

## **Pediatrics and Obstetrics**

### **182. Pediatric Home Intravenous Antibiotics: Avoiding Complications and Improving Outcomes by Utilizing an Infectious Disease Nurse Practitioner**

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**Background:** Studies have shown significant complications associated with pediatric home intravenous (IV) antibiotic therapy

**Objective:** To determine whether a dedicated infectious disease nurse practitioner, coordinating care, can minimize complications and improve outcomes in pediatric home IV antibiotic therapy.

**Methods:** We reviewed the medical records of children discharged from the duPont Hospital for Children on home IV antibiotic therapy, from June 2006-January 2008, whose care was coordinated by an infectious diseases nurse practitioner. Complications and outcomes were entered into a database for analysis.

**Results:** 97 patients were eligible for the study. 54 were male; 76 White, 15 Black, 5 Hispanic and 1 South Asian. Age range was 7-261 months. Type of IV (Central Venous Line 3, PICC 94). Duration of IV (Range 8-68 days). Most frequent diagnoses were osteomyelitis 45 (46%), post operative infection 12 (12%), Lyme disease 12 (12%). Most commonly treated microorganisms were MSSA (22%), MRSA (10%). Antimicrobials used included ceftriaxone (26%), clindamycin (15%), cefazolin (15%), vancomycin (12%) and oxacillin (6%). Percent of patients with complications (some patients had more than 1) included infection (5%); drug reaction (8%); abnormal laboratory values (11%); unscheduled hospital encounter (18%); premature removal and/or replacement of IV (9%).

**Conclusions:** Our cohort of patients experienced a variety of complications related to their home IV antibiotic therapy. 51 % of our patients experienced one or more complications. This is a similar number as seen in previous reports. Our infection rate, however of 5% was lower than reported in previous studies. Likewise 18% of our patients required an unscheduled hospital encounter (ED and/or re-admission) which was significantly lower than in other studies. 11% of the patients developed significant laboratory abnormalities, especially leukopenia and thrombocytopenia. The use of a dedicated Infectious Disease nurse practitioner may have had an impact on the lower rate of IV line infections and the need for unscheduled hospital encounters. The anticipatory guidance, family support and education provided by the nurse may result in more timely interventions to prevent potential complications. Our nurse was instrumental in detecting the laboratory abnormalities seen in 11% of our patients and expeditiously managing their care to prevent more serious complications. The use of an Infectious Disease nurse to coordinate care of pediatric patients with home IV therapy should be explored in future studies.

### **183. Implementation of Universal Post Partum Tdap**

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**Background:** Based on evidence of waning immunity and the role of mothers in transmission of pertussis to infants, the ACIP published recommendations for routine post partum administration of Tdap in November 2006.

**Objective:** Assess feasibility, implement, and evaluate standing orders for post partum Tdap administration

**Methods:** In anticipation of this recommendation, the Chair of OB-GYN gathered a group of stakeholders in August, 2006, including representatives from Pediatric Infectious Diseases, Family Medicine, Hospital Infection Control, Hospital Pharmacy, and the State Health Department for a roundtable discussion to review the background on the recommendations, discuss feasibility, and to begin to map a strategy for implementation. The primary goal was to assess implementation of standing orders for Tdap administration in the immediate post partum period. Barriers and key processes were identified, and each item was assigned to an individual for follow up. A survey tool was created to capture demographics, knowledge, and beliefs among postpartum women regarding the vaccine.

**Results:** Assessing vaccine supply, processing standing orders through forms committees, staff education and training, and supplying VIS sheets in English and Spanish were identified as key steps. A physician champion led education seminars for nursing staff. Implementation of the order form, which required physician check off, began 2/07. Over the next 10 months during which there were 2217 deliveries, standing orders for 1003 doses were received by pharmacy, and 621 were charged. Of the 146 women who completed the survey, 42% were African-American, 30% white, 27% Hispanic. Mean age was 26 years (SD 6.4). 39.6% had less than high school education, 34.7% had attended college or graduate school. Uptake rate for the survey respondents was 75%, and did not vary by race or ethnicity (Chi2 4.74, P=.192). Having correct responses to all 6 knowledge questions had borderline association with level of education (Chi2 6.8, P=.08), but was not associated with vaccine acceptance (Chi2 1.9, P=.17). 12/14 women who did not know that infants can die from whooping cough agreed to vaccine. More highly educated women were less likely to accept vaccine (OR .66, 95% CI .43-1.02). 99% of acceptors rated vaccine as safe v 73% of refusers (Fisher's exact P=<.001). 87.5% of refusers perceived their infant to be at some risk for pertussis.

