2014
RESEARCH
ABSTRACTS
Abstract #1: The impact of enzymatic activity and metabolites of thiopurine immunomodulators in inflammatory bowel disease (IBD).

Authors:
Elaine Porter, MD, Resident Physician, CHKD/EVMS
Amy M. Perkins, MS, Department of Pediatrics, CHKD/EVMS
Lauren Willis, MD, Pediatric Gastroenterologist, CHKD/EVMS

Introduction:
Immunomodulators are the standard medical therapy for Inflammatory Bowel Disease (IBD), which includes Crohn’s Disease (CD), Ulcerative Colitis (UC) and Indeterminate colitis (IC). The standard immunomodulator therapy for IBD includes immunomodulators Azathioprine (AZA) and Mercaptopurine (6MP) which are assessed in this study. Therapeutic and toxic metabolite levels of these drugs are already defined. Azathioprine is a prodrug that is converted to 6-MP in the body; 6-MP is then metabolized to therapeutic metabolite 6-thioguanine (6-TG) and 6-methylmercaptopurine (6MMP) by the enzyme thiopurine methyl transferase (TPMT). 6TG is the therapeutic metabolite. High levels cause WBC and bone suppression. High levels of 6-MMP metabolite increases the risk of hepatotoxicity and pancreatitis. A therapeutic range 230-400 pmoles X10^8 RBC for 6TG levels is targeted for treatment while 6MMP levels below 5700 X10^8 RBC are desired. TMPT enzyme activity predicts necessary dosing and candidates for its use. Individuals with high or intermediate enzyme activity can take these drugs. Individuals with low enzymatic activity are excluded from AZA/6MP use.

Objectives
The aim of this study is to evaluate levels of 6-TG in our cohort of pediatric patients with IBD and correlate these metabolite levels with care outcomes. Specific objectives include the following:
1. Define descriptive statistics for study population
2. Evaluate care outcomes (put here those you are showing on poster tables/graphs) based on 6TG levels for study cohort
3. Evaluate potential predictors of remission rate including 6TG level, WBC count, TPMT level, and adherence.

Methods: A retrospective chart review was completed; 170 of 200 patients met eligibility criteria. Variables including demographics, diagnosis, metabolite levels (6TG & 6MMP), WBC count, medication type (AZA or 6MP), TMPT enzyme activity, and remission status were collected and tabulated. Data analyzed using SAS 9.3 (SAS Institute, Cary, NC).

Results: The average age of diagnosis for IBD in the population was 11.8 years, with a minimum age of diagnosis at 3 years. The majority of the cases were inflammatory phenotype with a frequency of 124 (88.57%). Adherence was satisfactory or good during only 42% of the study visits. 51% of the study cohort was in remission during the study period.

Conclusion:
There were no significant differences in 6-TG level between the remission status groups, the medication adherence groups or the hospitalization groups. Those subjects with good or satisfactory adherence tended to have better 6TG levels.
Abstract #2: Hemichorea-hemiballism in a pediatric patient in the setting of ketotic hyperglycemia and type 1 diabetes mellitus.

Authors:
Jung E Park, MD
Gabriella F Richardson, MD
Ingrid Loma-Miller, MD
Shadi H Tabba, MD

Abstract:
Diabetes Mellitus is a common disease with numerous complications as a result of poor glycemic control. Hemichorea-hemiballism is a phenomenon uncommonly observed as one of these complications. A 19 year-old female with a history of chronically poorly controlled type 1 diabetes mellitus was admitted to our hospital with uncontrolled choreiform movements of her right upper and lower extremities. Her work-up was significant for hyperglycemia with a glucose of 604 mg/dl, elevated hemoglobin A1c of 10.1% and presence of large ketones on urinalysis. MRI was significant for increased T1 signal intensity in the left caudate head and putamen as well as findings on FLAIR and T2-weighted images with heterogeneous signal changes in the left basal ganglia region. Upon admission, her insulin regimen was reinstituted however she required haloperidol and valproic acid to control her chorea. At her 2 week follow-up, her movements had resolved and with report of good glucose control.

Our case illustrates a rare complication of diabetes mellitus in an atypical patient given that prior reported cases more commonly describe this phenomenon in elderly patients with type 2 diabetes mellitus with non-ketotic hyperglycemia. Consequently, our patient’s presentation challenges current theories to the pathophysiology of hemichorea-hemiballism associated with hyperglycemia.

Key Words:
Diabetes Mellitus, hemichorea-hemiballism, ketosis, hyperglycemia
Abstract #3: “1, 2, 3 Magic: A curriculum to improve pediatric resident management of common behavioral problems in children.”

Authors: John W Harrington, MD 1, 2, Bryan Stup, MD 1, 2 and Amy M Perkins, MS 1,2,3. 1 General Academic Pediatrics, Children's Hospital of The King's Daughters, Norfolk, VA, United States; 2 Pediatrics, Eastern Virginia Medical School, Norfolk, VA, United States and 3 Division of Biostatistics and Innovation in Research Design, Eastern Virginia Medical School, Norfolk, VA, United States.

Background: Residents have limited skills and do not feel confident teaching strategies of behavioral management to parents. Our curriculum prior to 2012, did not specifically address this important preventative aspect that can greatly impact childhood mental health outcomes.

Objective: To develop a sustainable curriculum change and improve the behavior management and confidence residents have when giving advice to parents of young children.

Design/Methods: During the one month rotation in outpatient pediatrics, residents are now required to read the book 1, 2, 3 Magic, learn 5 behavioral techniques (planned ignoring, time out, labeled praise, compliance training, and special time), and role play 3 clinical scenarios. A pre and post test was administered one year apart, to judge comfortability at discussing specific topics and providing behavior management techniques after initiation.

Results: Approximately 85% of the residents completed and participated in the curriculum. We found, of the residents who completed the curriculum, a statistically significant improvement in the residents ability to handle specific behaviors was reported. The residents reported they felt more comfortable discussing corporal punishment, moody children who seem to never listen, outburst behaviors and regression and active defiance.

Conclusions: A brief multi-modal curriculum change with role playing, integrated into a one month rotation, allowed pediatric residents to become more adept and comfortable at teaching parents simple, yet effective behavioral techniques. Details of the curriculum are currently being submitted to the Meded Portal.
Abstract #4: Pediatric Inflammatory Bowel Disease Patients’ Hepatitis B Immunity Prior to and Following Re-immunization

Authors: Sean Bingham, DO; Amy Perkins, MS; Lauren Willis, MD

ABSTRACT

Background: Hepatitis B virus (HBV) immunization using a three dose regimen confers 95% seroprotection in the average population, and no post immunization serologic evaluation or re-immunization is recommended. In the at-risk, immunocompromised, or hemodialysis populations, re-immunization is recommended for HBsAb < 10mIU/mL. No re-immunization guidelines exist for Inflammatory Bowel Disease (IBD) patients who often receive immune suppressing therapy.

Objectives: The purpose of this study was to evaluate and describe the HBV immune status of children with IBD at initial IBD diagnosis and after re-immunization intervention.

Methods: A retrospective chart review was performed on 241 IBD subjects at the CHKD Pediatric Gastroenterology Department from 1/1/2006 through 9/30/2013. Assessment included demographics, IBD type and extent, IBD medications, initial immunization status, and initial HBsAg and HBsAb serologies. Re-immunization interventions were then documented along with post re-immunization serologies. IBD medications, malignancy, or infection which may have interfered with re-immunization were also documented.

Results: Baseline three series HBV immunization was documented in 90% of subjects. 212 (87%) subjects had an initial evaluation of HBV serologies, but only 65 (27%) of these had both HBsAg and HBsAb evaluated. Re-immunization was performed in 78 subjects with one, two, or three dose re-immunization. Fifty subjects were re-evaluated for HBV serologies following re-immunization. Only 12 of these subjects had evaluation of both HBsAg and HBsAb. HBsAb was > 10mIU/mL or > 0.99 (both suggesting seroprotection) in 39 subjects (78%).

Conclusions: Though a minority of patients received re-immunization, 78% of these subjects had HBsAb levels at seroprotective levels. Low power and variation in HBV serologic evaluation limited this study. Serologic evaluation could improve with consistent measuring of HBsAg and HBsAb.
Abstract #5: Time to Detection of Positive Cerebrospinal Fluid Culture in Infants

Primary investigator: Rianna Evans, MD
Associate investigators: Natasha Erickson, MD, Bryan R. Fine MD, MPH, Ronen Zipkin, MD, Monica Stemmler, MD, Alan Schroeder, MD

Infants with concern for serious bacterial infection (SBI) who are admitted to the hospital are often placed on empiric antibiotic coverage and monitored awaiting bacterial culture results for 48 hours. This study was performed to investigate the time to detection (TTD) of CSF cultures performed in the otherwise healthy infant with the goal of shortening this inpatient observation time.

