SPA

Society for Pediatric Anesthesia
NEWSLETTER

Volume 7 Number 1 Winter-Spring 1994

PRESIDENT'S MESSAGE

By Charles H. Lockhart, M.D.

At its inception, your Society had four main goals. Our first goal is to attract anesthesiologists with a strong interest in pediatric anesthesia. In the past year, our membership expanded by 13 percent to more than 1,500 members. Our resident/fellow trainee numbers increased by 130 percent to 142 members. In addition, our Society is taking on an international flavor as our membership of colleagues from overseas increases.

Our second goal is to foster education in pediatric anesthesia, as evidenced by several activities. Foremost, as detailed in this newsletter, more than 500 attended the 1993 SPA Annual Meeting in October in Washington, D.C. Our newsletter continues its educational function and, in addition, SPA members may also subscribe to *Paediatric Anesthesia* at a reduced rate. Future educational plans include a second meeting in the late winter or early spring of each year. Hopefully, these meetings will commence in 1995. The potential for a combined meeting with the American Academy of Pediatrics Section on Anesthesiology is also being explored.

Our third goal is to support research and increase scientific knowledge in our subspecialty. In concert with the Foundation for Anesthesia Education and Research (FAER), the first Young Investigator Award with a pediatric anesthesia project has been awarded. SPA and FAER together provided financial support for the project.

SPA's fourth goal is to provide a collegial atmosphere and setting for interchange among our members. Four hun-

Charles H. Lockhart, M.D.

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SPA SEVENTH ANNUAL MEETING

By Francis X. McGowan, Jr., M.D. and Peter J. Davis, M.D.

MORNING SESSION

The Society for Pediatric Anesthesia (SPA) Seventh Annual Meeting took place on October 8, 1993 at the Renaissance Hotel in Washington, D.C. More than 500 attended a morning session devoted to presentations related to pulmonary endothelial function and regulation of pulmonary vascular tone as well as to newer strategies of improving lung function.

The keynote address was delivered by **C. Norman Gillis, Ph.D.**, Professor of Anesthesiology and Pharmacology, Yale University, New Haven, Connecticut. Dr. Gillis is an internationally recognized

C. Norman Gillis, Ph.D.

expert on the metabolic and vasoactive functions of the lung. He summarized the role of the pulmonary endothelium to metabolize and/or remove circulating substances such as serotonin, norepinephrine and certain prostaglandins. These metabolic functions appear to be injured prior to the appearance of morphologic lung damage or clinical respiratory distress, and thus may serve as markers for impending lung injury.

Dr. Gillis discussed the role of the pulmonary endothelium to synthesize compounds such as nitric oxide, prostacyclin and endothelin-1, which regulate local vascular tone under basal conditions and vascular tone in response to neurohumoral influences and autocoids such as bradykinin, norepinephrine, serotonin, thrombin and adenine nucleotides. Dr.

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Gills also discussed the role of nitric oxide. Nitric oxide produces vasorelaxation by stimulation of smooth muscle guanylate cyclase and is an important contributor to basal vascular tone; its synthesis and/or effects are reduced in hypertension, atherosclerosis, after ischemia-reperfusion injury and perhaps by inhaled anesthetics. Nitric oxide is also an important inhibitor of platelet aggregation and adhesion (as is prostacyclin) and may inhibit smooth muscle cell and fibroblast proliferation. Prostacyclin is also an endothelium-derived vasodilator that is released in response to changes in flow state as well as in response to bradykinin, thromboxane and serotonin.

Dr. Gillis also commented on the role of endothelin-1, which is the most potent endogenous vasoconstrictor identified to date. Its concentrations are elevated in shock, myocardial ischemia, after cardiopulmonary bypass and in children with pulmonary hypertension. In addition to promoting vasoconstriction (especially when endothelium-dependent dilation has been impaired), endothelin-1 also acts as a stimulant of smooth muscle proliferation and can result in the development of obstructive vascular disease.

The influence of lung injury upon endothelial regulation of pulmonary vascular tone was the subject of **Stephen Rimar, M.D.**, Assistant Professor, Departments of Anesthesiology and Pediatrics, Yale University, New Haven, Connecticut, and a collaborator of Dr. Gillis. Hyperoxia and free radical injury impair the ability of the lungs to remove serotonin and norepinephrine. Pulmonary vasodilation in response to acetylcholine (which is mediated, at least in part, by nitric oxide release) is also eliminated after free radical injury, while vasodilation in response to inhaled exogenous nitric oxide (and therefore vascular smooth muscle function) is preserved.

Citing several studies, Dr. Rimar noted that the loss of endothelial serotonin uptake and nitric oxide production can be observed in the absence of gross lung injury and that endothelial damage (an important phenomenon leading to abnormal pulmonary vascular tone) occurs early in the course of acute lung injury. Preliminary clinical evidence of endothelial injury has been obtained in humans after cardiopulmonary bypass and in patients with adult respiratory distress syndrome (ARDS). Dr. Rimar noted that although the exact mechanisms of endothelial cell dysfunction are unknown, preservation of the dilator response to exogenous nitric oxide localizes the defect to the endothelial cell and has important therapeutic implications as well.

The role of inhaled nitric oxide (NO) therapy was discussed by **Jeffrey R. Fineman, M.D.**, Assistant Professor of Pediatrics, University of California, San Francisco, California. In addition to emphasizing that the loss of endothelium-dependent dilation mediated by nitric oxide is a significant feature of acute lung injury in ARDS and after cardiopulmonary bypass, Dr. Fineman also noted that endogenous nitric oxide production has an important regulatory effect upon neonatal pulmonary vascular tone.

In an experimental animal model

Stephen Rimar, M.D.

Jeffrey R. Fineman, M.D.

(lamb), persistent pulmonary hypertension, produced by in utero ductal ligation, is associated with reduced NO synthesis and pulmonary hypertension after birth. Similarly, in lambs, chemical inhibition of nitric oxide synthesis prior to delivery results in sustained elevations in pulmonary vascular resistance (PVR) after birth. Current management of persistent pulmonary hypertension of the newborn (PPHN), which includes alkalosis, hyperoxia, intravenous vasodilators and extracorporeal membrane oxygenation, is associated with significant morbidity. Dr. Fineman noted that inhaled NO diffuses from alveoli and acts *selectively* on the pulmonary vasculature, since it is rapidly inactivated by hemoglobin upon reaching the pulmonary bloodstream. Consequently, inhaled NO may be a logical treatment modality for patients with increased PVR.

