PBLD – Table #25
Sunday, March 8, 2014; 4:30 pm-5:40 pm

Anesthetic Considerations for a Three Year-Old Ex-Premature Male with Autism, Craniosynostosis, and an Inguinal Hernia Scheduled for Outpatient Laparoscopic Surgery.

Moderators: Vincent J. Kopp, MD, FAAP; Matthias W. Konig, MD, FAAP

Institution: Department of Anesthesiology, School of Medicine, University of North Carolina at Chapel Hill, Chapel Hill, NC

Objectives:

1. Explore the differential diagnosis for pervasive developmental delay (PDD) and become familiar with Autism Spectrum Disorder (ASD) criteria, terminology, epidemiology, co-morbidities, and pathophysiology hypotheses.

2. Discuss challenges in family-centered care and consider the psychosocial issues families and medical professionals face during the anesthetic care of ASD patients.

3. Review issues germane to the anesthetic management of any ex-premie with emphasis on pre-operative assessment, respiratory management, and post-operative pain control strategies after laparoscopic inguinal herniorrhapy.

Case history:
A 3 year old 12 kg male presents to your ambulatory surgical center for outpatient surgery. You learn that morning from the nurse checking in patients and getting vital signs that he is "autistic" and can't be examined without resistance. He is scheduled for a laparoscopic EUA and repair of a suspected inguinal hernia.

Questions:
What is Autism Spectrum Disorder (ASD)? How does ASD relate to Pervasive Developmental Disorder (PDD)? How has the definition of ASD changed over time? What are the DSM-4 and DSM-5 criteria for ASD? What are some current theories about the pathogenesis of ASD? Are there special anesthetic considerations for ASD patients? What is meant by family centered care?

Case history and physical examination (continued):
You begin your pre-anesthesia evaluation. Mom tells you her son was born at 35 weeks gestation after successful *in vitro* fertilization. At his three month check-up the pediatrician noticed *café au lait* spots on his left arm, right leg, and lower back. At a year of age he developed staring spells which were labeled seizures but for which he takes no medications. He was subsequently diagnosed by a neurologist with neurofibromatosis at age 2. As you observe him you notice visible ridging down the middle of his forehead. Left alone he is calm, non-verbal, and plays

with the TV remote. As you approach to examine him he screams, dropping to the ground in a heap. His mom calmly says he won't let anyone touch him except her.

Questions:
Is ASD still a concern for you given his additional history? What history do you want about his prematurity? Is his degree of prematurity associated with neurodevelopmental challenges? You can't get vital signs, an oxygen saturation level, or do a physical exam. Does this concern you? What are the anesthetic implications of his neurofibromatosis type 1 (NF-1)? Does the fact he has unrepaired metopic craniosynostosis concern you? Does this have neurodevelopmental consequences? Will you use a premedication? If so what will you use? How will you administer your pre-med choice(s)? How about using your smart phone as a distractor?

Case development:
You propose using an oral or nasal premedication but mom declines your offer. She then states that she is concerned about all medications'—especially general anesthesia's—potential to effect on her son's future development but she knows he needs the surgery. She wants you tell her about brain safety.

When you ask if she would prefer to come with him into the operating room for induction she says she doesn't because she thinks she will "pass out" if she has to watch him "get put to sleep." Then she says he does fine when with his companion dog is with him. She says the dog is out in the car because the surgery center receptionist wouldn't permitted it in the facility. She says she read on an internet ASD support group page that some places allow dogs into the operating room a part of their family centered care commitment.

Questions:
Where is your clinical management heading at this point? How do you respond to mom's questions about general anesthesia's effects on development? How do you respond to her question about special concerns for ASD children? How would you address her son's un-repaired metopic craniosynostosis? What if any changes would you make to your anesthesia plan or technique? Would you propose regional anesthesia in this situation? How do you address her concerns about family centered care at your facility? Is her request to let the dog be present during anesthesia induction unreasonable? Would you cancel anesthesia at this point and urge further evaluations or preparations?

Case progression (continued):
The surgeon is beginning to wonder what is taking so long to get the case underway. You decide to let the dog be present during induction of anesthesia but the chief nurse objects. The instruments have been pulled and the room is ready. The mother objects to a "snatch and go" plan. You persuade mom to come into the OR with you for induction after you explain what she can expect. She agrees. She also permits you to do a caudal block for post-operative pain management.

You proceed with a mask induction using 66% nitrous oxide, 26% oxygen, and 8% sevoflurane. Mom departs in tears but OK. Monitors are placed and you examine the patient's heart and

lungs. The oxygen saturation hovers at 94%. Scant wheezing is present and you hear a 2/6 systolic murmur in the right and left 2nd intercostal spaces.

Questions:
What could have been done better to shield mom from emotional distress? Do you think the chief nurse's concerns were legitimate? What alternative arrangements might have been made for induction?

What is your differential diagnosis for wheezing upon induction? How about the newly detected heart murmur? Do you think they are related? Is prematurity a factor? Do you stop or go ahead with surgery? What precautions might you take under the circumstances? Will you use a muscle relaxant for intubation and during surgery? Will you perform the caudal block at the beginning or the end of surgery?