This was multicenter retrospective chart review of infants with positive CSF cultures drawn during evaluation for SBI. The infants were presumed to be previously healthy if they were admitted to the general pediatrics service or seen and discharged from the emergency department. Subjects included were ages 0-90 days and >37 weeks gestational age with cultures drawn between January 2000 and December 2013. Subjects were excluded if they were post-operative from a neurosurgical procedure, the sample was drawn in an ICU or a ventricular shunt was present.

Of 449 patients with positive CSF cultures, 186 met inclusion criteria and 35 (19%) were treated as true positive cultures. Of the true positive cultures, 80% were detected in ≤ 36 hours. Seventeen percent (6/35) of patients were described as ill appearing, had a positive CSF Gram stain, had a peripheral I:T ratio >0.2 and had a peripheral WBC count <5,000 or >15,000. An additional thirty-one percent (11/35) met three of these four criteria. In addition, 57% of true positive CSF cultures were correlated with a positive blood culture with the same organism. The median CSF WBC count for true positive samples was 1314.

Eighty-one percent (151/186) of the positive cultures were treated as contaminants with 87% (132/151) detected at >36 hours. Thirty-four percent (51/151) of the subjects with contaminant samples were described as ill appearing, 3% (5/151) had a positive blood culture with the same organism, all of which were coagulase negative Staphylococcus aureus, 1% (2/151) had a positive CSF Gram stain, 19% (28/147) had an I:T ratio >0.2, and 29% had a peripheral WBC count of <5,000 or >15,000. The median CSF WBC count for contaminants was 5.

A recently conducted review of positive blood, urine and CSF cultures at our institution and found that 97% of pathogenic organisms are identified in blood culture specimens in ≤ 36 hours and 92% of pathogenic organisms are identified in urine cultures in ≤ 36 hours; however, the number of positive CSF cultures was too few to make a strong conclusion on the TTD. Many prior studies have also had a small number of CSF samples for analysis, leaving most clinicians without strong evidence that meningitis will be correctly identified in less than the traditional 48-hour observation period. Though cultures are read once daily in our institution, these data suggest that most, though not all, pathogenic organisms will show growth in less than 36 hours. It also highlights the high rate of contamination of CSF cultures, suggesting the need for improvement in the process of collecting CSF.
Abstract #6: Umbilical Vein Catheterization is Significantly Associated with Death in Extremely Premature Newborns

Waleed Kurtom¹,², David G. Oelberg¹,², Ashlynn Baker², Deborah Quast², and Leslie Worley²

Department of Pediatrics, Eastern Virginia Medical School¹ and Children's Hospital of the King's Daughters²

INTRODUCTION: We found that umbilical vein catheterization is significantly associated with increased mortality in extremely premature newborns (<29 weeks gestation). We hypothesize that umbilical vein catheter (UVC) placement directly causes increased mortality via an undetermined pathophysiologic pathway.

METHODS: Using a retrospective cohort study design, we are comparing extremely premature (<29 weeks) newborns who died with UVC's in place (death cohort) with those who survived with UVC's in place (survival cohort) from 2008-2012 in our NICU. We expanded data collection to include review of electronic and/or written medical records regarding the management, laboratory results, radiology reports, and causes of death in these two cohorts. Our study is in progress.

RESULTS: 722 extremely premature newborns (<29 weeks gestation) were admitted to our NICU within the first 24 hours of birth between 01/01/08 and 12/31/12. UAC and UVC placements were attempted in all 722 newborns. Following failure of UAC placement, 87/722 newborns received only UVC placement. 15/87 newborns comprise the death cohort, and 72/87 comprise the survival cohort. From data collected on the death cohort, review of chest and abdomen x-rays reveal UVC malposition at some point during hospitalization (tip catheter not properly positioned between the top of T8 to the bottom of T10) in 13/15 newborns. 9/15 newborns had high lying catheters (ranging from 2-4 vertebral bodies above proper position, with a mean of 3.1 vertebral bodies). 4/15 newborns had low lying catheters (ranging from 2-8 vertebral bodies below proper position, with a mean of 4.3 vertebral bodies). 1/15 had proper line placement throughout hospitalization. 1/15 died before x-ray could be performed. To permit eventual quantitative comparisons between the two cohorts, we have created a scoring system that measures the amount of UVC tip malpositioning for each patient. A score of zero reflects perfect UVC tip positioning in all x-rays performed upon a given newborn. By this scoring system, the mean score for the death cohort is 1.36 (range = 0-2.5). To date, review of all collected information about our death cohort has not strongly supported other causes of mortality unrelated to UVC placement. However, increased occurrences of thrombocytopenia, chest tube insertion, RBC/platelet transfusion, metabolic acidosis, and medication administration (e.g. indocin) suggest that other pathogenic pathways may be involved. But their significance cannot be tested until data collection for the survival cohort is completed. Investigation of the survival cohort is underway.

CONCLUSION: Based on the results of the original study, we found that UVC placement is significantly associated with death during umbilical catheterization even after controlling for confounding factors. After review of medical records for those newborns that died with sole UVC placement, catheter malpositioning was repeatedly observed. If our review of the survival cohort shows reduced malposition occurrences, we will investigate how UVC tip placement might increase mortality when suboptimally placed.
Abstract #7: Factors predicting longer length of stay in hospitalized pediatric asthmatic patients.


Objective: Insurance companies often use diagnosis-related groups (DRGs) to determine reimbursement for patients hospitalized with a particular diagnosis. However, patients with the same diagnosis may require different lengths of stay (LOS). This study’s objective was to determine which factors might predict a longer than average LOS for a child hospitalized with status asthmaticus.

Methods: A retrospective chart review of patients discharged from Children’s Hospital of The King’s Daughters in Norfolk, VA from January 1, 2011 through June 30, 2012 with a diagnosis of asthma exacerbation (code 493.xx) was undertaken. Admissions were reviewed for demographic data, diagnoses and interventions received in the Emergency Department and hospital ward. For patients with multiple admissions, only the first was used for the primary analysis. 444 charts were included.

Results: The average LOS for an asthmatic patient was 1.7 days. Descriptive statistics were stratified by hospital LOS: < 2 days (the average) versus > 2 days. Patient demographics were similar between the two LOS groups. The majority of patients were admitted to the pediatric hospitalist service.

A greater percentage of patients in the LOS > 2 days group received antibiotics (P<0.001), chest x-rays (P<0.001), or supplemental oxygen (P<0.01) compared to the LOS < 2 days group. Odds ratios (OR) and 95% confidence intervals (CI) were calculated using a final best multiple logistic regression model for longer hospital LOS. Patients had increased odds of a longer LOS if they received antibiotics (OR 2.82, 95% CI 1.68-4.73) or were categorized as having severe persistent compared to intermittent asthma on admission (OR 3.58, 95% CI 1.28-10.02). Patients admitted on the Asthma Pathway were more likely to have a shorter LOS (OR 0.58, 95% CI 0.33-1.00). Patients who received epinephrine in the ED were more likely to have a shorter LOS compared to those who did not receive epinephrine (OR 0.11, 95% CI 0.01-0.95). In addition, patients admitted to the hospitalists had shorter LOS compared to the private pediatricians’ services (OR 0.32, 95% CI 0.17-0.59).

Conclusion: Pediatric patients hospitalized with status asthmaticus who require antibiotics, chest x-rays or supplemental oxygen, or who are identified as having severe persistent asthma are more likely to have a longer than average LOS. These factors may be used in the future to influence DRG reimbursement. Nonetheless, more research to further delineate these differences is needed.
Abstract #8: *C. difficile* post-operative wound infection after lipomeningomyelocele repair in an infant.