In addition, Dr. Fineman discussed several recent studies involving experimental animals, neonates with PPHN and infants with pulmonary hypertension secondary to congenital heart disease. These studies demonstrated that inhaled NO (usually 40-80 parts per million) can result in sustained improvement in arterial PO_2 and reduced PVR, but does not affect systemic arterial pressure or increase methemoglobin concentration (end-product of the reaction of NO with hemoglobin). Inhaled concentrations as low as 6-20 parts per million have also been used for as long as 23 days without tachyphylaxis or evident systemic toxicity. Potential problems with inhaled NO include safe delivery (it can react with O_2 to form toxic nitrogen oxides), possible lung injury (due to nitrogen oxides or its reaction with oxyradicals to form the radical peroxynitrite) and methemoglobinemia.

Dr. Fineman further emphasized that criteria for which patients may or may not benefit (e.g., diaphragmatic hernia patients) from inhaled NO therapy and its effects on long-term outcome in patients with severe lung disease remain to be defined.

William R. Clarke, M.D.

The presentation by **William R. Clarke, M.D.**, Assistant Professor, Departments of Anesthesiology and Pediatrics, University of Washington, Seattle, Washington, focused upon the role of pulmonary vascular smooth muscle in the regulation of PVR. He noted that both the adenylate cyclase and guanylate cyclase systems are involved in smooth muscle relaxation via the production of cyclic AMP and cyclic GMP, respectively. Furthermore, increasing pulmonary blood flow by increasing cardiac output from low to normal or slightly increased levels can reduce PVR, both by recruiting cross-sectional pulmonary vascular area and by virtue of the fact that the relationship of pulmonary blood flow to pulmonary artery pressure is not linear. Because the major cause of morbidity and mortality due to pulmonary hypertension is the reduction in pulmonary blood flow (and not increased PVR per se), increasing right heart cardiac output is the major goal of therapy. Both increased output, and decreased PVR can result from beta-adrenergic stimulation (beta-receptors are coupled to adenylate cyclase).

Prostacyclin, which will soon be available in this country, is a very potent stimulant of cAMP production and has been quite useful in controlling PVR after cardiac surgery and transplantation. Dr. Clarke noted that increased cAMP (via beta-agonists and prostacyclin) and cGMP (via inhaled NO and NO donors such as nitroglycerin and nitroprusside) concentrations in vascular smooth muscle can be maintained by inhibiting their catabolism. Breakdown of cAMP and cGMP occurs by a family of phosphodiesterases, which can be inhibited by compounds such as amrinone, milrinone and dipyridamole. Thus, there are a number of possible mechanisms to reduce PVR in patients with pulmonary hypertension. The choice between agents will partially depend upon etiology and partially upon trial and error.

Dr. Clarke concluded by saying that likely future medical regimens will involve attempts at synergistic combinations of beta-agonists (to improve cardiac output and increase smooth muscle cAMP), inhaled NO (to activate cGMP) and phosphodiesterase inhibitors (to potentiate and prolong the effects of cAMP and cGMP).

The next speaker of the morning was **Jon N. Meliones, M.D.**, Assistant Professor of Pediatric Critical Care, Duke University, Durham, North Carolina, who discussed new strategies of mechanical

Jon N. Meliones, M.D.

ventilatory support in the patient with a failing circulation. Dr. Meliones emphasized that several key interactions between right and left ventricles, the lungs and great vessels occur that markedly influence cardiac output and tissue oxygen delivery. Positive pressure ventilation (PPV) can reduce right ventricular preload by increasing intrathoracic and right atrial pressures, thereby decreasing systemic venous return. This sequence may also compromise left ventricular output by two forms of ventricular interdependence: since right ventricular output falls, the amount of blood returning to the left ventricle (and therefore left ventricular preload) is diminished; second, PPV

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increases right ventricular afterload and right ventricular pressure, which results in conformational changes in the interventricular septum that reduce left ventricular volume and compliance.

The effects of PPV upon right ventricular afterload are important and complex. Pulmonary vascular resistance is increased at very low or very high lung volumes. Therefore, PPV and PEEP may decrease PVR in patients with significant loss of lung volume. Alternatively, ventilation at very high airway pressures (generally considered to be mean airway pressures >15 cm H_2O) will increase right ventricular afterload due to pulmonary vascular compression. Right ventricular output, and especially that of the failing right ventricle, may be especially sensitive to small increases in afterload.

Standard methods of ventilatory support for the failing right ventricle include reducing PVR by increasing pH, increasing PAO_2 and PaO_2, and decreasing PCO_2 (as well as augmenting preload). Standard PPV regimens using high ventilatory rates, tidal volumes, etc. to accomplish these goals may increase intrathoracic pressure and thereby reduce right-sided preload and increase afterload. Therefore, PEEP, respiratory rate and mean airway pressure should be kept as low as possible.

Nonconventional modes of ventilation, e.g., high-frequency jet ventilation (HFJV), should be considered in patients in whom adequate reductions in PCO_2 cannot be achieved at mean airway pressures <15 cm H_2O. HFJV may provide equal or superior gas exchange at significantly lower mean airway pressures than standard PPV. Similar considerations may apply for the failing left ventricle. Thoracic pump augmentation, analogous to what occurs during chest compressions during cardiopulmonary resuscitation, has also been used experimentally to increase left ventricular cardiac output. This method uses brief periods (<3 cardiac cycles duration) of high tidal volume breaths (15-20 ml/kg) to augment left ventricular preload.

As Dr. Meliones' work has shown, the immediate challenge is to transfer what have been primarily research methods of measuring pulmonary and cardiac performance to the clinical setting.

