

Session: P-60. Pediatric Antimicrobial Stewardship (inpatient/outpatient pediatric focused)

Background. Perioperative antibiotics (PA) are routinely given to children undergoing congenital heart disease (CHD) surgery to prevent surgical site infection. National guidelines recommend narrow-spectrum PA (such as Cefazolin) for most CHD procedures. However, indications for broad-spectrum PA are not well established, and limited literature suggests high exposure to broad-spectrum PA in this population. We performed a contemporary, multicenter description of prevalence and variability of broad-spectrum PA exposure within the pediatric CHD surgical population.

Methods. We identified children 0-17 years admitted to U.S. academically-affiliated centers participating in the Vizient Clinical Database/Resource Manager from 2011-2018. Patients who had ICD-9 and ICD-10 codes indicating a CHD surgical procedure with intravenous antibiotics initiated the day of surgery were eligible for inclusion. Antibiotics broader than first- and second-generation cephalosporins were designated broad-spectrum. We excluded centers with 5 or fewer annual procedures. We excluded patients undergoing heart transplant, concurrent non-cardiac procedures, and those with missing medication data.

Results. 19,152 hospital admissions from 24 centers met inclusion criteria. 55% of patients were male, 18% were under 30 days of age at time of surgery, and 5.1% had diagnosis codes for prematurity. Broad spectrum antibiotics were administered in 21.4% of CHD procedures during the study period. Between the 24 centers, the proportion of surgical cases given broad-spectrum PA ranged from 1.5% to 95%, which was unrelated to center annual surgical volume. Children under 30 days of age and those with prematurity were significantly more likely to receive broad-spectrum agents. Vancomycin was the primary antibiotic contributing to broad-spectrum PA exposure.

Conclusion. Substantial variation in broad-spectrum PA use was observed among children undergoing congenital heart disease surgery in academically affiliated United States centers from 2011-2018. Neonates and premature infants have the highest rates of exposure to broad-spectrum antibiotics. Standardization of perioperative antibiotics in CHD surgery is a potential intervention to limit antibiotic exposure in young infants.

Disclosures. All Authors: No reported disclosures

1362. Antibiotic Prescribing for Acute Otitis Media in Commercially Insured Pediatric Patients in the United States

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Session: P-61. Pediatric Bacterial Studies (natural history and therapeutic)

Background. Overprescribing of antibiotics to treat conditions that are self-limiting and do not always require antibiotics is a well-recognized concern in pediatric care. The 2013 American Academy of Pediatrics (AAP) acute otitis media (AOM) guidelines reinforced previous recommendations regarding watchful waiting for three days among patients with non-recurrent uncomplicated AOM and provided more explicit diagnostic criteria.

Methods. We conducted a retrospective cohort study using the IBM MarketScan Commercial Claims Research Databases (2008-2018). Pediatric patients 1 to 12 years old were included. We required a primary diagnosis of AOM in an outpatient setting, without AOM or other complicated ear infections within 6 months prior and no other acute infections in the 2 weeks prior to or 1 week after AOM diagnosis. Patients were classified as treated (pharmacy dispensing record of antibiotics within 3 days of diagnosis) or watchful waiting (no treatment or treatment after > 3 days). We used segmented linear regression to examine changes in treatment proportions across the study period.

Results. We identified 2,640,920 pediatric AOM episodes, of which 2,033,697 (77.0%) were treated within 3 days. The majority of episodes were treated with amoxicillin (51.3%), followed by amoxicillin/clavulanate (15.3%) and cephalosporins (22.0%). Among episodes in the watchful waiting group, 18,793 (3.1%) filled a prescription within 4-7 days of diagnosis. Most patients saw a pediatrician (62.7%). A larger proportion of otolaryngologists adopted watchful waiting approaches compared to other physician types. There was no difference in chronic conditions or regional variation between the two groups. There was no immediate (p=0.31) or gradual change in treatment proportion (p=0.49) after release of the 2013 guidelines.

Conclusion. Most pediatric patients continue to be treated with antibiotics within three days of AOM diagnosis, reflecting no impact of the 2013 AAP guidelines. Physician specialty but not patient characteristics appear to determine treatment approaches.

Disclosures. Nicole Smolinski, PharmD, Nothing to disclose

1363. Assessment and Quantification of Nasopharyngeal Streptococcus pneumoniae Colonization Does Not Discriminate Between Children with Viral and Bacterial Respiratory Infection

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Session: P-61. Pediatric Bacterial Studies (natural history and therapeutic)

Background. Pediatric uncomplicated pneumonia can be caused by viruses, bacteria, and atypical pathogens. Unfortunately, readily-available diagnostics do not reliably identify which cases of uncomplicated pneumonia have a bacterial etiology. It has been suggested that measuring pneumococcal nasopharyngeal carriage can discriminate between viral and bacterial disease. The objective of this study was to determine if nasopharyngeal pneumococcal carriage differed between children with definite viral disease, definite bacterial disease, and respiratory disease of indeterminate etiology.