Authors:
Katherine L. Urban, MD (1) and Kenji M. Cunnion, MD (2)
(1) Pediatric Resident, EVMS, Norfolk, VA 23507
(2) Department of Pediatrics, Division of Infectious Diseases, Children’s Hospital of the King’s Daughters and EVMS, Norfolk, VA 23507

*Clostridium difficile* is a common cause of post-antibiotic colitis, and is rarely involved in extraintestinal infections. The majority of reported cases of extraintestinal infections have been in adults with underlying systemic illnesses or intestinal pathology. Here, we report on a case of *C. difficile* surgical site infection in a 7-week-old after lumbosacral lipomyelomenigocele repair. Fever and incision site inflammation were noted after her surgical dressing had been soiled with feces, despite the use of post-operative IV cefazolin. Initial incision site culture grew *C. difficile* and a coagulase-negative *Staphylococcus*. Incision and debridement of the site was performed, with repeat cultures obtained that grew only *C. difficile*. The patient was treated with IV vancomycin, which was later changed to IV metronidazole, and IV piperacillin-tazobactam. After debridement the patient had improved surgical site appearance and resolution of fever. This case report illustrates that *C. difficile* should be considered as a potential pathogen in post-operative infections in infants. Also, in instances where *C. difficile* is recovered from purulent discharge, surgical exploration and debridement of necrotic tissue is warranted.
Abstract #9: Evaluation of Rapid versus Traditional Infliximab Infusions in the Pediatric Population
Chephra McKee, PharmD, Nicole Rozette, PharmD, James Dice, PharmD, Nancy Yokois, MD
Children’s Hospital of The King’s Daughters
Norfolk, VA

Background:

Infliximab is used in the pediatric population to treat Crohn’s disease, ulcerative colitis, and rheumatologic disorders. The manufacturer recommends infusing infliximab over at least two hours to reduce the risk of infusion-related reactions. Several studies have been conducted in the adult population evaluating the safety of infusing infliximab more rapidly than the manufacturer’s recommendation, ranging from thirty minutes to one hour. These studies suggest that rapid infliximab infusions are safe for adults, but additional studies in pediatric patients are necessary to determine safety in this specific population. The primary objective of this study is to determine the safety of one-hour rapid infliximab infusions in the pediatric population. Secondary objectives of this study are to evaluate the impact of immunomodulator medications and the administration of premedication on the occurrence of infusion reactions.

Methods:

This is a prospective study with a historical control conducted from March 2014 to March 2016. Data for the retrospective portion of the study was collected from patients’ electronic medical records to evaluate the type and number of infusion reactions that occurred in patients receiving two hour infliximab infusions, requirements for premedications, and concomitant immunomodulator use (azathioprine, 6-mercaptopurine, or methotrexate). The prospective arm served as the study group for the trial. Patients who successfully completed induction plus two maintenance infliximab infusions (five total) administered over two hours without any infusion reactions were eligible for enrollment. After obtaining consent/assent from the study participant and their caregiver, patients began receiving one-hour rapid infusions. Subjects were monitored for any infusion reactions for thirty minutes post-infusion. Subjects who experienced infusion reactions during one-hour infusions were transitioned back to two-hour infusions and concluded participation in study. Patients receiving concomitant immunomodulators and patients receiving premedications prior to infusions were analyzed to determine the impact on infusion reactions.

Results:

Fifty patients were included into the historical control group. Of the 50, the majority of patients had Crohn’s disease or ulcerative colitis. In regards to the study’s secondary objectives, the majority of patients used no immunomodulator medications. All the patients in the retrospective portion of the study received at least one premedication prior to the two-hour infusion. The majority of patients in the control group, 48 (96%), had no infusion reaction with the two-hour infusions.

Currently, 24 patients have been consented for the one-hour rapid infusions and 17 have received the rapid infusions. In contrast to the retrospective portion, six (40%) patients have rheumatologic conditions and nine (60%) have Crohn’s disease or ulcerative colitis. Also, the majority of the patients (80%) in the prospective portion are receiving immunomodulator medications. Eleven (73%) patients received at least one premedication prior to receiving the rapid infliximab infusion. Thus far, no patients have experienced an infusion reaction with the rapid infusions. The study is continuing to enroll patients.

Conclusion:

Based on preliminary results of this study, rapid one-hour infliximab infusions may be safe in the pediatric population.
Abstract #10: Can point of care venous blood gases and electrolytes accurately diagnose diabetic ketoacidosis in the pediatric population?

Primary Investigator:
Kellease Brown, MD Pediatrics, Pediatric Emergency Medicine, CSG/EVMS

Sub-Investigators:
Joel Clingenpeel, MD Pediatrics, Pediatric Emergency Medicine, CSG/EVMS
Alice Werner, MD Pediatrics, Pathology, CSG/EVMS
Amy M. Perkins, MS Pediatrics, Division of Biostatistics and Innovation in Research Design, CHKD/EVMS

Objectives: The advent of point-of-care testing (POCT) has drastically reduced the amount of time required to receive information. Blood analysis results that once took clinicians several minutes to an hour to receive can now be obtained in a few minutes. Currently, the use of laboratory electrolyte analysis is recommended when managing and diagnosing pediatric diabetic ketoacidosis (DKA). The objective of this study was to determine whether DKA can be diagnosed using only POC electrolytes and to determine whether POC electrolytes can replace laboratory electrolytes when evaluating pediatric diabetic patients who present to the ED with suspected DKA.

Methods: This was a retrospective chart review of children who presented to the emergency department at Children’s Hospital of the King’s Daughters, a tertiary pediatric referral center, in Norfolk, VA. The chart reviewed spanned January 2004 to October 2013.

Results: There were 257 subjects who met inclusion criteria. Sodium, potassium, bicarbonate, chloride, and glucose values were compared between the lab and POC. It was found that with all these electrolytes that the limits of agreements are small enough to conclude that POC may be used with caution in place of laboratory measurements.

Conclusions: POC can potentially be used alone in a pediatric emergency department to diagnose DKA.
Abstract #11: Resident Breastfeeding Curriculum

Heather Minto, MD
Natasha Sriraman, MD
Pravash Mukherjee
Amy Perkins, MS

Rationale: Breastfeeding is an important source of infant nutrition. The benefits of breastfeeding are numerous including that its low cost; it helps the mother with baby weight loss and blood sugar regulation, it allows mother and baby bonding time, and breast milk is the easiest for the baby to digest and provides antibodies to help protect the baby in addition to vitamins and nutrients. Breastfeeding has become so important that the American Academy of Pediatrics has listed breastfeeding as an important topic for resident physicians to be comfortable talking about with families. A formalized online curriculum would help resident physicians to be more comfortable and proficient in counseling lactating mothers and families on breastfeeding basics and being able to help troubleshoot during infant visits.

Methods: The curriculum was modeled after the IBLCE blueprint of topics covered in their lactation consultant exam. An internet search was performed and multiple high quality sources that covered each aspect of the blueprint were assembled and linked to one central website. Two tracks were developed. Track one consisted of the core curriculum which covered the most important aspects of breastfeeding education and required 10 hours of clinical practice hours. Successful completion would lead to a certificate declaring course completion. Track two consisted of the core curriculum plus extra resources and support for those dedicated residents who wanted to complete the 90 hour education and 1000 hour clinical practice requirement and take the IBLCE lactation consultant exam. A pre and post test was required for all participants and allowed for feedback and improvement of the curriculum.

Results: The website was developed and included on the EVMS department of pediatrics website. Ten pediatric residents from all three levels of training completed the pre-test and have started the curriculum. One resident has successfully completed Track 1. The curriculum will continued to be improved and developed as additional feedback from participating residents is obtained.

Conclusions: Breastfeeding is an important source of infant nutrition, and its important to the AAP. However lactation education and troubleshooting concerns from nursing mothers and their families is not a formalized part of the CHKD residency curriculum. Our curriculum fills that education gap and provides the tools for residents to feel comfortable talking about breastfeeding in their practices and allows them the opportunity to complete the requirements to take the IBLCE lactation consultant exam.
Abstract #12:       AAAI Abstract

Authors: April Goolsby BS, Heather Minto MD, Amy Perkins, and Kelly Maples MD

Rationale: There is an increasing prevalence of food allergy (FA), with increased misdiagnosis and unnecessary food avoidance. Skin prick tests (SPT) and IgE testing have a high false positive rate and are insufficient for FA diagnosis. Traditional oral food challenges (OFC) are the gold standard for FA diagnosis, but are lengthy, costly, and impractical for many allergy clinics. A two-step abbreviated oral food challenge (AOFC) may be as reliable and safe in FA diagnosis in selected populations; while improving cost, efficiency, and availability of food challenges.

Methods: A retrospective chart review of 2-18 year olds at our children’s hospital, who completed an OFC or AOFC from January 2010-December 2012; was performed to assess the safety, efficacy, and reliability of AOFC compared to OFC. Demographics, history, and allergy sensitizations by SPT and IgE were collected and analyzed. Descriptive statistics were calculated and OFC and AOFC were compared by test passage rates, frequency of epinephrine usage, and length of time needed to complete the food challenge.

