What’s Happening Now?

Chair’s Corner by Edward E. Conway Jr., M.D., M.S., FAAP, FCCM

It gives me great pleasure to write to you as fellow members of the American Academy of Pediatrics (AAP) Section on Critical Care (SOCC). I am hopeful that the change in season brings better weather to most of you and it brings to mind a quote from Leo Tolstoy in Anna Karenina, “Spring is the time of plans and projects.” This is appropriate as we have a lot of new and exciting projects going on in our section. We realize how busy everyone is and thus we will keep our monthly newsletter brief and relevant to the practicing intensivist. This is the inaugural edition of the newsletter which was conceived and is now spearheaded by Dr. Carley Riley, our former PICU fellow representative to the Executive Committee and current Chair of the Subcommittee on Member Engagement and Mentorship.

The current members of the SOCC Executive Committee include myself as Chair, Don Vernon as Chair emeritus, Rich Mink (AAP representative to CoPS and Small Grants Chair), Rich Salerno (representative to AAP Committee on Hospital Care), Carley Riley (Chair of the Subcommittee on Membership Engagement and Mentorship), John Straumanis (former Scientific Program Chair), Jana Stockwell (member of the pediatric SCCM executive committee and our representative on coding), Michael Agus, Alice Ackerman (liaison to AAP Committee on Pediatric Emergency Medicine), Brad Poss (Scientific Program Chair being replaced by Dr Laura Ibsen in 2015), and Ms. Sue Tellez who is a member of the AAP Central Office Staff and our liaison. Sue is the glue that keeps SOCC together and moving along when we need some prodding!

With Drs. Salerno and Mink completing their second terms on the Executive Committee and Dr. Riley completing her term as the trainee member, we held elections last month to fill their vacancies. There were a large number of qualified applicants who applied and were considered for the 2014 electoral slate. The polls closed at the end of March, and results will be communicated shortly.

AAP SOCC Annual awards were granted to the following recipients in Orlando during the AAP National Conference and Exhibition in October 2013:
• 2013 Distinguished Career Award: Vinay Nadkarni M.D., FAAP, FCCM, FAHA
• Best abstract: Xiomara Garcia, MD
• Physician-In-Training award Jennifer C. Munoz Pareja, MD, FAAP
• Physician-In-Training Travel Grant Jun Sasaki, MD, FAAP

Small Grant project awards were also showcased:

• Natasha S. Afonso M.D., M.P.H. for her work entitled “Novel educational interventions aimed at enhancing adherence to clinical guidelines for pediatric septic shock”

• Christina L. Cifra M.D. for her work entitled “Transforming the morbidity and mortality conference to improve safety and quality in the PICU”

We had our most recent AAP SOCC Executive meeting during the SCCM Annual Congress in San Francisco in January 2014, and I am pleased to announce that we will again be offering the awards and grants listed above. The SOCC Scientific Abstract & Educational Program will be held on 10/12 and 10/13/2014 in beautiful San Diego, so remember to save the date (more to follow on that meeting in a subsequent newsletter). Information is available on the AAP SOCC website, which has been revamped, so please visit the new website and share with us your comments.

http://www.aap.org/en-us/about-the-aap/Committees-Councils-Sections/Section-on-Critical-Care/Pages/default.aspx

Many of you may be aware of the Choosing Wisely initiative of the ABIM Foundation of which the AAP participates. The 5 general pediatric practices which the Academy cited include: 1) antibiotics should not be used for apparent viral respiratory illnesses, 2) cough and cold medications should not be prescribed nor recommended for respiratory illnesses in children under 4 years of age, 3) computed tomography (CT) scans are not necessary in the immediate evaluation of minor head injuries; clinical/Pediatric Emergency Care Applied Research Network (PECARN) criteria should be used to determine whether imaging is indicated, 4) neuroimaging (CT, MRI) is not necessary in a child with a simple febrile seizure, and 5) CT is not necessary in the routine evaluation of abdominal pain.