Francis X. McGowan, Jr., M.D., Assistant Professor, Departments of Anesthesiology, Pediatrics and Critical Care Medicine, University of Pittsburgh, Pittsburgh, Pennsylvania, summarized considerations involved in surfactant replacement therapy of acute lung disease. Although the etiology of adult respiratory distress syndrome (ARDS) is multifactorial, Dr. McGowan pointed out that one consistent finding in both human and animal models has been reduction in surfactant activity; this can take the form of decreased total surfactant phospholipid, loss of necessary surfactant-associated proteins and/or accelerated conversion from active to inactive chemical forms.

Francis X. McGowan, Jr., M.D.

Dr. McGowan also noted that leakage of surfactant inhibitors such as fibrinogen, hemoglobin and other plasma proteins is likely to be an important phenomenon in acute inflammatory lung diseases (unlike neonatal respiratory distress). In addition to processes such as sepsis, trauma, multiple organ failure, pneumonia and hyperoxia, reduced surfactant activity may accompany lung collapse, hypocarbia, cardiopulmonary bypass and mechanical ventilation of surfactant-deficient lungs.

Dr. McGowan reviewed the two major types of surfactant available for replacement therapy: artificial phospholipid mixtures or extracts from animal lungs. An advantage of animal extracts for replacement therapy of ARDS is that they contain some surfactant-associated proteins, and consequently, may be less susceptible to surfactant inhibitors. In his review of several small and a few larger-scale trials, Dr. McGowan provided evidence that exogenous surfactant improved gas exchange and lung compliance in both children and adults with ARDS. However, optimal preparation, composition, dose, timing and mode of administration remain to be defined.

Dr. McGowan concluded that large, multiple doses administered by both direct bronchoscopic instillation and by aerosol will be required, but the cost of such therapy may be prohibitive. Also, results from surfactant treatment of neonatal respiratory distress syndrome suggest that this modality may increase the number of survivors with significant chronic lung disease.

AFTERNOON SESSION

The first part of the afternoon session addressed controversies in pediatric anesthesia. The first controversy dealt with the issue of the best anesthetic delivery system for infants and children. **J. Michael Badgwell, M.D.**, Associate Professor of Anesthesiology and Pediatrics at Texas Tech University, Lubbock, Texas, championed the cause of the circle system, while **Lynda J. Means, M.D.**, Associate Professor of Anesthesiology, Riley Children's Hospital, Indianapolis, Indiana, enumerated the benefits of partial rebreathing systems.

In his presentation, Dr. Badgwell noted that circle systems can function as safely

J. Michael Badgwell, M.D.

Lynda J. Means, M.D.

and efficiently as Mapleson D systems. In infants greater than 10 kg anesthetized with the use of circle systems, anesthesia could safely be administered if the tidal volume was increased to compensate for the compression volume of the circuit. Mapleson D systems are frequently used in preference to circle systems because of the faster wash-in of anesthetic agents and because they may provide a better sense ("educated hand") of the patient's lung compliance. Dr. Badgwell refuted these issues by citing evidence that there is no educated hand and that a faster anesthetic wash-in can be accomplished with a circle system by increasing the fresh gas flows.

Dr. Badgwell argued that the major advantage of a circle system is that it can be used in patients of all sizes. This convenience factor allows for circuit simplicity, especially for those anesthesiologists who anesthetize patients of all sizes and ages. This convenience allows for the occasional pediatric anesthetist to use familiar equipment on unfamiliar patients.

The use of Mapleson D circuits was argued for by Dr. Means. In her presentation, Dr. Means noted that the simplicity of the circuit coupled with the circuit's design features (low resistance to the work of breathing, easily scavenged exhaled gases, rapid adjustments of inspired anesthetic gases and humidification) are all reasons why the Mapleson D system is frequently used in pediatric anesthesia.

Of interest is that both presenters acknowledged that the best delivery system depends on the anesthesiologist's knowledge and understanding of the circuit's advantages as well as the circuit's limitations with respect to each individual patient.

The second controversy examined the routine use of atropine in pediatric surgical patients. **Susan C. Nicolson, M.D.**, Associate Professor of Anesthesiology, Children's Hospital, Philadelphia, Pennsylvania, discussed the use of atropine during induction of anesthesia, while **George A. Gregory, M.D.**, Professor of Anesthesiology and Pediatrics, University of California, San Francisco, California, presented arguments why atropine should not be used routinely.

Susan C. Nicolson, M.D.

George A. Gregory, M.D.

In her presentation, Dr. Nicolson stated that the risk-to-benefit ratio favored a liberal administration of atropine, and that the two major indications for atropine use before or during induction of anesthesia are: 1) to attenuate vagal reflexes secondary to anesthetic drugs, airway reflexes, nasopharyngeal stimulation and surgical stimulation, and 2) to decrease airway secretions. In her discourse, Dr. Nicolson cited a survey of 25 tertiary care children's hospitals in North America. In this survey, atropine premedication was routinely used by 15 percent of the respondents, while 85 percent never administered it as a premedication. During induction of anesthesia, however, 15 percent of respondents always administered atropine and 20 percent of respondents never did. In the remaining 65 percent of respondents, atropine was administered in specific circumstances. Those specific circumstances included children between 3 months and 6 years of age, patients receiving succinylcholine and patients undergoing specific procedures (e.g., awake intubations, strabismus repair, inguinal surgeries).

Dr. Gregory adamantly maintained that there was no compelling evidence to support the routine use of atropine. The side effects of atropine such as dry mouth, irritability, flushing, and elevated temperature were not insignificant. Dr. Gregory also challenged the validity for using atropine to reduce secretions, prevent laryngospasm and prevent decreases in heart rate and cardiac output. In his discussion, Dr. Gregory noted that with the advent of modern-day anesthetics, tracheal and oral secretions were seldom an issue. Laryngospasm on induction is more related to the level of the child's sedation rather than the presence of secretions. As for cardiovascular effects, the onset of anesthesia is associated with a reduction in heart rate, blood pressure and cardiac output as well as a matched reduction in oxygen consumption. Administration of atropine may just increase myocardial oxygen consumption.

Dr. Gregory did concede there were three circumstances in which he routinely administered atropine: 1) patients with large amounts of secretions, 2) patients being treated with beta blocking agents including eye drops, and 3) patients with bradycardia present preoperatively.