Results: 203 AOFC and 246.2 OFC were completed. 10% of patients in each group failed the challenge, with passage rates of 90% for both groups. 3 patients given AOFC and 4 patients given OFC required epinephrine. Mean AOFC time was 112.2 minutes while mean OFC time was 246.2 minutes.

Conclusions: In carefully selected patients AOFC are a safe, effective alternative to OFC in FA diagnosis. AOFC reduces time of food challenges increasing availability, office productivity, and reducing unnecessary food avoidance.
Abstract #13: A Case Series of Seven Pediatric Patients successfully treated with Ecallantide and Icatibant for Hereditary Angioedema

Heather Minto MD, & Kelly Maples MD.

Rational: Hereditary Angioedema (HAE) is a rare and potentially life-threatening disease. Over the last several years much progress has been made in the treatment of acute exacerbations of HAE. Previous studies have shown that ecallantide, a plasma kallikrein inhibitor, icatibant, a bradykinin B2 receptor blocker, and recombinant C1 inhibitor are effective treatments in adolescents and adults. However, there are no FDA approved treatments for acute exacerbations of HAE in the pediatric population.

Methods: We report a case series of seven pediatric patients treated for 23 HAE exacerbations at a children's hospital. Demographics, type of HAE, age at time of the attack, treatment used, response to treatment and adverse effects are reported.

Results: Seven patients with HAE ages 5-17 were treated at our facility for 23 HAE attacks. 6 patients have type 1 HAE and one patient has type 3 HAE. 22 attacks were treated with ecallantide and 1 attack was treated with icatibant successfully, all without adverse reactions.

Conclusion: In our cohort of 7 pediatric HAE patients, ecallantide and icatibant have been effective for resolution of HAE attacks and appear to be safe even in patients as young as five. Further studies need to be done to extend the FDA approval of ecallantide and icatibant to pediatric patients.
Abstract #14:

Study Title: Outpatient Transfers to an Academic Pediatric Emergency Department

Principal Investigator: Jennifer McCarthy, MD

Associate/Sub-investigators:
- Joel Clingenpeel, MD, MPH
- Margaret Eason, MD
- Amy Perkins, MS
- Sara Beth O’Shea, BS

Institution: Children's Hospital of the King's Daughters
Eastern Virginia Medical School

Objective of the Study:
This study is being done to investigate the hypothesis that a significant percentage of outpatient transfers to pediatric emergency departments can be discharged home without any clinical interventions. If demonstrated, this will allow for a potential decrease in future outpatient transfers thus leading to an overall decrease in healthcare costs and improvement in patient care.

Background and Rationale:
Pediatric emergency departments receive several transfers from outside emergency departments, urgent care centers, and primary care physicians' offices on a daily basis. Recommendations by the AAP and The Society of Critical Care Medicine for regionalization of pediatric critical services (1), has likely encouraged the liberalization of such transfers. These recommendations were based on studies that showed that critically ill patients have improved outcomes when transferred to a PICU (1). Few studies have been done that look at the transfer of non-critically ill patients to pediatric emergency departments. One such study looked at interfacility (ED to ED) transfers of non-critically ill children. Results from this study suggested that a significant proportion of these patients were discharged directly from the emergency department (24.7%) or admitted for less than 24 hours (17%) (2). Of those directly discharged from the accepting emergency department, 20.7% received no medical or procedural intervention (2). No such studies have been done looking specifically at transfers from urgent care centers or primary care physicians' offices to pediatric emergency departments.

Studies have shown that greater than half of the visits to pediatric emergency departments in the United States are for non-emergent reasons (3). These non-emergent visits lead to problems with over-crowding, inefficiencies, and adverse patient outcomes (4). In addition, such visits are associated with a significant cost burden that subsequently affects both families and taxpayers (3).

If a significant proportion of outpatient to pediatric emergency department transfers can be shown to require no clinical interventions, and the specific characteristics of such transfers clearly delineated, this will allow for recommendations regarding appropriate outpatient to
pediatric emergency department transfers. Such recommendations would have the potential to
decrease the amount of outpatient transfers, which would subsequently limit the amount of non-
emergent ED visits, therefore producing cost savings and better patient care.

**Description of the Study:**
We plan to perform a retrospective chart review on all patients over a 24-month period
(12/1/2010 – 11/20/2012) classified as either an “urgent care center” or a “primary care provider”
transfer through a “pre-arrival” note in the Firstnet database. The chart review time frame was
made 2-years in an effort to control for seasonality and referral bias. Patients of all arrival modes
will be included as long as they present within 4 hours of being seen at the outside facility. A
data collection tool will be utilized in the chart review process to characterize each transfer in
regards to demographics, diagnoses, reason for transfer, ED resource utilization, ED
disposition, and need for 72-hour ED return.

**Subject Population:**
This research will include approximately 3,600 pediatric patient charts. These charts will include
all direct outpatient transfers to the emergency department at CHKD hospital between
12/1/2010-11/20/2012 for any reason by any means of transportation. “Direct transfer” will be
declared as presenting to the emergency department within 4 hours of being seen at an outpatient
facility. Children need to be included in this study as they are the specific population involved in
outpatient transfers to pediatric emergency departments.

**Inclusion/Exclusion Criteria:**
Inclusion:
All patients aged 0-21 y.o. directly transferred to the pediatric emergency room at CHKD from
an urgent care center or a primary care physician's office between 12/1/2010 – 11/30/2012 who
present within 4 hours of being seen at the transferring facility.

Exclusion:
1) Interfacility/ hospital-hospital transfers to the pediatric emergency room at CHKD
2) Patients transferred from outpatient facilities presenting greater than 4 hours from initial
   outpatient presentation.
3) Patients >21 y.o.

**Methodology/Experimental Design:**
A retrospective chart review will be completed on all patients over a 24-month period (12/1/2010
– 11/30/2012) classified as either an “urgent care center” or “primary care provider” transfer
through a “pre-arrival” note in the Firstnet database. A query of the Firstnet database will be
performed to generate a list of all patients directly transferred to the emergency department at
CHKD who meet the inclusion criteria as noted above. A data collection tool focusing on
demographics, diagnoses, reason for transfer, ED resource utilization, ED disposition and need
for 72-hour ED return will be used to guide each individual chart review. Emergency department
resource utilization will be defined as lab tests, radiology studies, medication administration, IV
placement for medication or fluid administration, and any procedures. The need for 72-hour ED
return will be determined by the presence or absence of an ED visit note in the patients' chart.
dated within 72 hours of the initial transfer.

All data collected will be put into a password-protected database and analyzed. Descriptive statistics will be reported for all variables and stratified by whether the transfer resulted in clinical intervention in the emergency department. A one-sample chi-square goodness-of-fit test will be used to test whether the percentage of transfers not requiring clinical intervention is significantly different from the recommended 5%. Multivariable logistic regression modeling will be used to determine which factors are significantly associated with transfers not requiring clinical intervention. The level of significance will be set at $\alpha = 0.05$. Census data of monthly CHKD ED visits will also be collected to estimate the percentage decrease in total monthly ED visits if unnecessary transfers were avoided.

The clinical appropriateness of each transfer will be determined through the primary outcome measures of ED resource utilization, ED disposition, and need for 72-hour ED follow-up. Demographic data and information regarding the diagnoses and reason for transfer will be utilized to further characterize differences between the transfer requiring clinical intervention vs not requiring clinical intervention.

**Record Management:**
A list of patient names and medical record numbers will be generated from the initial Firstnet query. The list will be kept electronically in a password-protected database. Each subject on the above list will be assigned a unique study code which will be used to link them to the corresponding data collection tool document. The Data Collection Tool will also be kept electronically in a password-protected database separate from the list containing PHI. All documents will be shredded in 3 years after the closure of the study or permanently deleted if in electronic format.