At the 2014 Annual SCCM Congress, the Critical Care Societies Collaborative (CCSC) group (comprised of the American Association of Critical Care Nurses, American College of Chest Physicians, American Thoracic Society, and the Society of Critical Care Medicine) working with the Choosing Wisely campaign of the ABIM Foundation released 5 adult CCM practices that should be questioned by parents and physicians (many of which are applicable to PCCM) and include: 1) don’t order diagnostic tests at regular intervals but rather in response to specific questions, 2) don’t transfuse red blood cells in hemodynamically stable, non-bleeding ICU patients with a hemoglobin concentration greater than 7 mg/dL, 3) don’t use parenteral nutrition in adequately nourished critically ill patients within the first five to seven days of an ICU stay, 4) don’t deeply
sedate mechanically ventilated patients without a specific indication and without daily attempts to lighten sedation, and 5) don’t continue life support for patients at high risk for death or severely impaired functional recovery without offering patients and their families the alternative of care focused entirely on comfort. I share this information with you as one place where we should focus our resources: evaluating PICU quality. I have spoken to many of you and realize that Maintenance of Certification (MOC) Part IV activities either have no relevance for you or are not available to you if your institution is not participating in some of the national collaboratives. This is a place in the AAP SOCC where everyone can get involved.

There are currently approximately 2120 board certified pediatric intensivists and only approximately 690 (about one-third) are current members of our Section. We will be celebrating our 30th anniversary as a Section this fall at the National Conference. One of my goals as Chair is to encourage all eligible intensivists to join the Section and become active in one of our committees, or propose a new one. Your expertise and commitment is essential to the continued growth and development of our Section. I would like to hear from you, your colleagues, and your fellows. I would like to have the membership share your thoughts on how we can best serve your needs. We currently provide PREP® ICU to help you prepare for board certification and recertification and I would like to see the AAP, which has a newly formed Division of Quality, become a home for SOCC MOC Part IV projects. I look forward to hearing from everyone.

Regards,

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Who’s Advocating How?

February 2014 AAP Academic & Subspecialty Advocacy Washington Report

The AAP is actively engaged in federal advocacy for the needs of academic and subspecialist pediatricians and the children for which they provide care. In the February report from the AAP Department of Federal Affairs, you can learn about efforts around physician payment, pediatric subspecialty loan repayment, the Children’s Health Insurance Program, drug shortages, pediatric research, grassroots advocacy, and more. The report is available at www.aap.org/subspecialty.
What Opportunities Exist?

**AAP SOCC Small Grants for Young Investigators - Apply by April 18, 2014**

We are pleased to announce availability of two small grants for young investigators for projects devoted to education in Pediatric Critical Care Medicine and outcomes of quality and safety initiatives in the PICU. Additional details are available at [http://www.aap.org/en-us/about-the-aap/Committees-Councils-Sections/Section-on-Critical-Care/Pages/Small-Grant-Funding.aspx](http://www.aap.org/en-us/about-the-aap/Committees-Councils-Sections/Section-on-Critical-Care/Pages/Small-Grant-Funding.aspx).

**Deadline:** April 18, 2014.

**PREP ICU Q&A**

Each AAP SOCC Critical Results will include a question and answer courtesy of PREP® ICU - The AAP’s Premier Critical Care Self-Assessment. For a free trial or subscription to the PREP® ICU Self-Assessment programs, visit [http://prepicu.aap.org](http://prepicu.aap.org).

**Question**

A 6-year-old girl who has viral hepatitis is transferred to the PICU because of the rapid onset of hepatic dysfunction characterized by severe jaundice, coagulopathy, and declining mental status. Head computed tomography scan reveals cerebral edema.

Of the following, the BEST explanation for the development of cerebral edema in this child is

A. accumulation of ammonia in the neuron leading to cellular swelling
B. benzodiazepine-like substances stimulating gamma-aminobutyric acid (GABA) receptors
C. decreased nitric oxide production resulting in ischemia and associated cytotoxic edema
D. low cardiac output leading to cerebral ischemia
E. osmotic effects of glutamine accumulating in the astrocyte and promoting cellular edema

**Answer**

The BEST explanation for the development of cerebral edema in this child is osmotic effects of glutamine accumulating in the astrocyte and promoting cellular edema.