The second part of the afternoon discussions focused on airway management and the use of propofol outside the O.R. The airway management aspect centered on the use of laryngeal mask airways (LMA) and the use of lighted stylets for tracheal intubation of infants and children.

Mehernoor F. Watcha, M.D., Director of Pediatric Anesthesia Research, University of Texas Southwestern Medical Center, Dallas, Texas, discussed the use of the LMA in children. In his discussion, techniques of placement as well as sizing were noted. Situations where the LMA may be of particular benefit for children include: 1) the anesthetized child breathing spontaneously, 2) an adjunct for an

Mehernoor F. Watcha, M.D.

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emergency airway when a patient's lungs cannot be ventilated by conventional bag and mask technique, and 3) a conduit for fiberoptic bronchoscopy and tracheal intubation.

Although Dr. Watcha noted that the ideal position of the LMA is achieved when the epiglottis and esophagus are outside the LMA's laryngeal inlet, this position is achieved, however, in only 40-50 percent of patients. Nonetheless, in spite of less than optimal LMA placement, a satisfactory airway can be achieved in 90 percent of patients.

Dr. Watcha also noted that it is important to recognize that the LMA is not a substitute for an endotracheal tube, and it is absolutely contraindicated in patients considered "full stomachs." The LMA is relatively contraindicated in patients with laryngeal abnormalities and in patients with low pulmonary compliance who need high inflating pressures for ventilation.

Another aid in airway management, the lighted stylet, was described by **Mark S. Schreiner, M.D.**, Associate Professor of Anesthesiology and Critical Care Medicine, Children's Hospital, Philadelphia, Pennsylvania. During his presentation, Dr.

Mark S. Schreiner, M.D.

Scott R. Schulman, M.D.

Schreiner reviewed the historical development of the lighted wand for use in children, and he discussed and illustrated techniques for its use in patients with normal and abnormal airways. Useful aids, suggestions and advice were offered.

The role of propofol outside the operating room was addressed during this session by **Scott R. Schulman, M.D.**, Assistant Professor of Anesthesia and Pediatrics, Duke University Medical Center, Durham, North Carolina. In his presentation, Dr. Schulman addressed the potential uses of propofol in the cardiac catheterization laboratory, for patients requiring MRI and diagnostic/interventional procedures, and for patients undergoing laser ablation of hemangiomas. Because of the five reported deaths in pediatric patients receiving propofol for sedation in the intensive care unit (ICU), Dr. Schulman stated that one place where propofol should *not* be used is the pediatric ICU. The pharmacology of propofol was briefly discussed. Dr. Schulman noted that induction doses of propofol in infants and children range from 2.5 to 3.0 mg/kg, and infusion rates range from 50-300 µg/kg/min. Dr. Schulman also noted that apnea from propofol is dose-related and occurs in 30-50 percent of patients following an induction dose. However, the incidence of apnea can be attenuated if incremental doses (0.5 mg/kg) are used.

David E. Cohen, M.D.

Charles B. Berde, M.D.

Donald C. Tyler, M.D.

Myron Yaster, M.D.

The final session of the afternoon was a panel discussion on the "nuts and bolts" of running a pediatric pain service. The panelists included: **David E. Cohen, M.D.**, Associate Professor of Anesthesia, Children's Hospital, Philadelphia, Pennsylvania; **Charles B. Berde, M.D.**, Associate Professor of Anesthesia, Boston Children's Hospital, Boston, Massachusetts, and **Donald C. Tyler, M.D.**, Professor of Anesthesiology, Children's Hospital, Seattle, Washington. This session was moderated by **Myron Yaster, M.D.**, Director of the Pediatric Pain Service, Johns Hopkins University, Baltimore, Maryland. During this session, issues regarding staffing, resident coverage, billing and reimbursement of services were discussed. In addition, specific issues of dosages of drugs for patients having patient-controlled analgesia and spinal axis opioids were addressed. □

PRESIDENT'S MESSAGE

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dred members and guests attended our reception on October 8, 1993 at the Dirksen Senate Office Building in Washington, D.C.

Our new committee system, initiated last year, hopefully will provide open access for your contributions and concerns as well as help the Society maintain its goals. These SPA committees are listed in the 1993-1994 SPA Membership Directory. In addition, the Society is also establishing a new Governmental Affairs Committee. This committee will be headed by Juan F. Gutierrez-Mazorra, M.D., Birmingham, Alabama, with the purpose of establishing a liaison with the ASA Washington Office. □

ROUND AND ABOUT THE ASA

Several scientific presentations at the ASA Annual Meeting on October 9-13, 1993 in Washington, D.C. focused on various pediatric anesthesia topics. Some of these presentations are summarized here.

MONDAY MORNING CLINICAL FORUM - PEDIATRIC ANESTHESIA

By Scott R. Schulman, M.D.

Steven C. Hall, M.D., Chair, Department of Anesthesiology, Children's Memorial Hospital, Chicago, Illinois, moderated a lively and informative discussion at the Clinical Forum on pediatric anesthesia. Panelists were **Jerrold Lerman, M.D.**, Hospital for Sick Children, Toronto, Ontario, Canada; **Robert Spear, M.D.**, Children's Hospital, San Diego, California, and **J. Michael Badgwell, M.D.**, Texas Tech University, Lubbock, Texas who discussed two particularly challenging case scenarios. The first involved a 6-week-old ex-premature infant born at 30 weeks' gestation who presented for elective inguinal herniorrhaphy. The infant had rhinorrhea and a temperature of 38 degrees. Hemoglobin value was 8 gm dl^{-1}.

Anesthetic considerations for this patient included: prematurity, anemia and an upper respiratory infection. The risk of apnea after general anesthesia in both term and ex-preterm infants was discussed. When can these infants safely receive general anesthesia and what postoperative monitoring is indicated? Where should they be monitored — at home, in the hospital? How long should they be monitored?

There was a diversity of opinion on the panel, ranging from "cancel the case" to proceed with postoperative observation of 10-12 hours on the ward to an overnight stay in the pediatric intensive care unit. Regional anesthesia was briefly discussed as an alternative.