**Conclusions:** Strong support from the OB-GYN chair and identification of key steps by various stakeholders emerged as a critical elements in successful implementation of standing orders for post partum Tdap. Despite implementation, effectiveness was lower than expected. More effective education campaigns for ordering physicians, and for targeting highly educated women may be needed to increase vaccine use.

#### **184. Use of Personal Protective Equipment in Canadian Pediatric Emergency Departments**

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**Background:** Many barriers to maintaining infection control practices and using personal protective equipment (PPE) exist in the Emergency Department (ED).

**Objective:** To examine the attitudes, knowledge, self-reported behaviors and perceived barriers to compliance with infection control practices and the use of PPE in Canadian Pediatric EDs.

**Methods:** A self-administered survey tool consisting of 21 questions and scenarios was developed and validated de novo for this study. The survey was mailed to all individuals listed on the Pediatric Emergency Research Canada Database of physicians practicing Pediatric Emergency Medicine in Canada.

**Results:** 187 physicians were surveyed and 125 (67%) responded. Respondents had a median 9 years of experience (range 0-32 yrs) and 50 respondents (41%) had completed a Pediatric Emergency Medicine fellowship. Fifty-four percent reported that they had either never received PPE training or had not been trained in the previous 2 years. Respondents scored a mean of 4.92 out of 11 questions correct (SD 1.66) on knowledge-based questions although 53% reported being very or somewhat comfortable with their knowledge of transmission-based isolation practices. Only 11% reported always or usually wearing a mask when assessing febrile respiratory patients. For scenarios assessing self-reported use of PPE, respondents reported PPE use in accordance with national infection control standards in a mean of 1.01 out of 6 scenarios (SD 0.95). There was no statistically significant correlation between knowledge and reported use of PPE ( $p=0.08$ ). Respondents report they would be more likely to use PPE appropriately if patients were clearly identified prior to physician assessment, equipment was easily accessible, and PPE was made a priority in their ED.

**Conclusions:** Knowledge and self-reported adherence to recommended infection control practices among Canadian Pediatric Emergency physicians is suboptimal. These lapses put health care workers and patients at unnecessary risk. Early identification of patients requiring PPE, more convenient access to PPE, and improved education regarding isolation and PPE practices may improve adherence to these important guidelines.

### **185. Factors Associated with Surgical Site Infections after Pediatric Spinal Fusion Procedures**

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**Background:** Surgical site infections (SSIs) are the second leading cause of hospital-acquired infections. Spinal fusion procedures have been associated with higher rates of infection in adults and children, but there is minimal literature regarding factors associated with SSIs for pediatric spinal fusion procedures.

**Objective:** To determine the potentially modifiable factors related to SSIs for pediatric spinal fusion procedures that may lead to interventions to decrease SSI rates.

Methods: A retrospective case-control study was performed at a large tertiary children's hospital including all spinal fusion patients from Jan. 2000- Dec. 2006. SSI cases were identified by prospective surveillance using National Nosocomial Infection Surveillance System (NNIS) definitions. Each of the 34 identified cases involved a posterior fusion procedure. Cases were matched to 3 controls selected randomly from uninfected posterior spinal fusion surgery patients within +/- 3 months of their matched case. Factors relating to patient characteristics (demographics, ASA score, BMI and underlying diagnosis), the surgical procedure (duration of surgery, perioperative antibiotics, wound class and number/type of vertebrae fused), and tissue hypoxia (hypothermia, blood loss and blood/fluid resuscitation) were examined. Information was obtained through review of medical records. Univariate analyses were done to identify factors associated with infection. Odds ratios (OR) with 95% confidence intervals (CI) were calculated.

