceptual ages used for outpatient anesthesia from 41 weeks-60 weeks. Most programs used 41- 44 weeks post conceptual as a minimum age for outpatient anesthesia in full term infants. Forty one % of programs used a PCA of 51-54 weeks for outpatient anesthesia in the ex-preemie, while 25% used 60%. The authors concluded that there continues to be a lack of consensus regarding the minimal at which it is safe to perform outpatient anesthesia.

Prospective Randomized Trial of Very Early Extubation in Pediatric Cardiac Patients Sergey Preisman, M.D., Lembersky Henrietta, M.D., Yusim Yakov, M.D., Perel Azriel, M.D., Mishaly David, M.D. Department of Anesthesiology and Intensive Care, Sheba Medical Center, Tel Aviv University, Tel Hashomer, Israel. *Presented by Dr Preisman*

This study was undertaken to explore the feasibility of early extubation in children undergoing a variety of open cardiac surgery. Exclusion criteria included pre-operative ventilation, age less than 1 month, hemodynamic, pulmonary instability or excessive bleeding. The authors found that there were no differences in mortality, need for reexploration for bleeding, postoperative cardiac and septic complications or in need for re-intubation. The incidences of minor pulmonary complications were high, and greater in the intubated group compared to the early extubation group. As expected length of PICU and hospital stay were shorter in the early extubation group. Many in the audience were intrigued by these results.

Wednesday, October 17, 2007

Panel: Update on Sedation for Pediatric Patients

Reviewed by Shobha Malviya, MD
University of Michigan

This panel was coordinated and moderated by **Dr. Lynn Maxwell** from the Children's Hospital of Philadelphia. Procedural sedation in children remains a topic of interest as evidenced by the large turnout at this panel despite it being the last day of the ASA when attendance is usually sparse.

Ron Litman DO, FAAP from the Children's Hospital of Philadelphia opened the session with a discussion on "Who Should Provide Sedation". His talk was largely comprised of the sedation model at his own institution. While moderate sedation is practiced by a number of different services, deep sedation is restricted to hospitalists, emergency department physicians and cardiologists performing cardiac catheterization. Credentialing for moderate sedation at CHOP requires PALS training, completion of a web-based education module, 5 observed sedations signed off by the sedation provider and administration of sedation for 5 procedures per year to demonstrate ongoing competency. Deep sedation, on the other hand requires more comprehensive training including: a 10-day period of hands-on training in the operating room with a re-

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fresher course of 2 days each year, a 1-day long simulator training session, and education regarding sedation policies and standards. Dr. Litman commented that the standard drugs used for sedation are not very effective and associated with a high complication rate including vomiting, emergence agitation and apnea. He noted an increasing use of ketamine in the ICU and ED, and its benefits for brief painful procedures with an acceptable safety record. Dr Litman described the cautionary statements by organizations such as the ASA, ANA and JCAHO as well as in the package insert regarding the use of propofol for procedural sedation by non-anesthesiologists. He also cited a study that demonstrated that patients who receive propofol experience enhanced airway collapsibility and are likely to require upper airway support similar to those who receive 1 MAC isoflurane. A show of hands by the audience found that propofol is used in this setting at less than a third of the institutions.