Another interesting scenario was that involving a 3-year-old patient with a presumptive diagnosis of epiglottitis who had micrognathia and a family history of malignant hyperthermia (MH). The anesthetic considerations included management of a difficult pediatric airway, performance of an inhaled versus an intravenous induction, and the use of MH triggers. There was unanimity of opinion that the airway took precedence over the risk of MH. This was the only aspect of the case upon which the panelists agreed. The audience provided many interesting suggestions, not the least of which was the use of flexible fiberoptic laryngoscopy. Traditionalists in the crowd advocated a slow, smooth inhaled induction under controlled conditions in the operating room with halothane, while others urged an awake examination in the emergency department. Independent of the path chosen, the panelists mentioned the necessity of having personnel experienced in establishing a surgical airway immediately available.

MONDAY MORNING SCIENTIFIC PAPERS - PEDIATRIC ANESTHESIA

By Barbara W. Palmisano, M.D.

Muscle relaxants were the primary focus of this session, and the first three papers evaluated mivacurium. **Orliaguet et al.** from Bicetre, France, evaluated neuromuscular blockade with mivacurium (0.2 mg/kg) during steady-state halothane-N_2O anesthesia in patients between 3 months and 8 years of age. Onset time was reported to be less than two minutes and clinical duration less than 20 minutes with no differences between ages. Cardiovascular effects were minimal. It was noted during the session that during induction, many practitioners are using a higher dose (0.3 mg/kg) of mivacurium because of a perceived unreliability of the lower dose.

The second paper by **Safavi et al.** questioned whether avoidance of neuromuscular antagonists in conjunction with mivacurium would decrease postoperative emesis. It did not, but the use of antagonists was also not associated with the increased incidence of emesis that had previously been reported in adults.

The third study by **Cauldwell et al.** investigated whether intramuscular mivacurium could be an alternative to intramuscular succinylcholine. Subjects were infants and children anesthetized with halothane-N_2O. It was found that the onset of intramuscular mivacurium (6-9 minutes) was too slow to be clinically useful for rapid control of the airway.

Theroux et al. evaluated the dose-response of succinylcholine in children 2-10 years of age with cerebral palsy (and no history of chronic anticonvulsant therapy) who were anesthetized with propofol-N_2O. They reported that the ED_{50} was significantly lower and the ED_{95} was not significantly different from normal children. Although children with cerebral palsy are resistant to paralysis induced by nondepolarizing neuromuscular blocking drugs, this did not appear to be the case with a bolus dose of succinylcholine.

Meretoja et al. from Helsinki evaluated 51W89, a stereoisomer of atracurium. The study was conducted with children 2-12 years of age receiving halothane-N_2O and fentanyl. This isomer was found to be five times as potent as atracurium with similar onset, duration and recovery characteristics. There was a lack of cardiovascular effects, presumably due to a reduced propensity to release histamine.

Vuksanaj et al. evaluated intubating conditions and duration of action of ORG9426 (rocuronium, 600 µg/kg) in children during halothane-N_2O anesthesia. Intubation was performed at 92 ± 32 (SD) seconds, and the conditions were judged to be excellent. The drug produced no changes in blood pressure, but it increased heart rate from a mean of 82 to 94 beats/minute. Onset time was at 66 ± 32 seconds and duration was 26-36 minutes. The authors noted that if intubation is performed at 85 percent twitch depression, then the onset time is similar to that of succinylcholine, and this drug may be

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suitable for rapid sequence intubation in children.

MONDAY AFTERNOON SCIENTIFIC PAPERS - PEDIATRIC ANESTHESIA

By Barbara W. Palmisano, M.D.

Several papers in this session investigated epidural analgesia in infants and children. Investigators from Johns Hopkins Hospital evaluated the use of continuous lidocaine epidural analgesia in children. The premise of the study was that lidocaine would provide effective analgesia and, since it is measurable in the serum, it could be titrated to avoid toxicity. The study included more than 100 children from 1 month to 18 years of age who underwent major surgical procedures below T4. Continuous epidural analgesia was used intraoperatively (combined with general anesthesia) and postoperatively for pain control. Lidocaine, 0.3-0.5 percent, was infused at a rate of 1.5 mg/kg/hr up to 11 cc/hr and serum lidocaine levels were obtained daily. Epidural catheters were used for 5-124 hours. In 5 percent of patients, the serum levels were considered to be toxic (greater than 5 mg/l). Although the patients were asymptomatic, the lidocaine infusion was interrupted and restarted at a lower rate. Three patients (with known seizure disorders) had seizures while receiving epidural lidocaine with serum levels less than toxic level.

The authors concluded that continuous epidural lidocaine infusions provided effective postoperative analgesia in children, but they noted that even at subtoxic levels, lidocaine may contribute to seizures in patients with seizure disorders.

The same investigators evaluated epidural lidocaine analgesia in the management of sickle cell acute chest syndrome. Epidural analgesia was initiated in 25 patients after failure of conventional (I.V. narcotic) therapy. In most patients, this therapy was effective in relieving pain and increasing SpO_2. An additional benefit was that the patients were not sedated and were able to ambulate. Catheters remained in place for an average of four days with no significant complications reported. The authors suggested that improvement in oxygenation may be a critical factor in preventing further sickling.

In another paper from this group, cultures of the subcutaneous portion of epidural catheters were used to study colonization and infection rates of more than 200 continuous pediatric epidural catheters. Over 30 percent of the catheters were colonized at 72 hours. The rate of caudal catheter colonization exceeded that of lumbar catheter colonization for gram negative organisms only. The lumbar catheters were easier to secure, and the authors suggested that improved techniques to secure and protect caudal catheters are needed.

Two other papers evaluated epidural analgesia. **Lawhorn et al.** studied continuous epidural morphine/butorphanol infusion for postoperative pain control following selective dorsal rhizotomy in children. This procedure produces severe neuropathic pain postoperatively that inhibits limb manipulation and splint placement. The authors were able to attain satisfactory analgesia with minimal side effects.