Methods. Three cohorts were recruited. Cohort 1 consisted of children with acute respiratory illness admitted to the pediatric intensive care unit; Cohort 2 consisted of previously healthy children with acute respiratory illness admitted to the general pediatric ward; and Cohort 3 consisted of previously healthy children diagnosed with non-severe community-acquired pneumonia in the emergency department. Children were categorized into the following disease categories: a) viral infection syndrome, b) pneumonia complicated by effusion/empyema, or c) 'indeterminate' pneumonia. Study subjects' nasopharyngeal swabs (NPS) underwent quantitative PCR testing for *S. pneumoniae*.

Results. There were 206 children in Cohort 1, 122 children in Cohort 2, and 179 children in Cohort 3. The median subject age was 2.5 y (25-75th percentile 1.3-4.9 y). Only a minority (227/507, 45%) had pneumococcal carriage detected; in those participants, there was no association of quantitative genomic load with age, cohort, or disease category. In multivariate logistic regression, NPS pneumococcal carriage (positivity >3 log copies/mL) was associated with younger age and cohort of recruitment, but not with disease category (all those with indeterminate non-severe pneumonia were from Cohort 3).

Table 1. Comparison of subjects in different cohorts

	Cohort 1	Cohort 2	Cohort 3
Age category			
< 2 y	77 (37%)	67 (55%)	76 (43%)
2 to <5 y	61 (30%)	36 (30%)	65 (37%)
5 to <10 y	41 (20%)	15 (12%)	36 (20%)
10 y and over	27 (13%)	4 (3%)	1 (0.6%)
Proportion with no detectable pneumococcal genomic load	139 (67%)	65 (53%)	76 (42%)
Median genomic load (25-75th percentile) in those with detectable pneumococcal colonization	6.23 (4.85-7.21)	5.77 (5.03-6.82)	6.30 (5.06-7.17)
Pneumococcal genomic load			
<3 log	140 (68%)	66 (54%)	80 (45%)
3-6.9 log	46 (22%)	46 (38%)	61 (34%)
>6.9 log	20 (9.7%)	10 (8.2%)	38 (21%)

Bold indicates differences between categories, p<0.001.

Table 2. Comparison of subjects in different disease categories

	Viral	Pneumonia, indeterminate, nonsevere	Pneumonia, indeterminate	Pneumonia, complicated
Age category				
< 2 y	93 (58%)	76 (43%)	49 (37%)	2 (5.9%)
2 to <5 y	36 (22%)	65 (37%)	43 (32%)	18 (53%)
5 to <10 y	22 (14%)	36 (20%)	26 (19%)	8 (24%)
10 y and over	9 (5.6%)	1 (0.56%)	16 (12%)	6 (18%)
Proportion with no detectable pneumococcal genomic load	97 (61%)	76 (42%)	86 (64%)	21 (62%)
Median genomic load (25-75th percentile) in those with detectable pneumococcal colonization	6.12 (4.63-6.89)	6.30 (5.06-7.17)	5.80 (5.30-6.94)	6.26 (5.05-7.63)
Pneumococcal genomic load				
<3 log	98 (61%)	80 (45%)	87 (65%)	21 (62%)
3-6.9 log	48 (30%)	61 (34%)	35 (26%)	9 (26%)
>6.9 log	14 (8.8%)	38 (21%)	12 (9.0%)	4 (12%)

Bold indicates differences between categories, p<0.001.

Table 3. Associations with nasopharyngeal pneumococcal colonization >3 log copies/mL.

Covariate	Bivariate analyses		Multivariate analyses	
	OR (95%CI)	Wald p	OR (95%CI)	Wald p
Age category				
< 2 y	ref		ref	
2 to <5 y	1.27 (0.85-1.90)	0.25	1.28 (0.83-1.97)	0.27
5 to <10 y	0.39 (0.23-0.66)	0.001	0.39 (0.22-0.68)	0.001
10 y and over	0.16 (0.053-0.46)	0.001	0.22 (0.072-0.68)	0.008
Cohort				
1	ref		ref	
2	1.80 (1.14-2.85)	0.012	1.54 (0.94-2.53)	0.09
3	2.62 (1.73-3.98)	<0.001	2.20 (1.36-3.55)	0.001
Disease category				
Viral infection	ref		NS	
Indeterminate pneumonia, nonsevere	1.96 (1.27-3.02)	0.002		
Indeterminate pneumonia	0.85 (0.53-1.38)	0.52		
Complicated pneumonia	0.98 (0.46-2.10)	0.96		

Conclusion: The nasopharyngeal *S. pneumoniae* carriage patterns of subjects with definite viral infection were very similar to those with definite bacterial infection and to those with indeterminate pneumonia. It would therefore appear that assessment and quantification of nasopharyngeal pneumococcal colonization is not useful to discriminate between acute viral and bacterial respiratory disease in children in North America.