Shobha Malviya MD from the University of Michigan presented her views on "Consciousness Monitoring and Sedation Scoring". The objectives of monitoring sedation depth include titrating sedative agents to a target sedation depth, ensuring that patients are not at deeper than intended levels of sedation but most importantly to ensure discharge readiness. Following a discussion of observational measures of sedation including the Ramsey Scale, the University of Michigan Sedation Scale and the Observers' Assessment of Alertness/Sedation, she noted that despite good psychometric properties such scales remain subjective and allow room for observer bias. Additionally, use of such scales requires stimulation of the child which may awaken the child and disrupt the procedure. She went on to discuss the use of Bispectral index in the sedation setting. Dr Malviya cited some of her own data that found lower BIS cutoffs in infants less than 6 months of age compared to older children. Additionally, since BIS correlated poorly with observational scores in the presence of opioids and ketamine she cautioned that use of BIS to titrate sedation depth with these agents may result in oversedation. Pediatric data with other anesthesia depth monitors such as cerebral state index and narcotrend are very limited. She concluded that BIS may be useful in selected patients but it would require extensive education to ensure correct interpretation. The last part of her talk identified imprecise assessment of discharge readiness as the weakest link in the care of sedated children. The discharge criteria in the current AAP guidelines allow room for observer interpretation and bias. She emphasized a need for very specific discharge criteria including specific scores using observational sedation scales that must be achieved prior to discharge. Another simple test of discharge readiness is the ability of the child to stay awake for 20 minutes in a quiet environment. While use of such specific criteria prolongs recovery time, it enhances the safety of sedation by avoiding premature discharge.

The next presentation on "Assuring High Quality Procedural Sedation for All Practitioners" was made by **Joseph P. Cravero MD** from the Dartmouth Hitchcock Medical Center. He identified the problem as the huge need for deep sedation. The Pediatric Sedation Research Consortium (PSRC) reported more than 25,000 propofol sedations this year raising the question as to who can/should give sedation using these agents and how does anyone document the ability of a given provider to deliver this care? Another problem is the vast spectrum of education and expertise among sedation care providers ranging from R.N. to primary care M.D. to the intensivist. The choices for anesthesiologists are to ignore the problem, not participate yet legislate against the use of potent drugs, take on all deep sedation, or take on the most challenging cases, help design education and credentialing and remain engaged. He went on to describe a tiered system of sedation privileging based on the intended depth of sedation and evaluated the ability of standardized courses such as PALS to provide this education. While both PALS and APLS courses do include a fairly comprehensive didactic component on sedation related issues, the hands-on portion of these courses rarely involve sedation scenarios. Additionally, the sedation module of PALS is often not included as part of the course at many institutions. The sedation courses at some institutions do include hands-on training in the ICU or in simulation centers. Dr. Cravero went on to discuss the complication rates from sedation as reported by the PSRC data. He reported that critical adverse events are rare with no deaths, 1 cardiac arrest and 1 aspiration. Serious adverse events including laryngospasm, bronchospasm, stridor and apnea occurred in 1 in 400 cases and 1 in 100 cases required emergency airway manipulation. Dr Cravero then went on to describe the very comprehensive sedation training in place at his own institution including model events in the simulator and video instruction. He concluded with emphasizing the importance of QI process to model errors and reenact to educate on an ongoing basis.

Joseph D. Tobias MD concluded the panel with an in-depth discussion on dexmedetomidine. It is an $\alpha 2$-adrenergic agonist with an $\alpha 2$ to $\alpha 1$ ratio of 1600:1. It has a shorter half-life than clonidine (2-3 vs. 8-12 hours). Its effects on the cardiovascular system include hypotension, bradycardia and in some cases hypertension. It has been shown to cause short periods of obstructive apnea in high doses. Dexmedetomidine does not alter ICP, decreases cerebral blood flow and animal studies have shown that it may have cerebral protective effects during ischemia. Its clinical applications include: intraoperative administration as part of a balanced anesthetic, sedation during mechanical ventilation, treatment of withdrawal syndromes, prevention of emergence delirium, treatment of postoperative shivering and procedural sedation. Dr. Tobias described one of his own studies comparing the use of dexmedetomidine and midazolam for ICU sedation. Children who received dexmedetomidine (0.5 mcg/kg/hr) required less morphine for agitation and had better sedation scores than those who received midazolam. He then went on to describe his experience with dexmedetomidine in 7 infants who experienced severe withdrawal following a fentanyl infusion and prn midazolam. These infants received a bolus of 0.5 mcg/kg dexmedetomidine followed by an infusion of 0.5 mcg/kg/hr. All 7 patients experienced effective control of withdrawal symptoms with a second bolus and increase in infusion being required in 2 cases. A case series of 24 patients with postoperative shivering reported successful treatment in all cases with 0.5 mcg/kg of dexmedetomidine. It has also been used successfully for procedural sedation. A study by Koroglu et al reported that that 20% of children sedated with dexmedetomidine for MRI required rescue sedation compared to 80% of those who received midazolam. Another study by the same investigators found similar success rates with slightly longer recovery time but a lower incidence of hypoxemia in children sedated with dexmedetomidine vs. propofol for MRI. Dexmedetomidine, however, has been found to have limited success for sedation for painful procedures. After a detailed description of the literature related to this agent, Dr. Tobias concluded with practical tips related to its use.