Results: Annual spinal fusion SSI rates were between 3.09 and 5.88 /100 procedure days. The study population was 66% female, 82% Caucasian and had a mean age of 14.7 years. The underlying diagnosis for surgery was idiopathic scoliosis in 47% and neuromuscular scoliosis in 30% of patients. Univariate analysis revealed 24% of cases received clindamycin as their perioperative antibiotic compared with 8% of controls (OR=3.6, CI 1.2-10.6). Inappropriately low antibiotic doses were administered in 24% of cases and 10% of controls (OR= 2.8, CI 1.0-7.9). Controls had a longer mean duration of hypothermia (31% vs. 20% of the surgery, P=0.04) and a lower mean temperature nadir (34.97°C vs. 35.27°C, P=0.04).

Conclusions: The results support the importance of perioperative antibiotics and suggest potential added importance of bactericidal agents. Mild hypothermia appears to be protective against infection in this population.

### **186. Improving Contact Isolation for Children Admitted with Soft Tissue Abscesses**

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Background: MRSA causes the majority of soft tissue abscess admissions at many pediatric institutions. Contact precautions are recommended to prevent transmission of MRSA. Variation in processes to implement contact precautions may contribute to poor healthcare worker (HCW) compliance.

Objective: To develop and test the impact of human factors engineering principles to increase to  $\geq 95\%$  the percentage of children with soft tissue abscesses placed in contact isolation on admission and maintained in appropriate isolation throughout their hospitalization.

Methods: The intervention was developed and tested on the unit with the most soft tissue abscess admissions over a 6 month period. Intervention components were: contact precautions as the admission isolation order (default is the desired action), patient isolation signs visibly posted (color coding and reminders within process), personal protective equipment (PPE) easily accessible (standardization, make the right thing the easy thing), and empowering nurses to place children with abscesses

in contact isolation at admission regardless of the physician order (identify and mitigate). Soft tissue abscess admissions were identified by reviewing the daily unit census. Medical record review and direct observation were used to track the intervention components. Run charts were used to assess initial and ongoing performance.

Results: Physician education and an admission order set increased contact as the initial isolation order from 65% to 94%. Nurse identification of patients requiring isolation resulted in placement of 100% of patients with abscesses in contact isolation. Highly visible isolation signs remained posted on patient doors 100% of the time. After a redundant stocking process was implemented, stocking of PPE carts was consistently  $\geq 95\%$ . The percentage of soft tissue abscess admissions effectively placed in contact isolation increased from 75-99 %.

Conclusions: The application of human factors principles can achieve reliable implementation of contact precautions for children with abscesses. Future research will monitor the sustainability of these approaches and assess how to disseminate these interventions to other institutions.

### **187. Impact of Methicillin-Resistant *Staphylococcus aureus* (MRSA) Strains of Community Origin in a Tertiary Care Pediatric Intensive Care Unit (PICU)**

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Background: MRSA is estimated to cause more than 90,000 deaths per year in the United States. Increasingly, healthy children are colonized with MRSA strains of community origin. Most hospital-onset invasive MRSA infections are caused by MRSA strains of healthcare origin. Little is known about the prevalence and transmission of MRSA among children in the PICU or the impact MRSA strains of community origin will have on healthcare MRSA transmission and infections.

Objective: To identify the MRSA colonization rate of children admitted to a 26-bed PICU at a 926-bed urban, tertiary care center. To characterize the molecular epidemiology of MRSA strains in patients colonized on admission to the PICU or who acquire MRSA colonization or infection while in the PICU.

Methods: Nasal cultures were performed on admission in children admitted to the PICU over a 9 month period in 2007. Microbiology databases were queried to identify patients with clinical cultures growing MRSA. Pulsed-field gel electrophoresis (PFGE) was performed on available isolates to determine genotype.