Disclosures. All Authors: No reported disclosures

1364. Effect of Cefepime Prophylaxis on Bacterial Bloodstream Infections in Neutropenic Patients with Acute Myelogenous Leukemia

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Session: P-61. Pediatric Bacterial Studies (natural history and therapeutic)

Background. Bacteremia is a major cause of morbidity and mortality among children with acute myelogenous leukemia (AML) and chemotherapy-induced neutropenia. Data evaluating the utility of bacterial prophylaxis in this pediatric population are limited. In April 2014, Children's Health (CH) implemented the use of cefepime bacterial prophylaxis for AML patients undergoing induction and intensification chemotherapy. The objective of this study was to evaluate the impact of this practice on the frequency of documented bacterial bloodstream infections (BSIs).

Methods. This was an observational, retrospective cohort study of patients < 21 years of age with AML admitted at CH from January 2010 through December 2018. The primary outcome was frequency of documented BSIs before (PRE; Jan 2010 to Mar 2014) and after (POST; Apr 2014 to Dec 2018) implementation of routine bacterial prophylaxis. Secondary outcomes included differences in total antibiotic days per neutropenia days and the occurrence of neutropenia-associated *C. difficile* infection between groups.

Results. Of 90 patients with AML who met the cohort inclusion criteria, 38 and 52 were treated during the PRE and POST prophylaxis periods, respectively. The incidence rate of documented BSIs per 1000 neutropenia days decreased from 15.5 to 2.8 after the implementation of routine cefepime prophylaxis (incidence rate ratio 0.18, Poisson regression 95% CI 0.09 to 0.33, $P < 0.001$). Patients were more likely to have febrile neutropenia in the PRE group (OR 11.9, 95% CI 6.6 to 20.8). The POST group had more antibiotic days per total neutropenia days (0.76 PRE vs 0.97 POST, $P < 0.0001$), but the frequency of first-episode *C. difficile* infection was not significantly different between groups (OR 0.36, 95% CI 0.1 to 1.4).

Conclusion. Universal cefepime prophylaxis for children with AML and chemotherapy-induced neutropenia was associated with a significant reduction in the incidence of febrile neutropenia and neutropenia-associated BSIs without increasing the incidence of *C. difficile* infection.

Disclosures. All Authors: No reported disclosures

1365. How Severe Are Rickettsial Infections Among Children

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Session: P-61. Pediatric Bacterial Studies (natural history and therapeutic)

Background. Rickettsial infections (RI) usually mimic benign viral infection due to similarities in clinical symptoms. However, severe forms and complications have been reported with rickettsiosis. Children can be affected as well. We aimed to study the particularities of RI among children.

Methods. We conducted a retrospective study including all patients aged \leq 18 years hospitalized for RI between 2000 and 2018. The diagnosis was confirmed by serologies (seroconversion).

Results. In total, we encountered 59 children with confirmed RI, among whom 45 were male (76.3%). The mean age was 14 ± 3 years. Forty children had a close contact with animals (71.4%). All patients consulted for a febrile maculopapular skin rash, which was associated to headache in 45 cases (76.3%), vomiting in 28 cases (47.4%) and cough in 8 cases (13.5%). Physical examination revealed an eschar in 13 cases (22%) and meningial syndrome in 11 cases (18.6%). Laboratory investigations showed thrombocytopenia (31 cases; 52.5%) and liver cytolysis (26 cases; 44%). Severe forms of RI were represented by meningitis in 11 cases (18.6%), pneumonia in 2 cases (3.3%) and myocarditis in one case (1.6%). The treatment was based on doxycycline in 42 cases (71.2%), fluoroquinolones in 10 cases (17%) and macrolide in 7 cases (11.8%) for children aged less than 8 years. The mean duration of treatment was 9 ± 3 days. The disease evolution was favourable in all cases.

Conclusion. The diagnosis of RI among children should be largely based on high index of suspicion, careful clinical and laboratory results. Prompt diagnosis is crucial in order to start antibiotics and avoid, therefore, fatal untreated forms.