The presentations by the speakers were followed by a spirited discussion by the audience and speakers regarding several related contentious issues such as use of propofol by non-anesthesiologists and sedation vs. general anesthesia for MRI.

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often including an echocardiogram, additional laboratory studies or adjustments in preoperative medications. The decision to institute invasive monitoring intraoperatively is also best assessed by the pediatric cardiac anesthesiologist: when is it critical to place arterial monitoring in the infant who has struggled through his postoperative course after Stage I single ventricle palliation and now requires a Nissen fundoplication, and when should that access be preserved for forthcoming cardiac catheterizations and surgeries? Experience with this patient population facilitates such complex decision making. Not only are pediatric cardiac anesthesiologists able to provide unique perspective on the patient's anatomy, physiology, and anesthetic management, but we are also best suited to provide education regarding the patient's heart disease for other members of the anesthesia care team and operating room personnel. We are easily able to facilitate communication with the patient's cardiologist, cardiac surgeon, and/or the cardiac OR team should that become necessary. Finally, we can best guide perioperative decision-making regarding the patient's expected hemodynamics, outcome, and the appropriate level and venue for postoperative care, using both our training as pediatric anesthesiologists as well as the additional expertise gained by caring daily for patients with complex congenital heart disease.

Just as knowledge and awareness of pediatric anesthesia as a subspecialty has evolved over the past twenty years since the inception of the Society for Pediatric Anesthesia in 1986, so too we predict that over the coming years with the increasing number of complex cardiac patients requiring anesthetics, the care of these patients will increasingly be delegated to specialized groups of pediatric anesthesiologists. Proponents of health care reform advocate value-based care for the individual patient in specialist centers organizing care around medical conditions. Pediatric cardiac anesthesiologists working in cardiac centers within pediatric hospitals would be best suited to provide this circle of care for these patients.[7] The recently established Congenital Cardiac Anesthesia Society, affiliated with the Society for Pediatric Anesthesia, also underscores the importance and growing size of this special patient population. Although all pediatric cardiac anesthesiologists are accustomed to caring for pediatric patients, not all general pediatric anesthesiologists are comfortable caring for patients with cardiac disease. Just as pediatric cardiologists have recognized the need for specialized training to care for adults with congenital heart disease, so too it is time for us as pediatric anesthesiologists to acknowledge the advantages of dedicated pediatric cardiac anesthesiologists to care for this very heterogeneous group of neonates, children and adults.

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an onerous call schedule. These physicians may look to their pediatric colleagues to lighten the burden of clinical work by covering non-cardiac surgeries. This highlights the issue nationwide that the demand is overwhelming and there remains a limited supply of service providers.

To support this theory, I contacted by telephone the anesthesia departments of the top ten pediatric hospitals in the US, as described by the US News and World report, published in August this year[6]. In six of the ten hospitals contacted, the cardiac catheterization suite was staffed primarily by cardiac anesthesiologists, and the other four by pediatric anesthesiologists. However all stated that in the general operating room, pediatric anesthesiologists were typically the responsible physician. Only three institutions described a selective or hybrid coverage by pediatric cardiac anesthesiologists for patients with significant CHD having non-cardiac surgery that were considered high risk.