Intraoperative care:
Intravenous access is gained swiftly. Endotracheal intubation is uneventful following a 1 mg/ Kg dose of propofol and a 0.1 mg/Kg dose of cis-atricurium. You elect to delay the caudal block until after surgery. Wheezing persists but is no worse than before. It does not abate following albuterol treatment. The surgeon examines the patient, finds no palpable testicle on the left and a hydrocele on the right. Laparoscopy ensues. Ten minutes after insufflation you notice the end-tidal CO2 climbing progressively but slowly. Peak inspiratory pressure requirements are increased. Heart rate has increased slightly, blood pressure is stable, and body temperature changes not at all. Oxygen saturation remains constant at 94% on 30% oxygen and 80% oxygen. You suction the endotracheal tube but nothing changes. You think you feel crepitus on the anterior chest wall.

Questions:
Are propofol and cis-atricurium appropriate drugs to use in wheezing children? What are possible causes of elevated end tidal CO2 in this patient? What is the significance of crepitus in this setting?

What medications would you use in your caudal block? Would clonidine be an appropriate addition? Fentanyl? What is the implication of an unchanging oxygen saturation in this patient?

Postoperative care:
The surgeon must convert from a laparoscopic to an open procedure to accomplishes a left orchipexy and right inguinal hernia repair. Peak pressures decline somewhat but mild wheezing persists until the end. With the patient still anesthetized you accomplish a successful caudal block placement using 12 ml of 0.25% bupivacaine with 1:200 k epinephrine added plus clonidine 12 mcg. Upon extubation the endotracheal tube contains thick green mucus. Wheezing is gone as the patient awakens. He is quiet and comfortable upon entry to the PACU.

Questions:
At what point would you have the mother come to the PACU? Would you let the dog into the PACU to be with the child? Would you let this child go home or would you observe him overnight in your outpatient short-stay unit? Should he be admitted to the Pediatric hospitalist

service with recommendations for further evaluation of his heart murmur, craniosynostosis, and autism diagnosis?

Discussion:
According to the Center for Disease Control, autism or Autism Spectrum Disorder (ASD) manifests in one per 88 children as of 2012, up from one per 110 in 2009. It is estimated that one in 54 boys now have ASD, making males five times more at risk than girls. The largest increase has been seen in Hispanic and black children. Region by region variations exist that are poorly understood. And while the cause for reported population increases is as uncertain as the etiology of ASD itself, some of the rate rise is attributable to more awareness, better diagnosis, and better community services for affected children than in the past. Indeed, the percentage of children diagnosed by age 3 has increased over time.

The implications of ASD for pediatric anesthesiologists and primary care physicians who care for ASD children before and after procedures requiring anesthesia (diagnostic as well as therapeutic, ranging from MRIs to dental work and other interventional surgeries) are considerable. Participants in this PBLD will come away with a new appreciation of the multiple issues that can intersect in any given clinical care setting like the one illustrated by this case.

Of particular concern is the possible interaction between factors that predispose children to ASD and other Pervasive Developmental Disorders (PDD) and those that predispose them to possible anesthesia associated neurotoxicity. As this case illustrates ASD and conditions associated with PDD can be difficult to distinguish from one another. Given the overlapping nature of these "at risk" populations, discussion of factors that might be modifiable in any case involving children with or without ASD/PDD will be open for discussion.

References:

1. Baker JP. Autism at 70—redrawing the boundaries. N Eng J Med. 2013; 369:1089-91

2. Bagshaw M. Anaesthesia and the autistic child. J Perioper Pract. 2011 Sep; 21(9):313-7

3. Kohane IS, McMurry A, Weber G, MacFadden D, Rappaport L, Kunkel L, Bickel J, Wattanasin N, Spence S, Murphy S, Churchill S. The co-morbidity burden of children and young adults with autism spectrum disorders. PLoS One. 2012; 7:e33224. doi: 10.1371/journal.pone.0033224. Epub 2012 Apr 12

4. Conti E, Mazzotti S, Calderoni S, Saviozzi I, Guzzetta A. Are children born after assisted reproductive technology at increased risk of autism spectrum disorders? A systematic review. Hum Reprod. 2013 Oct 15. [Epub ahead of print]

5. Anesthesia for Genetic, Metabolic, and Dysmorphic Syndromes of Childhood (2nd edition). Editors: VC Baum and JE O'Flaherty. Lippincott Wiiliams and Wilkins, 2007. Neurofibromatosis pp. 269-71.

6. Da Costa AC, Anderson VA, Holmes AD, Lo P, Wray AC, Chong DK, Greensmith AL,

Meara JG. Longitudinal study of the neurodevelopmental characteristics of treated and untreated nonsyndromic craniosynostosis in infancy. Childs Nerv Syst. 2013; 29:985-95

7. Rossigno DA, Frye RE. Mitochondrial dysfunction in autism spectrum disorders: a systematic review and meta-analysis. Molecular Psychiatry. 2012; 17:290-314

8. Jevtovic-Todorovic V, Absalom AR, Blomgren K, Brambrink A, Crosby G, Culley DJ, Fiskum G, Giffard RG, Herold KF, Loepke AW, Ma D, Orser BA, Planel E, Slikker W Jr, Soriano SG, Stratmann G, Vutskits L, Xie Z, Hemmings HC Jr. Anaesthetic neurotoxicity and neuroplasticity: an expert group report and statement based on the BJA Salzburg seminar. Br J Anaesth. 2013; May 30:1-9 (Epub ahead of print)

9. Ambardekar AP, Litman RS, Schwartz AJ. Case report: "stay, give me your paw." the benefits of family-centered care. Anesth Analg. 2013 ;116:1314-6

10. A Practice of Anesthesia for Infants and Children (4th edition). Editors: CJ Coté, J Lerman, ID Todres. Saunders, 2009. Preoperative Evaluation, Premedication, and Induction of Anesthesia pp. 37-69