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Contributions



## BACTERIOLOGY OF URINARY TRACT INFECTIONS IN EMERGENCY PATIENTS AGED 0–36 MONTHS

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**Abstract—Background:** Because urinary tract infection (UTI) is the most frequent source of serious bacterial infections in young children, we studied the bacteriology of such infections in our institution. **Objectives:** Pediatric urine cultures were reviewed for age- and sex-specific differences in testing, prevalence, causative organisms, and antibiotic sensitivities. **Methods:** A retrospective 5-year observational study of all urine cultures from Emergency Department patients aged 0–36 months found 4403 cultures. Primary outcomes were numbers of cultures obtained, infections found, the organisms isolated, and their antibiotic sensitivities. **Results:** Boys were cultured much less frequently (overall 4.7% vs. 19.4% of girls,  $p < 0.001$ ). Three hundred ninety-six cultures yielded infection episodes. Although far fewer boys were cultured, their overall positive culture rate (10.9%) was significantly higher than for girls (8.4%;  $p = 0.01$ ), with more Gram-positive organisms (52.3%; vs.

18.6% Gram-positives in girls;  $p < 0.001$ ). The rate of positive cultures in boys and girls remained 8.4% and 10.3%, respectively, even in 2-year-olds. Trimethoprim-sulfamethoxazole and amoxicillin/clavulanic acid were effective against all isolates. **Conclusions:** Age- and sex-based assumptions guiding evaluation for and treatment of UTIs in young children should be reevaluated. We may not be culturing enough young boys, risking missed UTIs with potential for renal injury in this vulnerable group. Based on their significant rate of Gram-positive infections, those boys we treat empirically might benefit more from trimethoprim/sulfamethoxazole or amoxicillin/clavulanic acid than from third-generation cephalosporins. The persistence of positive cultures in 2-year-olds suggests we should be culturing beyond 24 months in both sexes. Urine Gram stains should be more frequently considered. Published by Elsevier Inc.

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**Keywords—**UTI; pediatrics; infectious disease; guidelines; cultures

### INTRODUCTION

As serious bacterial infections in childhood have declined overall, urinary tract infections (UTIs) have become the most frequent occult and serious bacterial infection in young children (1–3). As a result, the common outpatient or Emergency Department (ED) presentation of a well-appearing child with “Fever Without A Source (FWS)” is often managed with algorithms outlining

indications for urinalysis and culture. Such indications incorporate common assumptions from previous literature: that UTIs are more frequent in girls, UTI frequency declines with age, and empirical therapy should be directed at Gram-negative organisms, predominantly *Escherichia coli* (4–7). Our institution's emergency-medicine-residency-generated evidence-based algorithm for the ED evaluation of well-appearing children aged 0–36 months with FWS was typical, calling for urinalysis and culture for patients deemed at risk for UTI: those with “Any of the following: female (particularly aged <24 months); male aged <6 months or uncircumcised; malodorous urine; hematuria; abdominal or suprapubic tenderness; history of UTI; genitourinary abnormality.” Any child's urine sent for analysis was also cultured. By this algorithm and department policy, all urines were to be obtained by urethral catheterization.

When urinalysis suggests infection, empirical antibiotic therapy is best guided by knowledge of the locally prevalent infecting organisms and their antibiotic sensitivity patterns (2). Most hospital antibiograms do not differentiate by age, sex, or inpatient/outpatient source. This study was generated to ask the clinical question: “In our institution, what antibiotics are best for the empirical treatment of UTIs in children 0–36 months of age?” We looked at the bacteriology of UTIs in a 5-year sample of all ED urine cultures from children aged 0–36 months for the purpose of validating testing and treatment assumptions and optimizing antibiotic choices.

## MATERIALS AND METHODS

### *Study Design*

This was a retrospective observational study from the ED of a 360-bed military teaching hospital with an emergency medicine residency and an average annual volume of 66,800 patients.

### *Study Setting and Population*

The study period was January 1, 2005 through December 31, 2009. Included were all patients under the age of 36 months with urine cultures sent from the ED.

### *Study Protocol*

The Navy and Marine Corps Public Health Center Epi-Data Center Health Level 7 microbiology database was searched. Outpatient microbiology records with a collection date during the study period indicating “urine” as a source, and sent from the ED, were retrieved. A positive culture was defined as the verified isolation of an organism from that urine specimen. Age, sex, and positive cul-

ture results certified in the medical center's Composite Health Care System were extracted.

### *Measurements*

An “Infection Episode” was defined as 30 days between positive urine cultures based on the collection date. Specifically, if two different organisms were isolated on the same specimen collection date, both were included in the analysis. If the same organism was isolated more than once on the same specimen collection date, or less than 30 days apart, only the first isolate was selected. If the same organism was cultured 30 days or more apart, then it was considered two infection episodes.

Antibiotic sensitivities were analyzed using WHO-NET5 (World Health Organization Collaborating Centre for Surveillance of Antimicrobial Resistance) software. Analyses of antibiotic resistance were conducted per individual where only the first isolate per patient was included. All organisms identified at a species level were included in the antibiogram analysis. Antibiotic sensitivities were reported as percent susceptible.

### *Data Analysis*

The primary outcome measures were the number of urine cultures obtained, the subset of positive urine cultures and infection episodes, the organisms isolated from those infection episodes, and the antibiotic sensitivities of those isolates. The data were analyzed by sex and by age group (<3 months, 3–11 months, 1-year-olds [months 12–23], and 2-year-olds [months 24–35]). Statistical comparisons were by chi-squared analysis.

No outside funding organizations or sponsors were involved in the conduct or reporting of this study. The medical center's Institutional Review Board approved the research protocol.

## RESULTS

### *Culture Rates*

The age and sex distribution of the study population and the rates at which urine cultures were obtained are found in Figure 1. During the 5-year period, the ED registered 334,021 patients; 38,844 (11.6%) were age 0–36 months; and 4403 (11.3%) had urine cultures sent. Although 22% more boys were seen, they were cultured much less frequently (4.7% of boys vs. 19.4% of girls;  $p < 0.001$ ). Seventy-seven percent of all cultures were from girls. The sex difference in culture rate was present even in the <3-month age group where 20.2% of girls were cultured, vs. 11.6% of boys ( $p < 0.001$ ). Culture rates for boys declined markedly in the remainder of the first

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