However, just because it is logistically difficult, should that deter us from what is appropriate? Is it indeed in the patient's best interest to have a pediatric cardiac anesthesiologist above all others, for their non-cardiac surgery? It might be if there was any evidence to support that.

There is data to suggest that children with CHD are a higher risk. Baum noted an incremental risk greatest in neonates and infants where the presence of congenital heart disease is associated with a 2-fold increase in mortality from non-cardiac surgery[7]. In this paper however, the author admits that the mortality rates for children with and without CHD were higher than previously reported as a consequence of the methodology of data collection. Also the cause of death may not be directly related to the presence of CHD but more that there may be associated congenital anomalies leading to complications.

The most recent review of Anesthesia-Related cardiac arrest in children from the Pediatric Perioperative Cardiac Arrest (POCA) Registry, noted that the most common association was no longer halothane-induced arrhythmias but inadequately managed blood loss/transfusion[8]. There were 26 patients in which the cause of the arrest was unknown, nine of which had CHD. However at no point in this analysis was the training or status of the anesthesiologist discussed. Of note, 23% of all the cardiac arrests occurred during weaning from cardiopulmonary bypass. It appears even pediatric cardiac anesthesiologists are not immune from the odd mishap.

Recently, the British Report of the Pediatric and Congenital Cardiac services Review Group, a multidisciplinary group formed after disappointing pediatric cardiac surgical outcomes in a British hospital, noted that "there is currently no evidence that variations in training or experience of anesthetists have any bearing on outcomes in pediatric and congenital cardiac surgery"[9]. This may be because it has simply not been studied. The fact remains however that there is no evidence, direct or indirect, in the literature to determine who is best suited to care for children with CHD.

In summary, the proposal is ill defined, unrealistic and unsupported by the data. As professionals it is more important that we recognize our individual limitations and seek assistance when confronted with a new or unfamiliar challenge. That does not mean that a competent pediatric anesthesiologist is unable to care for a patient with CHD undergoing non-cardiac surgery. Furthermore, we cannot afford to alienate ourselves from our colleagues, but should instead embrace the opportunity to learn from one another.

Propofol for MRI— Is it Monitored Anesthesia Care (MAC) or is it General Anesthesia?

By Helen V. Lauro, M.D., F.A.A.P.
SUNY-Downstate Medical Center/Long Island College Hospital Brooklyn, NY

A perusal of pediatric anesthesia literature reveals the description of intravenous propofol for pediatric magnetic resonance imaging (MRI) as total intravenous anesthesia[1,2] sedation[3,4], light anesthesia[5], unconscious sedation[6], deep sedation[7,8] or general anesthesia[9]. Navigating this quagmire is compounded by the lack of consensus on billing practices when administering intravenous propofol for pediatric MRI. This can run the gamut of "general anesthesia", "total intravenous anesthesia", "conscious sedation", "monitored anesthesia care" or "propofol", as the term "deep sedation" typically is not found on billing documents.[10,11] This nebulous area is further exacerbated when pediatric anesthesiologists have the risks/benefits discussion with anxious parents, many of whom say "I only want sedation." This first issue of "Pushing the Envelope" examines and reviews this provocative issue.

> "Pushing the Envelope" is a new annual SPA newsletter feature which will address contentious areas concerning pediatric anesthesia practice. It is hoped that after reading the feature, SPA newsletter readers elect to participate in casting their point of view on important practice issues. This can be done by logging on to the web site and electronically voting. Results will be displayed in the subsequent printed and online newsletter.