Central nervous system dysfunction occurs in most patients who have acute and chronic liver failure. Its etiology is multifactorial and appears to differ somewhat between the two types of liver failure. Neurologic dysfunction is common and develops rapidly in patients who have acute liver failure, often progressing to coma, cerebral edema, and death from elevated intracranial pressure and herniation within days or even hours. Seizure activity and muscle twitching may be seen prior to the onset of coma. Neurologic dysfunction is much less frequent and more insidious in those who have chronic hepatic insufficiency. Episodes of gastrointestinal hemorrhage, sepsis, and sedative administration (among other events) may precipitate deteriorating mental status. Personality changes, motor dyscoordination, and asterixis precede the onset of stupor and coma. Histologic findings are consistent with cytotoxic edema, primarily severe swelling of astrocytes and...
astrocyte end feet. The dysfunction resolves in patients who recover spontaneously or undergo liver transplantation if secondary damage has not occurred. However, secondary damage is common, with moderate-to-severe neurologic deficits.

The association between elevated ammonia concentrations and the development of hepatic encephalopathy and cerebral edema has been recognized for many years. When ammonia taken up from the circulation into the astrocyte (not the neuron) is deaminated, glutamate is converted to glutamine. Glutamine accumulates in astrocytes, where its osmotic effect is to promote edema formation.

Treatment with methionine sulfoximine, which inhibits glutamine synthesis, blocks accumulation of glutamine and water in experimental animals. In cell culture, free radicals form in astrocytes exposed to ammonia, leading to mitochondrial dysfunction, which can be prevented by inhibition of glutamine synthetase. Inhibition of glutamine synthetase also prevents edema formation and death in rats that have hepatic failure. In chronic disease, other organic osmolytes (e.g., myoinositol, taurine) decrease as glutamine increases, but it is likely that there is inadequate time for equilibration in acute/fulminant disease. When the glutamine is pumped out of the astrocyte, it is taken up by the presynaptic neuron and converted back to glutamate. Release of glutamate into the synaptic cleft stimulates receptors on the postsynaptic neuron.

GABA is an inhibitory neurotransmitter found throughout the central nervous system. An alternative hypothesis to explain hepatic encephalopathy attributes neurologic dysfunction to excess GABA or heightened sensitivity to it. Increased blood-brain permeability allows increased amounts of GABA, derived from the gut, to enter the brain and bind to its receptor, producing neuronal inhibition and, presumably, hepatic encephalopathy. This hypothesis predicts that patients who have hepatic encephalopathy will be exquisitely sensitive to the benzodiazepines and endogenous benzodiazepine-like substances, which appears to be the case, and that benzodiazepine antagonists such as flumazenil will improve the encephalopathy. Although flumazenil does appear to decrease neurologic manifestations of chronic liver failure, its effect is partial and transient. However, increased GABA does not appear to promote development of cerebral edema.

Gradual vasodilatation is believed to contribute to edema formation as well as the accumulation of glutamine. Failed autoregulation occurs with uncoupling of cerebral metabolic rate for oxygen (CMRO2) and cerebral blood flow (CBF), loss of arteriolar tone, and vasogenic edema. Rather than a decrease in nitric oxide production, stimulation of NMDA receptors on the postsynaptic neuron by glutamate released from presynaptic neurons may stimulate nitric oxide synthase and promote nitric oxide production via conversion of arginine to citrulline. Subsequent cerebral vasodilatation may contribute to vasogenic edema. Decreased cerebral blood flow is unlikely until severe cerebral edema results in elevated intracranial pressure and secondarily compromised flow.
With hepatic dysfunction, the systemic circulation is hyperdynamic, characterized by elevated cardiac output and increased heart rate, with low systemic vascular resistance and diminished response to vasopressor agents until very late in the course of disease. Measurement of CBF in patients indicates significant variability. The cerebral metabolic rate for glucose and CMRO2 are proportionately decreased, apparently due to decreased energy demand. Most affected patients appear to have decreased CBF in spite of increased systemic cardiac output, probably consistent with decreased energy consumption, but some have elevated flow, which is associated with edema and higher mortality.

Suggested Reading:


American Board of Pediatrics Content Specifications:

- Understand the pathophysiology of coma in hepatic failure
- Understand the pathophysiology of hepatic encephalopathy