Bailey et al. evaluated the efficacy of intravenous and epidural butorphanol (a mu-antagonist) in preventing side effects of epidural morphine in infants and children following major thoracic or abdominal surgery. Epidural morphine (60 µg/kg) was administered either alone or in combination with I.V. or epidural butorphanol (30 µg/kg). The incidence of side effects was not decreased by the use of intravenous or epidural butorphanol. Patients who received epidural butorphanol and morphine had greater analgesia and greater sedation postoperatively compared to those who received intravenous butorphanol or no butorphanol.

One paper addressed preoperative sedation. **Preston et al.** explored the relationship between fentanyl plasma levels and clinical effects in children receiving oral transmucosal fentanyl citrate. They reported that plasma concentrations correlated with degree of sedation and that levels of 1.3-1.4 ng/ml were required to produce drowsiness. Doses of 10-15 µg/kg were administered to achieve this plasma concentration. The incidence of nausea and vomiting was lower when the patient was taken to the operating room 15 minutes after administration of the drug. Twenty-six percent of patients required stimulation and/or supplemental oxygen to maintain $SpO_2 > 90$ percent.

Other papers addressed various topics of postoperative pain control. **Chambers et al.** found that topical analgesia with lidocaine jelly applied at the completion of surgery was less effective than dorsal nerve block of the penis performed prior to surgery in providing analgesia after circumcision. **Houck et al.** reported that I.V. ketorolac used postoperatively in 383 children was associated with few complications and that substantial monetary savings could be made by dispensing the drug in unit doses. Savings of $12,000 in drug costs to the hospital were realized over a 15-month period with this method.

In a study comparing sciatic nerve blockade between infant and adult rats, **Hu et al.** demonstrated the duration of blockade to be shorter in infants than in adults. This model may be useful in a future study of age-related effects of peripheral nerve blocks.

TUESDAY MORNING SCIENTIFIC PAPERS - PEDIATRIC ANESTHESIA

By Francis X. McGowan, Jr., M.D.

Presentations concerning cerebral metabolism, myocardial preservation and coagulation during cardiopulmonary bypass (CPB); measurements of bypass-related alterations in beta-adrenergic receptor function and pulmonary artery O_2 saturation; and the effects of inhaled anesthetics upon myocardial function in hypertrophied infant hearts and the ventila-

tory response to hypoxia were the focus of oral abstracts in a pediatric congenital heart disease session moderated by **William J. Greeley, M.D.**, Associate Professor, Duke University Medical Center, Durham, North Carolina. In separate presentations, **Greeley et al.** (Duke University, A1143), **Foster et al.** (University of Toronto, A1144) and **Kern et al.** (Duke University, A1145), using different techniques (e.g., measurements of cerebral blood flow, $CMRO_2$, jugular bulb temperature and oxygen saturations, and near-infrared spectroscopy, respectively), demonstrated that the brain is likely to be inadequately and unevenly cooled during standard regimens involving deep hypothermic cardiopulmonary bypass and/or circulatory arrest. This uneven and inadequate cooling may lead to inadequate cerebral metabolic suppression.

Jonassen and Young (Columbia University, A1146) presented data to indicate that cerebral blood flow autoregulation is preserved in infants undergoing hypothermic bypass (without circulatory arrest).

Two studies by **Miller et al.** (Emory University, A1150-51) examined clotting parameters after pediatric CPB; the authors concluded that prolonged ACT values (HemoTec ACT) were most often related to thrombocytopenia and/or platelet dysfunction, and that thromboelastrographic (TEG) abnormalities can also be frequently corrected by platelet transfusion. In cases where platelets alone were inadequate, cryoprecipitate was superior to fresh frozen plasma in producing normalization of TEG parameters. **Sun et al.** (Columbia University, A1147) investigated the effects of CPB upon lymphocyte beta-receptor function and found, in contrast to previous studies, that lymphocyte beta-adrenergic receptor function and responsiveness were in fact increased after CPB in children. Evidence that reductions in mixed-venous O_2 saturation may correlate with poor outcome in children at risk for pulmonary hypertension after repair of congenital cardiac defects was presented by **Gúenoun et al.** (Hopital Laennec, Paris, A1152). **Palmisano** and colleagues (Medical College of Wisconsin, A1142) studied the myocardial effects of halothane and isoflurane in normal and chronically hypoxic (right ventricular hypertrophied) infant rabbit hearts. In this study, she found that halothane and isoflurane had similar negative inotropic effects, and that the effects were similar in both normal and chronically hypoxic hearts.

McGowan et al. (University of Pittsburgh, A1148) used histidine to buffer a myocardial preservation solution and obtained 20 hours of complete protection of contractile and vascular function as well as oxidative metabolism in neonatal pig hearts. **Morray** and co-workers (University of Washington, A1141) studied chemoreceptor discharge responses to halothane in kittens and found that halothane depresses chemoreceptor activity but does not prevent increased discharge during hypoxia and concluded that the depressant effects of halothane upon neonatal ventilation were likely to be effected at other sites (e.g., brain stem).

WEDNESDAY MORNING POSTER SESSION

By Peter J. Davis, M.D.

This scientific poster session contained an eclectic group of abstracts. Two posters on the new inhalational anesthetic agents were reported: "Emergence and Recovery from Sevoflurane in Pediatric Ambulatory Patients: A Multicenter Study" by **Davis, Lerman, Welborn, Orr and Rabb**, and "Emergence and Recovery from Desflurane Anesthesia in Premedicated Ambulatory Pediatric Patients" by **Davis, Cohen, McGowan and Latta.**

In a multicenter study of 221 pediatric ambulatory patients, sevoflurane and N_2O were compared to halothane and N_2O. In this study using blinded nurse observers, it was noted that patients anesthetized with sevoflurane and nitrous oxide had faster times to alertness and shorter recovery room stays, but the overall hospitalization times were the same. Of interest was that in patients anesthetized with sevoflurane and N_2O, the emergence from anesthesia was associated with a large incidence of emergence delirium (40 percent) compared to the group of patients anesthetized with halothane and N_2O (16 percent).

The other poster reported on a study of 45 patients in which desflurane and N_2O anesthesia was compared to halothane and N_2O in pediatric ambulatory patients undergoing inguinal hernia repair hypospadius repair, or orchiopexy. In this study, all patients were premedicated with nasal midazolam. All patients received a caudal nerve block with bupivicaine at the beginning of surgery, and all patients breathed spontaneously with bag and mask ventilation. The anesthetic agents were maintained at 1 MAC until the end of surgery, and a blinded nurse observer evaluated the anesthetic recovery characteristics in all of the patients.