Moderate sedation (Conscious sedation) is a state of depressed consciousness in which the child retains a patent airway and protective reflexes and is arousable to verbal commands and/or light physical stimulation. Deep sedation is a state of depressed consciousness in which the child is not easily aroused but responds purposefully to painful stimulation, and may impair maintaining a patent airway. General anesthesia is a drug-induced loss of consciousness during which patients are not arousable, even by painful stimulation.[12,13]

In truth, pediatric sedation is not discrete but rather represents a continuum with the patient drifting in and out of and across the various levels of sedation.[14] According to the ASA/JCAHO/AAP criteria, the distinguishing characteristic between deep sedation and general anesthesia is the presence or absence of a response to repeated painful stimuli. This difference, however, can be subtle (patients can go in and out of a given state quite rapidly.)[15]

The University of Michigan Sedation Scale (UMSS) is a valid and reliable simple observational tool to assess the depth of sedation in children.[16] A prospective study comparing anesthesia depth monitors with the UMSS administered during induction and emergence from propofol sedation in children undergoing MRI found that propofol induction resulted in a progressive and significant decrease in anesthetic depth measurements from UMSS scale value of 0 (awake and alert baseline) to UMSS scale values of 3 (deeply sedated: deep sleep, arousable only with significant physical stimulation) and 4 (unarousable).[17] Monitored anesthesia care may include varying levels of sedation, analgesia and anxiolysis as necessary.[18] However, the ASA Position on Monitored Anesthesia Care states "If the patient loses consciousness and the ability to respond purposefully, the anesthesia care is a general anesthetic, irrespective of whether airway instrumentation is required."[18]

The involvement of qualified professionals is essential to safeguard and improve our pediatric anesthesia practice. Proper coding and billing to ensure accurate reimbursement for services rendered depends on payer mix, private insurer commitment to sedation, and state Medicaid reimbursement schedules. Pediatric anesthesiologists should not have to argue on what billing term is the closest to "deep sedation." To assure reimbursement is appropriate; anesthesiologists need to lobby insurance companies and state agencies to assure that payment is appropriate for this critical service of deep sedation.

How do you bill for intravenous propofol for pediatric MRI ?

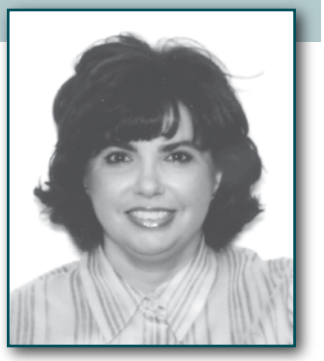
o General anesthesia.
o Monitored anesthesia care

Please respond to the poll online at www.pedsanesthesia.org

REFERENCES

References for articles in SPA NEWS are available online at **www.pedsanesthesia.org**

PEDS PASSPORT Your global meeting itinerary



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

February 20-23: Whistler, British Columbia, Canada
17th Annual Pediatric Critical Care Colloquium/5th Annual Canadian Critical Care Conference
Tel: (604)-834-9362, Fax: (604)-875-5957
Information Ms. Zena Davidson, Rm. 2448 Vancouver General Hospital ICU, 899 West 12th Avenue, Vancouver, British Columbia, V5Z1M9
Website: http://www.canadiancriticalcare.ca

March 27-30: Monte Carlo, Monaco
PCICS Europe 2008-European Symposium of the Pediatric Cardiac Intensive Care Society
Tel: +41 22 908 04 88 ext. 275, Fax: +41 22 732 28 50
Information: Secretariat, 17 rue du Cendrier, P.O Box 1726, CH-1211 Geneva 1, Switzerland
Website: http://www.kenes.com

April 3-6: San Diego, California, USA
Society for Pediatric Anesthesia/American Association of Pediatrics (AAP) 2008 Winter Meeting
Tel: (804)-282-9780, Fax (804)-282-0900
Information: Society for Pediatric Anesthesia, 2209 Dickens Rd., Richmond, VA 23230-2005
Website: http://www.pedsanesthesia.org

May 8-10: London, United Kingdom
Association of Paediatric Anaesthetists of Great Britain and Ireland Annual Scientific Meeting
Tel: +44 20 70921739, Fax: +44 20 70921733
Information: APA Secretariat, Churchill House, 35 Red Lion Square, London WC1R, 4SG
Website: http://www.apagbi.org.uk