**References:**

Abstract #15: **Intravenous Omega-3 Fatty Acids for the Treatment of Parenteral Nutrition Associated Liver Disease (PNALD): a case report of 20 NICU patients**

Eloise D. Woodruff, PharmD¹,³ and Brett H. Siegfried, MD²,³

¹ Neonatal-Perinatal Medicine, Children’s Specialty Group
² Department of Pharmacy, Children’s Hospital of The King’s Daughter, Norfolk, VA
³ Department of Pediatrics, Children’s Hospital of The King’s Daughter and Eastern Virginia Medical School

Pediatric patients, particularly infants, with gastrointestinal failure often require long-term total parenteral nutrition (TPN) to allow for intestinal growth and adaptation. Infants at high risk for parenteral nutrition associated liver disease include prematurity, low birth weight, multiple surgical procedures, TPN dependence, sepsis and limited enteral intake. Although traditional fat emulsion provides calories and prevents essential fatty acid deficiency, Intralipid® 20%, composed of omega-6 fatty acids and phytosterols, may increase free radicals, reduce bile flow and impair biliary secretion leading to cholestasis and liver injury. Intravenous omega-3 fatty acids, like Omegaven™, are not approved in the United States. Under an IRB-approved Compassionate Use Protocol, our institution reports the successful and safe use of Omegaven™ in 20 patients over the last 3 years. The objectives are to determine if Omegaven™ is beneficial and effective in reducing hepatic inflammation and reversing hepatic dysfunction associated with long-term TPN use in infants admitted to the NICU and demonstrate that Omegaven™ is well tolerated by infants and exhibits few adverse effects. A prospective, observational study of infants who received treatment for PNALD with Omegaven™ was conducted from March 2011- March 2014. All TPN regimens prior to the start of Omegaven™ included maximal amino acids, Intralipid and glucose infusion rates. Omegaven™ was given in place of Intralipid® 20%, receiving 1 gram/kg daily administered over 12 hours. Omegaven™ was continued until the patient was completely weaned from TPN and on full enteral nutrition. Baseline labs were performed prior to the start of Omegaven™, obtained routinely during the study and then monthly for 2 months after the completion of Omegaven™. The safety profile of Omegaven™ was evaluated with routine labs to monitor for coagulopathy, essential fatty acid deficiency and hypertriglyceridemia. Twenty infants, 12 males and 8 females, were enrolled. 19 were less than 6 months old with a mean gestational age of 28 weeks (23-36 weeks) and a mean birth weight of 1.08 kg (0.43-3.72 kg). Omegaven™ was administered for a median of 39 days (1-173 days). Fifteen patients of the 20 enrolled completed the Omegaven™ study and follow-up, 1 patient is currently enrolled. Three non-Omegaven™ related deaths occurred and one candidate withdrew from our study for transplant evaluation at another facility. The infants all tolerated Omegaven™ well without significant changes in INR, platelet count, essential fatty acid profile, or serum triglycerides. There were no significant bloodstream infections related to Omegaven™. Serum direct bilirubin significantly decreased during the course of treatment (p = 0.001). Intravenous omega-3 fatty acids, such as Omegaven™, are beneficial, effective and safe in treating PNALD due to prolonged TPN exposure. Omegaven™ was well tolerated in 20 term and preterm infants at our institution. We strongly encourage FDA approval for use of Omegaven™ in the United States due to the extensive use of this product already in compassionate use protocols in North America and the overwhelming beneficial results with few clinical adverse effects.
Abstract #16: Effects of Nocturnal Intermittent Hypoxemia on the Complement System in Severe Pediatric Obstructive Sleep Apnea

C.S. Sendon, MD, J.F. Chocano, MD

Eastern Virginia Medical School/Children Hospital of Kings Daughters, Norfolk, Virginia

The purpose of this study is to determine the association among intermittent hypoxemia (IH) and changes in complement system (CS) activation in pediatric patients with severe obstructive sleep apnea (OSA) evaluate the IH in OSA leading to the activation of CS products. The first phase of the project consists of recruiting adolescents with severe OSAS and adolescents without OSAS as control group. Patients will be classified into three groups: group A (patients with OSA with desaturations); group B (patients with OSA without desaturations) and group C (patients without OSA). The second phase will be performing an overnight sleep study (PSG) with serial blood sample collection. The blood sample will be used to analyze the CS cascade and inflammatory mediators. Sleep parameters such as sleep efficiency, total sleep time, sleep latency, percentage of sleep by stage, REM latency, duration of oxygen desaturation, and apnea-hypopnea index will be collected. We expect to show the activation of CS and inflammatory mediators in patients with IH. The anticipated outcome is the identification of IH as a trigger of the activation of the complement cascade and inflammatory response. The findings may be useful to better understand the IH effects on CS.
Abstract #17: Sleep Education for Medical Students and Pediatric Residents by an Online Sleep Review Course

Author Block: C. Sendon,1,2 G. Rulong,1,2 P. Kiger,1 C. Martin,2 K. Ferguson,1 M. Brenner,1,2 C. W. Gowen,1,2,3 J. F. Chocano1,2,3; 1Eastern Virginia Medical School, Norfolk, VA, 2Children's Hospital of Kings Daughters, Norfolk, VA, 3Children's Specialty Group, Norfolk, VA

Abstract:
Introduction: Sleep disorders are common and a significant health problem. Studies have shown a deficiency in sleep knowledge amongst physicians, attributed to a shortage of sleep training during medical school and residency. The purpose of this study was to assess pediatric residents and medical students sleep attitudes and knowledge, before and after an online sleep course.

Methods: Participants completed a pre-test, followed by an introductory lecture. Six online modules were then reviewed. The modules included: Introduction, History and Sleep hygiene, Sleep physiology, Sleep disorders, and Sleep pharmacology. Participants completed a post-test and a course evaluation once the modules were completed.

Results: 184 participants completed the pre-test. 126 participants completed the entire program (68%). Most of participants indicated minimal or no training in sleep medicine. Significant increase in sleep knowledge was seen in all participants and in the students and residents groups separately (p <.0001). Significant increase in attitude to sleep medicine for all participants (p = 0.018) and for the residents (p = 0.005) was found, but not for the students group (p = 0.1909). Participant’s sleep behavior did not change significantly.

Conclusion: Sleep education was deficient in the participants. This online course was effective to improve their sleep knowledge and attitude about the importance of sleep. These improvements did not change their sleep behavior. The participants were pleased with the length and content of the modules; however they suggested the course to be more interactive.

Support (If Any): American Sleep Medicine Foundation Grant Award # 71-EP-11.
Abstract #18: Clinical Characteristics of Sleep Disordered Breathing in Moebius Syndrome: Case Report

C.S. Sendon, MD, J.F. Chocano, MD

Eastern Virginia Medical School and Children’s Hospital of The King’s Daughters, Norfolk, Virginia.

Introduction

The Moebius Syndrome is an extremely rare congenital neurological disorder, its incidence is 2 cases per million births. It is characterized by facial paralysis and inability to move the eyes laterally due to underdevelopment of VI and VII cranial nerves. Limb abnormalities, chest-wall deformities (Poland syndrome), difficulty to breathe and swallow had been described. The combination of structural and cranial nerve dysfunction, makes sleep disordered breathing a complication.

Case Presentation

5 years old African American male with Moebius Syndrome, presenting with central sleep apneas, tracheostomy and ventilator dependent. He has a frozen facial expression, aphonie-type voice due to inability to move his tongue and lips, vertical light follow but there was no lateral follow to the either side. By 3 years of age, he was referred for a reevaluation of the central sleep disorder breathing and to confirm the need of a tracheostomy tube. The overnight sleep study was performed with a capped tracheostomy, he did not tolerate being capped for more than 90 minutes. Study results showed obstructive events with oxygen desaturations. After 2 years, a repeated Polysomnogram showed severe obstructive sleep apnea without impairment of gas exchange. It was recommended not to decanulate and ENT evaluation of the upper airway to define the presence of malacia or granuloma formation around the tracheostomy site.

Discussion

Moebius Syndrome had been associated with central apneas but it is important to evaluate also an obstructive component. A tracheostomy or its complications can produce obstruction in the airway and may responsible for sleep breathing problems. Patients with multiple comorbidities have central and obstructive components. The use of non-invasive methods such as nasal CPAP, BIPAP needs to be considered.
Abstract #19: Sleep Evaluation in a Patient with Chromosomal Disorder duplication (17) p11.2

(Smith-Magenis Syndrome and Potocki-Lupski Syndrome): Case Report

C.S. Sendon, MD, J.F. Chocano, MD

Eastern Virginia Medical School and Children’s Hospital of The King’s Daughters, Norfolk, Virginia.

INTRODUCTION

The duplication 17p11.2 Syndrome is a contiguous gene syndrome. Potocki-Lupski Syndrome (PTLS) was the first reciprocal of a homologous recombination. Its reciprocal disease is Smith-Magenis Syndrome (SMS), in which the chromosome portion duplicated in PTLS is deleted altogether. Both syndromes extremely rare, characterized by multiple congenital abnormalities and mental retardation. A key feature is autism spectrum disorder. Other features include infantile hypotonia, sleep apnea, structural cardiovascular anomalies, learning disabilities, attention-deficit disorder, obsessive-compulsive behaviors, malocclusions, short stature and failure to thrive. Disrupted sleep patterns are characteristics of SMS due to an inverted melatonin circadian rhythm.