Disclosures. All Authors: No reported disclosures

1366. Microbiology of Acute Hematogenous Osteomyelitis in Hospitalized Children

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Session: P-61. Pediatric Bacterial Studies (natural history and therapeutic)

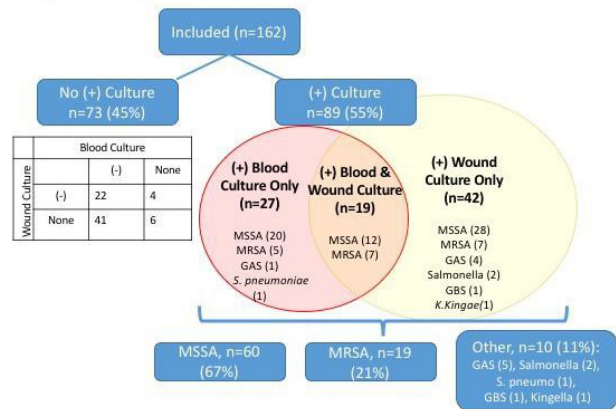
Background. Acute hematogenous osteomyelitis affects 1 in 5,000 children in the U.S. and *Staphylococcus aureus* is the most common bacterial cause. At our institution, clindamycin is used empirically for osteomyelitis, despite increasing clindamycin-resistance over the years. The objective of this study is to describe microbiologic results and antibiotic resistance patterns in children hospitalized with acute hematogenous osteomyelitis.

Methods. This was a single-center retrospective cohort study of patients < 21 years of age with acute osteomyelitis hospitalized between 1/1/2010 and 5/31/2019 at Children's National Hospital. We excluded patients with recent orthopedic surgery, hardware infection, penetrating trauma, or with an underlying immunocompromising condition. We performed chart review to collect data on location of infection; blood, synovial fluid, or surgical site cultures; culture results, and susceptibilities.

Results. Of the 162 encounters of acute osteomyelitis that met inclusion criteria, the average patient age was 8.3 years. Lower extremity infections were most common (105, 64.8%), followed by upper extremity (31, 19.1%), pelvis (14, 8.6%), spine (7, 4.3%), shoulder (4, 2.5%), rib (1, 0.6%) and mandible (1, 0.6%). Almost half of cases (73, 45%) had no positive cultures, and 89 cases (55%) had at least one positive culture from blood or local source (Figure 1). The most common pathogen was methicillin susceptible *S. aureus* (MSSA) followed by methicillin resistant *S. aureus* (MRSA) comprising 60 (67%) and 19 (20%) of culture-positive infections respectively. Other isolated pathogens included *S. pyogenes* (5, 5.6%) *Salmonella* species (2, 2.2%), *S. pneumoniae* (1, 1.1%), *S. agalactiae* (1, 1.1%), and *Kingella kingae* (1, 1.1%) (Figure 1). Among *S. aureus* infections, 69 (87%) were susceptible to clindamycin (85% among MSSA, 95% among MRSA).

Categorized Blood and Wound Culture Results

Figure 1. Categorized Blood & Wound Culture Results



Conclusion: Almost half of all children with acute hematogenous osteomyelitis did not have any microbiologic data to guide antibiotic usage. *S. aureus* was the most common (87%) isolate, with more MSSA (74%) than MRSA (24%). Non-*S. aureus* isolates were more likely to grow from surgical specimen cultures than from blood cultures. Clindamycin resistance was more commonly seen in MSSA than in MRSA osteomyelitis.

Disclosures. All Authors: No reported disclosures

1367. Reduced Ceftaroline Susceptibility Among Invasive MRSA Isolates at a Tertiary Children's Hospital

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Session: P-61. Pediatric Bacterial Studies (natural history and therapeutic)

Background. The emergence of community-acquired methicillin-resistant *Staphylococcus aureus* (MRSA) in the late 1990s-early 2000s complicated the empiric management of suspected staphylococcal infection in children. Rising clindamycin resistance rates in many communities adds further to management challenges. Ceftaroline, an anti-MRSA cephalosporin, represents an attractive therapy option. Little data are available, however, regarding the frequency of reduced susceptibility (RS) to ceftaroline among MRSA isolates from a general pediatric population.

Methods. Isolates were selected from an ongoing *S. aureus* surveillance study at Texas Children's Hospital. Invasive MRSA isolates from 2015-2018 were included. Isolates were initially screened for ceftaroline RS with E-test; all isolates with a ceftaroline E-test MIC $\geq 1.5 \mu\text{g/ml}$ underwent ceftaroline broth dilution. Ceftaroline RS was regarded as an MIC $\geq 2 \mu\text{g/ml}$; full ceftaroline resistance was defined as an MIC $\geq 8 \mu\text{g/ml}$. Accessory gene regulator (*agr*) groups were characterized by PCR.

Results. 201 viable isolates were included. The ceftaroline MIC₅₀ and MIC₉₀ were 0.5 and 1 $\mu\text{g/ml}$, respectively (Figure 1). Six isolates had MIC $\geq 2 \mu\text{g/ml}$ (2.9%) with two having MIC $\geq 8 \mu\text{g/ml}$ (0.9%). All ceftaroline RS isolates were from healthcare