May 21-24: Boston, Massachusetts, USA
Second Annual Pediatric Anesthesiology and Critical Care Medicine Conference: Perioperative Care of the Infant and Child
Tel: (617) -384-8600, Fax: (617)-384-8686
Information: Harvard Medical School, Department of Continuing Education, P.O. Box 825, Boston, MA 02117-0825
Website: http://www.cme.med.harvard.edu

May 29-31: Zurich, Switzerland
34. Annual convention the society for Neonatologie and Pädiatri intensive medicine
Tel: +41 (0) 44-255-53 40, fax +41 (0) 44-255-44 42
Information: Professor Dr. med. Hans Ulrich Bucher, University University of Zurich, hospital for Neonatologie, Frauenklinikstr. 10, CH Zurich
Website: http://www.gnpi2008.com

June 14-17: Istanbul, Turkey
Europaediatrics 2008
Tel: +90 216 330 90 20, Fax: +90 216 330 90 05-06-07-08
Information: Topkon Congress Services Zühtü Pa?a Mah. R?fat Bey Sokak No:24 PK. 34724 Kalam??-Kad?köy Istanbul, Turkey
http://www.europaediatrics2008.org

September 25-27: Athens, Greece
Federation of European Assoications of Paediatric Aaesthesia (FEAPA) in association with the Greek Society of Paediatric Anaesthesia
Tel: (+30) 210 3232433, Fax: +30 210 3232338
Information: Aktina-City Congress SA, 26 Filellinon Street, GR-10558, Athens, Greece
Websites: http://www.feapa.org, http://www.aktinacitycongress.com

September 27-29: Porto, Portugal
Resuscitation, Respiratory Assistance, Ventilation and Care of the Newborn Infant
Tel: +49 (0) 621/4106-134, Fax: +49 (0) 621/4106-80134
Information: IPOKRaTES Head Office c/o m:con GmbH Rosengartenplatz 2, D-68161 Mannheim October 24-27: Nice, France
Website: http://www.ipokrates.info

October 17: Orlando, FL
Society for Pediatric Anesthesia Annual Meeting
Tel: (804)-282-9780, Fax (804)-282-0900
Information: Society for Pediatric Anesthesia, 2209 Dickens Rd., Richmond, VA 23230-2005
Website: http://www.pedsanesthesia.org

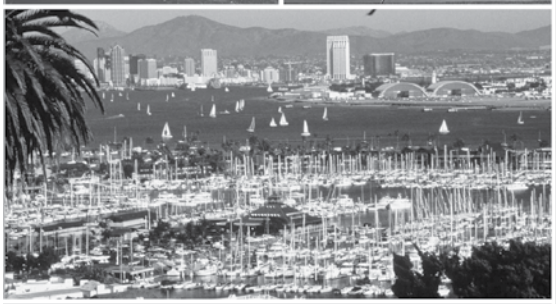
October 24-27: Nice, France
19th ESPNIC Medical and Nursing Annual Congress at the European Academy of Paediatrics
Tel: +41 22 908 0488, Fax: +41 22 7322850
Information: Kenes International, European Academy of Paediatrics, 17 Rue du Cendrier, P.O. Box 1726, CH-1211 Geneva 1, Switzerland
Website: http://www.kenes.com/paediatrics