CASE PRESENTATION

3 years old African American male with a history of PTLS/SMS Syndrome, with developmental, speech, and motor delays. He has hearing loss and myopia. Mom referred that her son gets up and walk around during the night. A sleep study showed mild snoring, obstructive respiratory events, and few periodic leg movements. Patient fall asleep very quick but have awaken several times. He woke up at the last part of the night and he did not go back to sleep. Time in bed was 7.1 hours; total sleep time 6.2 hours; Sleep efficiency was 87.5%; Arousal index was 25.8; Stage 2 was 60%; stage 3 was 11%; REM was 29%; SpO2 mean was 97% and SpO2 minimum was 84%; Apnea/Hypopnea index was 12.8; Apnea/Hypopnea index in REM was 34.0; ECO2 mean was 31.7 and ECO2 max was 53.0. No sleep walking, no sleep talking, no seizure activity.

CONCLUSION

The polysomnography evaluation of a patient with Smith-Magenis /Potocki Lupski Syndrome allows us to understand the sleep pattern of an affected individual. The Obstructive Sleep Apnea syndrome is related to structural midface defects. Awakenings and arousals may disrupt sleep pattern modifying sleep architecture. Polysomnography study should be included in the evaluation of patient’s with SMS/PTLS Syndrome.
Abstract #20: Analysis of the Sterility of Morphine Patient-Controlled Analgesia Cartridges Utilized for More Than 24 Hours
Christina M. Oravec, PharmD, Nicole A. Rozette, PharmD, BCPS, Mary-Margaret Fisher, BSMT (ASCP), James E. Dice, PharmD, FPPAG
Children’s Hospital of The King’s Daughters, Norfolk, VA

Background:
Although the Center for Disease Control and Prevention recommends intravenous (IV) tubing to be changed every 96 hours, they make no recommendation for the hang time of IV fluids and other commercially-prepared drug containers, including commercially available patient-controlled analgesia (PCA) cartridges. Institutional policy states that morphine PCA cartridges should be routinely changed every 24 hours; however during a recent shortage period, patient hang time was extended to a maximum of 72 hours. Extending the hang time expiration would eliminate or lessen the manipulation of the PCA pump, reducing the potential for line contamination, but data to support the extended sterility of these cartridges is limited. The objective of this study is to evaluate the sterility of commercially-prepared morphine PCA cartridges to determine if extended hang time up to 72 hours could be safely instituted.

Methods:
A 0.5mL sample was collected under aseptic conditions from previously administered morphine PCA cartridges (Hospira, 1 mg/mL or 5 mg/mL) for sterility testing. Duration of PCA administration was noted after disconnection from the patient. Samples were tested for sterility in tryptic soy agar, incubated at 35 degrees Celsius, and assessed for bacterial growth at 24 and 48 hours.

Results:
Preliminary testing has included thirty-two samples from morphine PCAs with hang times ranging from 13-91 hours. All samples were found to have no growth at 24 and 48 hours. A goal sample size of at least 50 morphine PCA cartridges with an extended hang time will continue to be evaluated for sterility.

Conclusions:
Preliminary data suggests that commercially-prepared morphine PCA cartridges with hang times greater than 24 hours can be safely instituted; however, analysis will continue.
Abstract 21: Impact of Umbilical Catheterization on Morbidity and Mortality in Extremely Premature Newborns

OBJECTIVE: Investigate the benefit of umbilical catheterization upon survival and selected morbidities in extremely premature newborns (≤28 weeks gestation). We hypothesize that umbilical catheterization of extremely premature newborns provides benefit by improving survival and reducing selected morbidities.

STUDY DESIGN: This study is a single institution, retrospective analysis of prospectively-collected clinical information originally entered into 3 databases for the purpose of quality assessment. Utilizing a retrospective, cohort study design, survival and outcomes of catheterized and non-catheterized newborns ≤28 weeks gestation (n=722) hospitalized between 2008 and 2012 inclusive are compared by univariate and multiple logistic regression analyses.

RESULTS: 66.8% of newborns (22 0/7 – 28 6/7 weeks gestation) had both umbilical arterial catheter (UAC) and umbilical venous catheter (UVC) placements, 15.0% had only UAC placement, 13.7% had only UVC placement, and 4.6% had neither. Overall survival was 82.5% (range = 50.0% for 22 weeks gestation to 95.1% for 28 weeks gestation). Survivals with and without UAC were 82.5% and 82.6% (NS), but survival with UVC was 80.7% versus 90.1% without UVC (p=0.012). Among selected morbidities, only late-onset sepsis was significantly associated with UAC placement (16.4 vs 9.1%, p=0.046) and early-onset sepsis inversely associated with UVC placement (0.5% vs 2.8%, p=0.041). Of those newborns who died during umbilical catheterization, 96.1 % had UVC’s and 84.0% had UAC’s vs 78.7% (p<0.001) with UVC’s and 81.5% (p=0.702) with UAC’s in survivors. After adjusting for confounding variables, the only risk factors or morbidities significantly associated with death during umbilical catheterization were gestational age (OR=0.46, 99% CI 0.25-0.85, p=0.013) and UVC placement (OR=35.7, 99% CI 3.67-347.3, p=0.002).

CONCLUSION: Umbilical catheterization of extremely premature newborns does not provide benefit by promoting survival or reducing selected morbidities. UVC placement is significantly associated with death during umbilical catheterization even after controlling for confounding factors.

David G. Oelberg¹,², Ashlynn Baker², Deborah Quast², and Leslie Worley²

Department of Pediatrics, Eastern Virginia Medical School¹ and Children's Hospital of The King's Daughters²
Abstract #22: Elevated head positioning of extremely low birth weight infants: effects on respiratory and cardiac function.

Angela Firestine, M.D.¹, Bianca Leonardi, M.D.¹, W. Thomas Bass, M.D.², Danielle Cobb, B.S.², Amy M. Perkins, M.S.³
¹Department of Pediatrics, ²Division of Neonatal Medicine, ³Biostatistics and Innovation in Research Design, Eastern Virginia Medical School, Children’s Hospital of The King’s Daughters, Norfolk, Virginia, United States.

Background: Elevated head positioning of premature infants has been advocated for the prevention of intraventricular hemorrhage and ventilator-associated pneumonia. Tilting maneuvers have been shown to influence heart rate, blood pressure and mechanics of ventilation. These changes in respiratory and cardiac function may be even more pronounced in ELBW infants at greatest risk of complications.

Objective: To compare indices of cardiopulmonary function in ELBW infants cared for in a standard flat position versus an elevated position.

Design/Methods: After parental consent, ELBW infants were randomized to standard care FLAT group (flat supine, head turned 180° every 4 hours) or ELEV group (supine, head of bed elevated 30°, head kept in midline) for the first 96 hours of life. Maternal demographic, health, pregnancy, labor and delivery data, and infant resuscitation data were collected. Maximum ventilator settings, lowest pH, highest pCO2, lowest mean blood pressure, medications and complications were recorded during the first 96-hours of life. Infants were followed until discharge for the occurrence of BPD, PDA, sepsis, NEC, ROP and pulmonary hemorrhage. Cranial ultrasounds were done on admission, daily for the first 4 days and weekly thereafter.

Results: One hundred ELBW infants were studied, 49 infants were randomized to the FLAT group and 51 infants to the ELEV group. Gestational age was lower in the FLAT group, 25.4 weeks compared to 26.2 weeks in the ELEV group, p=0.01. No significant differences between the two groups were noted for birth-weight, antenatal steroid use, APGAR scores or time to discharge. Infants in the ELEV group required increasing respiratory support during the first 96 hours (p=0.01), required higher mean airway pressures (p=0.01), and had higher pCO2 levels (p=0.02). ELEV infants had a trend toward higher mean arterial blood pressures (p=0.06) with similar vasopressor support. There were no differences in BPD, PDA, sepsis, NEC, ROP or pulmonary hemorrhage.

Conclusions: ELBW infants maintained an elevated head position for the first 96 hours of life required greater ventilator support and had higher pCO2 levels without evidence of increased BPD. Further study is needed to determine the effects of ELEV positioning on intraventricular hemorrhage.
Abstract #23: A Comparison of the Rate of Spontaneous Intestinal Perforation in Neonates Receiving Indomethacin or Ibuprofen for Patent Ductus Arteriosus

Authors: Katherine Hapgood, PharmD\(^1\), Lindsay Patrick, PharmD\(^{1,2}\), Brett Siegfried, MD\(^{1,2}\), and J. Bryan Carmody, MD\(^{1,2}\).