In this study, desflurane anesthesia was associated with a faster awakening time and a shorter recovery room stay. In both the halothane and desflurane anesthetized patients, hospital discharge times were the same. Although there was no significant difference in the incidence of emergence delirium between the two groups, there was a trend for the desflurane anesthetized patients to have more emergence delirium ($p=0.09$). The small patient sample size may have precluded finding statistical significance. Of interest is that in the patients induced with halothane, desflurane can be delivered by bag and mask, and airway difficulties observed with desflurane inductions do not appear during emergence.

Blood conservation and coagulation changes during massive blood loss were presented during this session. "The Relationship Between Surgical Hemostasis and Coagulation Factors" was presented by **Murray, Pinnell, Sandell and Olson.**

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ROUND AND ABOUT THE ASA

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This study was designed to determine coagulation changes when packed red cells are used to replace massive blood loss. **Murray et al.** measured PT, aPTT, platelet count, and fibrinogen levels in 32 adolescent patients (mean age = 14 years) who required greater than 0.5 blood volume replacement. The initial coagulation abnormality in these patients was an increase in PT and aPTT (30 of 32 patients). Thrombocytopenia <100,000 was not observed in this elective surgical patient population who received approximately 1.0 blood volume replacement. Clinical hemostasis remained normal in 15 patients, but 17 of the patients developed a hemostatic abnormality which was effectively treated with FFP.

The authors concluded that significant coagulation factor decreases occur prior to thrombocytopenia during packed red cell replacement of blood loss. An increase in bleeding due to a dilutional coagulopathy required treatment with FFP in one-half of the patients.

"Are Blood Conservation Techniques Useful in Pediatric Patients Undergoing Cardiopulmonary Bypass" was presented by **Valley, Freid, Norfleet, Calhoun, Mill** and **Wilcox**. Because of concern over the use of homologous blood products, a trial of acute autologous blood donation (AABD) with or without hemoconcentration (H) was begun in children undergoing surgical procedures requiring cardiopulmonary bypass (CPB). Data was prospectively collected on 27 children. AABD alone was used in 11 patients. H and AABD were used in the remaining 16. Control data was obtained from review of consecutive charts of 13 patients who underwent CPB without AABD or H. AABD was carried out by diverting venous return immediately upon initiation of CPB to a blood collection bag until the desired volume of blood was collected. This volume averaged 30.5 cc/kg. Autologous blood infusion was begun immediately after the termination of CPB. Hemoconcentration of the residual bypass circuit blood was done postbypass by ultrafiltration and all or a portion reinfused.

Groups were similar for age, duration of CPB and postoperative hemoglobin concentrations. Both blood salvage techniques were easy to perform and well-tolerated. Using AABD alone or in conjunction with H resulted in a significant reduction in blood product exposure. Operating room use of pRBCs decreased to 53 percent of control with AABD and to 39 percent of control when using both techniques. Similarly, total blood product donor exposures for the first 24 hours were reduced to 51 percent and 29 percent of control values respectively. In addition, patients in both blood salvage groups had less postoperative blood loss in the first postoperative day, with a reduction to 59 percent and 51 percent of control values for the AABD and the AABD with H groups, respectively.

In conclusion, the investigators were able to demonstrate a significant decrease in homologous blood product usage and less postoperative blood loss in children undergoing CPB utilizing two relatively simple blood conservation techniques.

Other presentations in this session included "Effects of Sufentanil and Fentanyl on Hormonal Changes During Posterior Spinal Fusion" by **Guay, Haig, Poitras, Nadeau** and **Delvin**, and "A Comparison of Ketorolac and Morphine in Pediatric Outpatient Strabismus Surgery" by **Riegger, Munro, Reynolds, Wilton** and **Lewis.**

In the study by **Guay et al.**, the authors measured renin, aldosterone, ADH, ANF, ACTH and cortisol before, during and after posterior spinal fusion (PSF). Patients received either fentanyl 10 to 20 μg/kg (F) or sufentanil 2 to 4 μg/kg (S). Intraoperative renin was higher than normal limits in group F at 30 minutes and two hours. Aldosterone was higher in group F after induction, at 30 minutes and at two hours. Urine output was higher in the third hour in the S group. Postoperatively, the patients who were oliguric during the first 24 hours (3 F and 4 S) had not only a greater number of fused vertebrae but also higher aldosterone levels at 6 and 8 hours.

The authors suggest that the intraoperative oliguria in PSF patients is due to the activation of the RAS. This activation can be partially blocked with sufentanil in the doses used. The postoperative oliguria is due to activation of RAS and release of ADH. This seems to be increased with increased surgical stress.

The study by **Riegger et al**. was a prospective, double-blind, randomized trial designed to compare intravenous ketorolac and morphine in pediatric outpatient strabismus surgery. Forty-two ASA 1 or 2 children, 2 to 12 years of age, were randomly allocated to receive either intravenous ketorolac 0.75 mg/kg alone or intravenous morphine 0.1 mg/kg with metoclopramide 0.15 mg/kg. All drugs were administered immediately after induction. Anesthesia was induced with propofol and maintained with propofol and nitrous oxide. Pain was assessed in the recovery room every 15 minutes until discharge, and the incidence of nausea and vomiting was recorded during the first 24 hours. There was no difference in the pain behavior scores, and recovery times were similar between the two groups.

The incidence of vomiting in the first 24 hours was 19 percent in the ketorolac group compared with 52 percent in the morphine/metoclopramide group ($p< 0.05$), and the incidence of nausea and vomiting in the first 24 hours was 19 percent in the ketorolac group compared to 71 percent in the morphine/metoclopramide group ($p<0.001$). It was concluded that ketorolac 0.75 mg/kg I.V. provides analgesia comparable to morphine 0.1 mg/kg I.V. for strabismus surgery while it significantly decreases the incidence of nausea and vomiting. ❑

EMLA CREAM

By Linda Jo Rice, M.D.