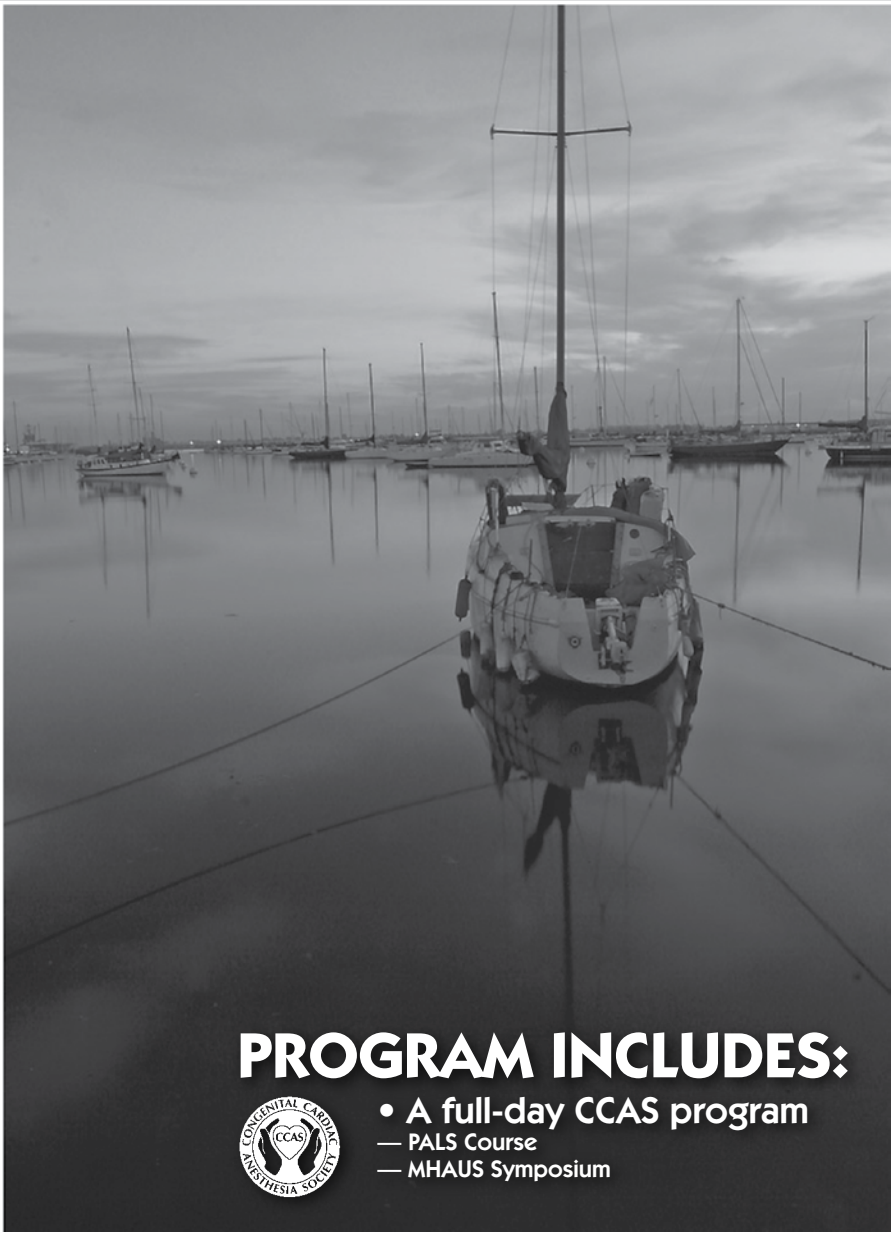
Footnote:
Please forward all information concerning congresses relevant to Pediatric Anesthesia to: Dr. Helen V. Lauro, M.D., F.A.A.P., Department of Anesthesiology, Long Island College Hospital, 339 Hicks Street, Brooklyn, New York 11201.

Pediatric Anesthesiology 2008

A meeting co-sponsored by the Society for Pediatric Anesthesia and the American Academy of Pediatrics Section on Anesthesiology and Pain Medicine

April 3 – 6, 2008 • Sheraton San Diego Hotel & Marina • San Diego, California





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American Academy of Pediatrics

www.aap.org/sections/anes

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- **A full-day CCAS program**
  - — PALS Course
  - — MHAUS Symposium

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22nd Annual Meeting
October 17, 2008 • Orlando, Florida

Pediatric Anesthesiology 2009
March 18 - 22, 2009 • Jacksonville, Florida

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