1. Children’s Hospital of The King’s Daughters, Norfolk, VA 2. Eastern Virginia Medical School, Department of Pediatrics, Norfolk, VA

Introduction/ Objective:
During fetal gestation the ductus arteriosus is open; shortly after birth the ductus arteriosus closes in most neonates. However, the ductus may not close, resulting in a patent ductus arteriosus (PDA). Presence of a PDA leads to shunting of blood from left to right in the heart. The presence of a hemodynamically significant PDA is associated with an increased risk for intraventricular hemorrhage, bronchopulmonary dysplasia, hypotension and death. Given these risks, the standard of care is to attempt to close hemodynamically significant PDAs.

Intravenous ibuprofen and indomethacin are the two pharmacologic agents used to close PDAs. Each of these drugs is associated with serious adverse effects, including spontaneous intestinal perforation (SIP). Receipt of hydrocortisone by neonates is also associated with SIP. There is limited evidence investigating an association of SIP between receiving either ibuprofen or indomethacin along with hydrocortisone. This study is comparing the rate of SIP between indomethacin or ibuprofen when used for PDA closure, as well as investigate if hydrocortisone increases the rate of SIP when used with these agents concomitantly.

Methods:
The study is a retrospective cohort. Neonates admitted to a level IV neonatal intensive care unit from April 2006 through December 2012 comprised the patient population. To be included patients were required to receive either ibuprofen or indomethacin for PDA closure. Of note, patients received either drug based on availability. The inclusion criteria required patients to weigh 1500 grams or less, and have a gestational age of 32 weeks or less. Any neonate with a history of necrotizing enterocolitis or abdominal perforation prior to treatment with ibuprofen or indomethacin was not included in the data collection. Also neonates were excluded if they had multiple congenital abnormalities or they died before completion of indomethacin or ibuprofen course.

The data collected included: gestational age, gender, birth weight, classification of PDA size left atrial to aortic root ratio prior to treatment with ibuprofen or indomethacin, occurrence of SIP, mortality, daily serum creatinine and urine output during treatment with ibuprofen/indomethacin, and platelet count before and after treatment with ibuprofen/indomethacin. The data collected with regards to ibuprofen or indomethacin included dose, dosing schedule, time between initial dose and remaining doses in treatment course, number of courses of therapy, and timing of administration compared to last hydrocortisone dose. The dose and duration of hydrocortisone was also collected.
Results: 108 patients met inclusion criteria. Of these patients, 82 received indomethacin, 19 received ibuprofen, and 7 patients received treatment courses of both drugs. In the indomethacin group 14 (17%) experienced SIP, while 3 (16%) in the ibuprofen group experienced SIP. Of the patients who received both drugs 3 (43%) experienced SIP. Of the 20 patients who experienced SIP, 10 were receiving hydrocortisone at the time, with 7 of those patients on stress hydrocortisone at this time. The ibuprofen group had a higher rate of diagnosis of NEC within two weeks of treatment, with 2 (10%) experiencing this. Only 3 (3.7%) of the indomethacin group had this occur. No patients in the ibuprofen/indomethacin group experienced NEC. Patients in the ibuprofen/indomethacin group had a higher rate of treatment being stopped early due to renal dysfunction.

Conclusions: There was no difference between the drugs for rate of SIP. However, patients receiving both drugs had an increased rate of occurrence of SIP. Differing baseline characteristics in the patient groups, as well as receipt of prophylactic indomethacin could have influenced these findings. It was unable to determine if prior receipt of hydrocortisone was associated with SIP.
BACKGROUND: In 2003, the ACGME restricted resident work hours to 80 per week which significantly increased the number of patient hand-offs. The increase in hand-offs has contributed to patient care failures. The current study evaluated a method for hand-off training and assessment based on a combination of formalized curriculum and content checklists.

OBJECTIVE: To evaluate whether formalized hand-off education and checklists would improve the quality of content conveyed during intern hand-offs.

DESIGN/METHODS: Prior to starting clinical responsibilities, 22 pediatric interns were enrolled in the study and randomized to trained versus untrained groups. The trained group received a formal one-hour hand-off curriculum and was given checklists to use during the training process and hand-off scenarios. The untrained group served as the control group. All interns participated in three standardized patient emergency department encounters and were required to hand-off the patients to a standardized resident (SR). The interns then read 4 written inpatient scenarios and performed a second hand-off to a SR. The role of SR was filled by actors working for the medical education department. All hand-offs were videotaped and scored by two blind raters using checklists of content expected to be conveyed during the hand-off. Positive point values were assigned for reporting information pre-determined to be relevant to the patient hand-off process and negative point values were assigned for any superfluous information conveyed. Interns were also awarded positive points for signing out the patients in order of most sick to least sick.

RESULTS: The ratings were summed across patient scenarios to obtain overall scores for ED and inpatient hand-offs for each intern. The inpatient and ED hand-off scores were then translated into 1 mean score per intern. The results of an independent samples t-test showed a significant effect for training, $t(13.81)=4.39, p<.001$. Trained interns had higher patient hand-off scores ($M=135.45, SD=17.91$) compared to untrained interns ($M=109.44, SD=7.35$). Inter-rater reliability was assessed and established for a subset of the scored scenarios, $r = 0.97$.

CONCLUSIONS: The results indicate that a standardized training protocol that uses a combination of traditional lecture and checklists, can improve the quality of content conveyed during intern hand-offs.
Abstract #25: Glucose-based peritoneal dialysis solutions inhibit complement effectors against *Staphylococcus aureus*

Parvathi S. Kumar, Clifford T. Mauriello, Pamela S. Hair, Nicholas S. Rister, Courtney Lawrence, Reem H. Raafat, Kenji M. Cunnion
Eastern Virginia Medical Center/ Children’s Hospital of the Kings Daughters

Background: *Staphylococcus aureus* peritonitis is a serious complication of Chronic Peritoneal Dialysis (CPD). It is associated with more severe infections and a higher risk for relapse. Complement-mediated effectors of innate host defense are essential for optimal opsonophagocytosis and control of *S. aureus* infections. Our laboratory has shown that hyperglycemic conditions impair optimal C3-mediated opsonization of *S. aureus in vitro* and *in vivo*. Since the most commonly used peritoneal dialysis (PD) fluids are glucose-based, we hypothesized that glucose-based PD fluids likely inhibit *S. aureus*-induced complement host defenses.

Methods: Commercial glucose-based (Dianeal) or icodextrin-based (Extraneal) PD fluids were purchased. Amino acid-based (Nutrineal) PD fluid was donated by Baxter International. Control PD fluid, excluding glucose, was generated with the same electrolyte composition as Dianeal. Dianeal supplemented with amino acids was used as an additional control. Three glucose concentrations of Dianeal were tested: Dianeal 1.5% (15gm/1000ml), Dianeal 2.5% (25gm/1000ml) and Dianeal 4.25% (42.5gm/1000ml). Normal human serum (NHS) and 10⁹ CFU *S. aureus* was incubated in each PD fluid for 1 hour at 37°C. The samples were sedimented and the supernatant was assayed for C5a and C3a, by ELISA and quantitative Western blot, respectively. Pelleted *S. aureus* was washed and stripped of covalently-bound C3-fragments, which were assayed by ELISA. A Laboratory strain and 6 clinical strains of *S. aureus* (3 MRSA, 3 MSSA) were tested.

Results: Glucose-based PD fluids caused a significant inhibition of *S. aureus*-initiated generation of complement anaphylatoxins C3a (>3 fold reduction) and C5a (>10 fold reduction) compared to non-glucose based PD fluids. Glucose based PD fluids caused a similar, 4 fold inhibition of C3-fragment binding. All three Dianeal glucose concentration inhibited C3 binding similarly. Glucose-based PD fluids inhibited C3 opsonization of all clinical (MRSA and MSSA) *S. aureus* strains similar to what was found for the laboratory strain.

Conclusion: *S. aureus* activation of complement was severely inhibited by glucose-based PD fluids compared with amino acid or icodextrin-based PD fluids. Generation of anaphylatoxins critical for neutrophil recruitment and opsonization was dramatically inhibited. These results suggest that glucose-based PD fluids may inhibit critical complement-mediated host defenses contributing to the increase in the severity and risk of relapse of *S. aureus* peritonitis.

The authors declare that there are no conflicts of interest.
Abstract #26: A Diagnostic Dilemma in a Patient with Evan’s Syndrome

Authors: Keegan Ziemba, MD and Anthony Villella, MD

Introduction: Evan’s Syndrome is the combination of immune thrombocytopenic purpura and autoimmune hemolytic anemia. It is a rare disease that is usually associated with systemic lupus erythematosus, antiphospholipid antibodies, and autoimmune lymphoproliferative syndrome. Treatment focuses on controlling the autoimmune destruction of platelets and red blood cells through immunosuppression, which creates an immunocompromised state in this population.