Much has been written about EMLA® cream in the British and European literature for years; however, it has only been available in the United States since the spring of 1993. EMLA (eutectic mixture of local anesthetics) is a mixture of lidocaine and prilocaine which was discovered by a Swedish chemist when he accidentally spilled lidocaine and prilocaine powder on his workbench. When mixed together, the two powders formed an oil. This oil, when placed on intact skin, covered with an occlusive dressing and left undisturbed for an hour, can penetrate to a depth of 5 millimeters. Five millimeters is sufficient for vascular access, whether for placement of an intravenous catheter or for drawing of a blood sample. It is not, however, sufficient to block all sensation for an intramuscular injection, but it will attenuate the pain from the injection.

EMLA is administered by identifying the area where the intended invasive procedure (usually venipuncture) is to take place. A dollop of cream is then placed on the skin, covered with a Tegaderm® or other occlusive dressing and left for an hour. The occlusive dressing is removed, the skin cleaned with alcohol (to improve traction) and/or povidone-iodine (for sterile skin preparation), and then the venipuncture is performed. If the procedure involves placement of an intravenous catheter, it is important to secure the catheter because the cream moistens the skin.

How can EMLA be useful to an anesthesiologist? EMLA has been used successfully in the United Kingdom and Europe to decrease pain of venipuncture in both children and adults. EMLA has been shown to decrease observer pain scores in premedicated and unpremedicated children. However, some studies in the United States have noted no difference in the self-assessment pain scores in children. This may be due to the fact that "just because it's numb doesn't mean it doesn't hurt," and/or that children often do not believe a grownup when told that the "magic cream" will make a needle not hurt. Thus, a young child's first encounter with EMLA may not decrease the emotional component of pain, even though it will block the physical component of pain.

It is important for the anesthesiologist to help the child realize that the back of his/her hand is "asleep" before inserting the intravenous needle. I do this by tapping the child's hand with a pen, then having the child pinch the back of the hand and tell me that it is asleep before I begin the venipuncture. However, even with this, I still notice some children have pain behavior such as crying, but rarely will they pull away their hand. Interestingly though, when I see that child weeks or months later for the next procedure, the child usually tells me that he/she does not want a needle without the "magic cream."

EMLA also has uses outside the operating room. In situations where arterial catheters are needed, EMLA can attenuate the pain from arterial cannulation. Perhaps EMLA is most useful for the child who faces repeated needlesticks: the oncology patient, the nephrology patient, the sickle cell patient or the child who finds the "dreaded needle" to be the most frightening part of the medical treatment. These children often say that EMLA has made the treatment of their disease less terrifying. These children rely on EMLA to decrease or eliminate the pain of repeated mediport access, lumbar punctures and/or bone marrow sampling. For lumbar punctures and bone marrow aspiration, additional injectable local anesthetic must be added.

EMLA has also been employed very successfully for children undergoing laser ablation of port-wine stains as outpatient procedures in dermatologists' offices. In this situation, EMLA is applied and left in place for two hours. Another area for EMLA use may be with pediatric immunizations.

EMLA is not perfect, and it does require prior planning. At Newington Children's Hospital, Hartford, Connecticut, all children having intravenous catheter insertions receive EMLA. All children coming to the operating room who are to receive an I.V. induction (teenagers and those who need a rapid sequence induction) have EMLA placed by a nurse on arrival to the hospital. Even teenagers who undergo multiple procedures have said that EMLA makes facing "one more procedure" easier and makes coming to the hospital just a bit less awful.

References:

1. Ehrenstrom Reiz GME, Reiz ALS. EMLA—a eutectic mixture of local anaesthetics for topical anaesthesia. *Acta Anaesthesiol Scand* 1982; 26: 596-598.
2. Engberg G, Danielson K, Henneberg S, Nilsson A. Plasma concentration of prilocaine and lidocaine and methaemoglobin formation in infants after epicutaneous application of a 5% lidocaine-prilocaine cream (EMLA). *Acta Anaesthesiol Scand* 1988; 31: 624-628.
3. Koren G. Use of the eutectic mixture of local anesthetics in young children for procedure-related pain. *J Pediatr* 1993; 122:S30-35.
4. Soliman IE, Broadman LM, Hannallah RS, McGill WA. Comparison of the analgesic effects of EMLA (Eutectic Mixture of Local Anesthetics) to intradermal lidocaine infiltration prior to venous cannulation in unpremedicated children. *Anesthesiology* 1988; 68: 804-806.
5. Steward DJ. Eutectic mixture of local anesthetics (EMLA): What is it? What does it do? *J Pediatr* 1993; 122:S21-23. □

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SPA/FAER GRANT RECIPIENT NAMED

Zeev Kain, M.D., Assistant Professor of Anesthesiology, Yale University, New Haven, Connecticut, is the recipient of the first Society for Pediatric Anesthesia/Foundation for Anesthesia Education and Research (FAER) Anesthesiology Research Starter Grant. The announcement was made by Martin Helrich, M.D., Executive Director of FAER. In making the announcement, Dr. Helrich commented that this year, FAER received five pediatric-related grant applications, and FAER looks forward to receiving an even greater number of applications in the future.

The title of Dr. Kain's research is "Preoperative Anxiety in Preschool Children: Parental Presence at Induction of Anesthesia." In explaining this investigation, Dr. Kain commented that providing anesthesia for preschool children presents a special challenge to the anesthesiologist. At this age, children are old enough to appreciate the stress of the operating room and separation from parents. However, their ability to profit from psychological preoperative preparation and develop new social contacts is limited.

The purpose of this investigation is to determine if parental presence at the induction of anesthesia reduces the immediate anxiety in the child and results in a lower incidence of adverse long-term behavioral sequelae.

In addition, this investigation will lead to future studies designed to develop a simple anxiety scale that can be employed by the practicing anesthesiologist and predict which child/parent pair may benefit most from parental presence during induction of anesthesia.

The deadline for the next SPA/FAER Anesthesiology Research Starter Grant is **July 31, 1994.** Applications should be sent to: FAER, 3701 Old Court Road, Suite 24, Baltimore, Maryland 21208-3901. □

Zeev Kain, M.D.