Results: PICU admission surveillance cultures were performed on 757 patients. The admission prevalence of MRSA in screened patients was 5.2%. Of the 39 patients colonized with MRSA on admission, 33 isolates (85%) were available for analysis, of which 19 (58%) were PFGE-type USA300. During the 9 months, 9 at-risk patients became colonized with MRSA after being in the PICU for greater than 48 hours. 5 of 8 available isolates (63%) were PFGE-type USA300. Only 1 of 9 patients (11%) developed invasive MRSA disease, bacteremia with PFGE-type USA300.

Conclusions: The 5.2% MRSA admission colonization rate in children in our tertiary care PICU was lower than the 8 - 44% MRSA colonization prevalence reported among adults admitted to ICUs. Of the patients colonized with MRSA at the time of PICU admission, more than 50% were colonized with PGFE-type USA300. MRSA strains of community origin are entering the healthcare environment and being transmitted between patients. Despite previous reports that most hospital-onset invasive MRSA infections are caused by MRSA strains of healthcare origin, the only invasive isolate in our PICU was PFGE-type USA300. Further characterization of the transmissibility and infectivity of different MRSA strains is needed among pediatric patients to curb healthcare-associated transmission of MRSA.

### **188. Control of Methicillin-Susceptible *Staphylococcus aureus* Related Infections in a Neonatal Intensive Care Unit**

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Background: *Staphylococcus aureus* (*Sa*) is an endemic pathogen in neonatal intensive care units (NICUs). Colonization occurs rapidly after birth. Incidence of infections varies according to the host, the strain, and the environment. Data concerning the level at which an investigation should be undertaken is undefined. Following a perceived increased number of positive Methicillin-Susceptible *Sa* (MSSA) results from cultures of clinical specimens in our NICU, an investigation of a potential outbreak was carried out.

Objective: To describe the epidemiological characteristics of MSSA infections and to measure the impact of the infection control interventions.

Methods: The CHU Sainte-Justine is a pediatric tertiary care center which includes a large NICU. Data on *Sa* strains isolated from clinical specimens, between Jan. 2006 and Nov. 2007, are obtained from our microbiology laboratory computer system. Infants were considered infected if MSSA was isolated from either a normally sterile site or cultures obtained for clinical purposes. Surface surveillance cultures (nose, anus, umbilic), are performed every 3 weeks since May 17, 2007. A punctual colonization screening was done on the health care workers (HCW) and on a limited number of parents. Pulsed Field Gel Electrophoresis (PFGE) was performed at the Québec Public Health Laboratory on most strains isolated from infants and on some of those isolated from parents and HCW. Infection control measures (cohorting, hand hygiene, gown and mask) were implanted on May 17, 2007. Incidence and prevalence of infections and colonization are reported per 1,000 patient-days (1000PD) per 28-day budget period of hospitalization.

Results: The NICU includes 57 beds/isolettes. Approximately 1,000 newborns, many of them premature, are admitted yearly. During the study period, MSSA was isolated from 82 clinical specimens (6% blood, 55% eyes, 23% respiratory tract, 11% skin wounds, 1% urine, 4% others) obtained from 60 newborns (55% boys, 45% girls; mean age 43.7 days, median 34.5 (9-210)). All strains showed to be different by PFGE study. Mean incidence of infections decreased from 1.98/1000PD before to 0.58/1000 PD after May 17, 2007. Mean difference 1.4, CI 95% 0.32-2.57; p = 0.02.

Prevalence of colonization/infections was maximum at 7.01/1000PD on May 29, 2007 and gradually decreased to a minimum of 0.52 on Sept. 12, 2007. We are observing an increased number of cases since Oct. 11, 2007 potentially related to a unit overcrowding among others.

Conclusions: Our study confirms the need for implementation of appropriate infection control measures to minimize the incidence of *Sa* related infections in our NICU. These measures contributed to decrease the mean incidence of infections to a minimum of 0.58/1000PD and the prevalence of colonization/infections to a minimum of 0.52 /1000 PD. These thresholds could be used as a reference for future surveillance.