Case: The patient is a 13-year-old female, with a history of Evan’s Syndrome who presented with high fever, cough, and hypoxia. She had a two-month history of an intermittent productive cough, productive with yellow sputum, worse in the mornings, and with activity. She noted significantly decreased exercise capacity during this time, as well as some low-grade fevers. Her hemolytic anemia was well controlled on azathioprine and prednisone 15 mg twice daily. She was also receiving monthly aerosolized pentamidine prophylaxis for Pneumocystis jirovecii pneumonia. Following initial stabilization on nasal cannula and hydration, the patient’s initial evaluation included blood and urine cultures that remained negative. She was started on Cefotaxime. Her initial chest x-ray revealed a diffuse micronodular pattern. A high resolution computed tomography (CT) scan of the chest revealed a bilateral disseminated nodular and cavitary pattern without adenopathy or pleural effusions. A bronchoscopy was performed on day 2 of admission, with no findings. A PPD was negative. The patient’s hypoxia improved following increased dosing of prednisone to 30mg twice daily. She was placed on empiric anti-tuberculosis and anti-fungal treatment. Rheumatology evaluation was negative. A surgical lung biopsy was done. Pathologic analysis revealed Pneumocystis jirovecii. The patient’s treatment regimen was changed to intravenous Bactrim and later completed a 21-day course of Bactrim orally. After initiation of Bactrim, the patient did have worsening of her hemolytic anemia, which responded to increased doses of prednisone. This was later tapered once her hemoglobin improved and stabilized. Following lung biopsy and chest tube placement, the patient developed subcutaneous emphysema and a recurrent pneumothorax. It was felt that her poor healing was due to chronic corticosteroid use. The patient was eventually discharged on an alternating day schedule of Bactrim prophylaxis.

Discussion: Although HIV and transplant patients comprise the bulk of patients who contract Pneumocystis, it must be recognized among other immunocompromised states, like chronic corticosteroid use, patients undergoing chemotherapy, and primary immune deficiencies. It is important that this remains on a differential diagnosis for these patients when they present with fever, hypoxia, and cough, even if they are receiving appropriate prophylactic therapy. Also, although imaging and bronchoscopy may be helpful, a lung biopsy may be required to make a final diagnosis.
Clinical Presentation
A 4-month-old girl presents with 24 hours of listlessness and decreased oral intake. She was born at term and is exclusively breast fed. There is no reported history of trauma. She has been healthy and has received all standard vaccinations for her age. She received vitamin K at birth. Her temperature is 37.8 degrees Celsius, heart rate is 135 beats per minute, blood pressure is 111/63 mmHg, respiratory rate is 26 breaths per minute, and oxygen saturation is 100% in room air. Weight is in the 45th percentile at 6.8 kilograms, length in the 55th percentile at 63 cm, and head circumference in the 50th percentile at 41 cm. She is lethargic, with abdominal distension, chest brusing, and pallor. Her anterior fontanelle is full but soft. Her pupils are both 3 mm and equally reactive to light. She opens her eyes in response to tactile stimulation, but she does not withdraw. There is hepatosplenomegaly with the liver edge palpable 4 cm below the right costal margin.

CT scan of the head reveals bilateral acute and chronic subdural hematomas, concerning for non-accidental trauma.

Upon arrival to the pediatric intensive care unit interval development of right pupil dilatation prompts a repeat head CT, which demonstrates expansion of the right subdural hematoma, now with a midline shift and uncus herniation. After emergent craniectomy with clot evacuation she is stabilized with multiple transfusions of packed red blood cells and fresh frozen plasma, but she continues to have a persistent coagulopathy and severe anemia. The coagulopathy ultimately corrects after a single dose of IV vitamin K, but the cholestasis and anemia persist.

Laboratory Studies

<table>
<thead>
<tr>
<th>Component</th>
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<tr>
<td>Hemoglobin</td>
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<td>Mean corpuscular</td>
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<td>ALT</td>
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<tr>
<td>Partial thromoplastin</td>
<td>37 seconds (23.3-31.8)</td>
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<tr>
<td>Fibrinogen</td>
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</tr>
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</table>

Hepatitis B surface antigen was negative.

Factor II: 20% (71-116)
Factor V: 20% (79-127)
Factor VIII: 15% (59-142)
Factor IX: 40% (59-116)

Direct Coombs testing: Positive anti-IgG and anti-IgM

Diagnosis
Liver needle biopsy showed distortion of the overall hepatic architecture by striking giant cell change and cholestasis with formation of numerous pseudocysts consistent with a diagnosis of giant cell hepatitis (GCH). Hematologic evaluation revealed a warm direct Coombs positive autoimmune hemolytic anemia (AIHA).

Management
The patient was started on high-dose IV corticosteroids and intravenous immune globulin, which resulted in initial disease remission. She was later started on azathioprine, and her steroids were successfully weaned. She has been followed as an outpatient by both hematology and gastroenterology and has had an uncomplicated initial recovery.

Patients with GCH-AIHA are managed with immunosuppressive therapies. Steroids, azathioprine, cyclophosphamide, and intravenous immune globulin have all been used with consistent success. Recent reports have shown particularly good clinical responses with the monoclonal antibodies Rituximab and Alemtuzumab, both of which have anti-B cell actions. The clinical course for GCH-AIHA is commonly marked by initial improvement on immunosuppressive therapy with frequent subsequent relapses of the liver disease. Many patients ultimately require liver transplant, and there is a high rate of recurrence of GCH in transplanted livers.

Discussion
The combination of GCH and AIHA (GCH-AIHA) has been described in multiple pediatric case reports. GCH describes a histopathologic entity in which injured hepatocytes fuse and transform into giant cells, resulting in impaired hepatic function and cholestasis. The cause of the hepatocytic injury remains unknown but is suspected to be driven by an underlying genetic susceptibility with superimposed B-cell autoimmunity. The trigger for initiation of autoimmunity is unknown but case reports have implicated infectious and metabolic causes as well as inherited conditions such as congenital hemoglobinopathies and maternal blood group incompatibilities.

Patients with GCH-AIHA have a direct Coombs-positive hemolytic anemia, which results from binding of IgG autoantibodies to red cell surface membranes with subsequent activation of the complement cascade and premature red cell destruction.

Also described in the literature is acquired vitamin K deficiency in the setting of neonatal cholestasis, particularly when accompanied by exclusive breastfeeding. This is presumed secondary to fat malabsorption with corresponding deficiencies of the fat-soluble vitamins D, E, A, and K. Breast milk, being low in vitamin K, further increases the risk in exclusively breastfed babies.

The importance of this case lies in the unique pathology it combines and the way that combined pathology presented. The patient had cholestasis due to GCH, severe anemia due to AIHA, and acquired vitamin K deficiency presenting with multiple subdural hematomas due to the combination of cholestasis and breastfeeding. Upon admission, however, the leading diagnostic consideration was non-accidental trauma. It was only after extensive literature review, evaluation by multiple subspecialists, and a month-long diagnostic workup that the true etiology of the patient’s underlying predisposition to bleeding was revealed.

References
Other Projects with Posters

Abstract #27: Pediatrics Department at EVMS Global Health: Past, Present, and Future  
Authors: Mary Vaughn DeSoto, MD  
Carolyn Moneymaker, MD

Abstract #28: Improving Direct Admissions at CHKD  
Authors: Dana Ramirez, MD  
Elisabeth Heiser, MD  
Susan Murray, MD

Abstract #29: Case Report: Methotrexate Pneumonitis in an Adolescent Female Receiving Therapy for Juvenile Idiopathic Arthritis  
Stevens, BE, Gabriel, CA

We report the case of a 13 year old female with systemic onset Juvenile Idiopathic Arthritis (JIA) who presented with subacute respiratory symptoms leading to respiratory failure secondary to methotrexate pneumonitis. Methotrexate pneumonitis is a well recognized entity in the adult literature, however there are only two previously reported cases of pediatric patients with JIA receiving methotrexate therapy. Methotrexate is a frequently used medication in many rheumatologic conditions, including JIA. It has widely documented efficacy as a second line non steroidal medication and has a benign side effect profile with appropriate monitoring studies. Pediatric rheumatologists must remain mindful of the more rare and severe outcomes of methotrexate use, such as methotrexate pneumonitis, as quick recognition and treatment may be life saving.

Abstract #30: Case Report  
Mark Dexter, MD

Abstract #31: Case Report  
Dan Dison, MD