

Repeat urine cultures in children with urinary tract infection

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Abstract

Background Urinary tract infections (UTIs) are the second leading cause of infection in children, following respiratory tract infections. Repeat urine cultures after antibiotic treatment are routinely obtained in clinical practice to verify proof of bacteriologic cure. The American Academy of Pediatrics does not recommend repeat cultures, due to increased cost and discomfort to patients.

Objective To determine the frequency of positive repeat urine cultures after 3 days of antibiotics in children with UTIs.

Methods We conducted a retrospective study on children with UTIs who visited the Division of Pediatric Nephrology, Department of Child Health at Dr. Soetomo Hospital, Surabaya from January 2006 to December 2011. Results of repeat urine cultures were obtained after 3 days of antibiotic treatment. Descriptive statistics were used to analyze the data.

Results Of the 779 pediatric UTI cases, repeat urine cultures were performed in 264 (33.9%) cases. Of the 264 patients who comprised our study, there were similar numbers of girls and boys (50.4% vs. 49.6%, respectively). The mean age of patients was 43.9 (SD 1.59) months and 35.5% of subjects were aged under 1 year. In the initial urine cultures of our subjects, *Escherichia coli* was the most common organism found, with 92 cases (34.8%), compared to 58 cases (21.9%) of *Klebsiella pneumoniae* and 29 cases (10.9%) of *Pseudomonas aeruginosa*. Repeat urine cultures showed no bacterial growth in 168 cases (63.6%).

Conclusion Mostly negative repeat urine cultures will probably obviate the need of this test in daily routine practice. [Paediatr Indones. 2012;52:170-4].

Keywords: repeat urine culture, children, urinary tract infection

Urinary tract infection (UTI) refers to bacteriuria associated with the presence of proliferating bacteria in the urinary tract, causing tissue invasion and inflammation, through infection in the renal parenchyma to the bladder.^{1,2} UTIs are the second leading cause of infection in children, after respiratory tract infections, with *Escherichia coli* as the most prevalent cause.³⁻⁵ A high UTI prevalence of 5% among febrile children aged between 2 and 24 months was reported by the American Academy of Pediatrics (AAP).^{2,6}

The complications of pyelonephritis and long-term kidney damage, such as renal scarring and eventual hypertension in adulthood, are sufficiently common to necessitate early and thorough treatment of febrile UTIs in infants.^{3,6-8} Children with anatomic abnormalities of the urinary tract, including hydronephrosis, posterior urethral valves, vesicoureteral reflux, and ureteropelvic obstruction, are thought to be predisposed to recurrent UTIs.⁷

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A relapse will rarely occur if the urine is sterile 10 days after treatment. The early reappearance of the same bacterial species, or biotype/serotype of *E. coli* suggests that the original pathogen was not completely eradicated and that the patient may require a longer period of treatment and further investigation. Most recurrences are re-infections by a different bacterial species.⁹

The previous recommendation for children with UTIs was to repeat urine cultures at some point after stopping the antimicrobial agents. This recommendation was based on the premise that cultures can reliably identify the minority of patients who need more intensive treatment and investigation, aside from the high risk of relapse.⁹ Therefore, repeat urine cultures are still routinely obtained in clinical practice as proof of bacteriologic cure. In contrast, this practice was recently not recommended by the AAP, due to increased costs and discomfort to patients.^{2,7} In lesser developed countries, where urine culture may be unavailable or prohibitively expensive, the cost of treating a UTI is almost completely confined to the cost of the antimicrobial agents used. However, repeat urine cultures may be appropriate in certain circumstances, including for infants or young children who do not have the expected clinical response after 48 hours of antimicrobial therapy.⁷ Our preliminary 2010 study in 135 children with UTIs revealed 60.7% of cases to have sterile follow-up urine cultures.¹⁰ There is little published information on the yield and clinical usefulness of repeat urine cultures, therefore, this study was done to assess the usefulness of repeat urine cultures in children with UTIs. The objective of this study was to determine the frequency of positive repeat urine cultures, obtained after 3 days of antibiotics treatment in children with UTIs.

Methods

A retrospective study was conducted in Dr. Soetomo Hospital, Surabaya. We enrolled all children aged 1 week to 15 years with UTIs who visited the Division of Pediatric Nephrology, Department of Child Health between January 2006 and December 2011.

Patient data included analyses of age, gender, causative organisms, and results of repeat urine

cultures after 3 days of antimicrobial treatment. UTI diagnosis was based on significant bacteriuria and more than 100,000 colonies/mL grown in the urine culture.

Descriptive statistical analysis was performed by SPSS for Windows version 13.0 software.

Results

Of 779 pediatric UTI cases, repeat urine cultures after 3 days of antibiotic treatment were performed in 264 (33.9%) cases. There were similar numbers of female and male subjects (50.4% females vs. 49.6% males). One-third of the patients were under 12 months of age. However, the frequency of illness in the over 5 year age group was equal to that of the 13-36 month age group (**Figure 1**). Subjects' ages ranged from 2 weeks to 15 years, with a mean age of 43.9 (SD 1.59) months.

Escherichia coli was the most common organism grown in our subjects' initial (before treatment) urine culture, with 92 cases (34.8%) compared to only 58 cases (21.9%) with *Klebsiella pneumoniae* and 29 cases (10.9%) with *Pseudomonas aeruginosa* (**Figure 2**). Repeat urine cultures were sterile in 168 cases (63.6%) (**Figure 3**).

Of the 96 remaining cases with non-sterile repeat urine cultures, most cases (86.5%) did not have fever and only 12 cases (12.5%) had leukocyturia in urinalysis. Only 8 cases (8.3%) had underlying renal disorders (neurogenic bladder, ureterovesical junction stenosis, ureteropelvic junction stenosis, vesicoureteric reflux, and urolithiasis).

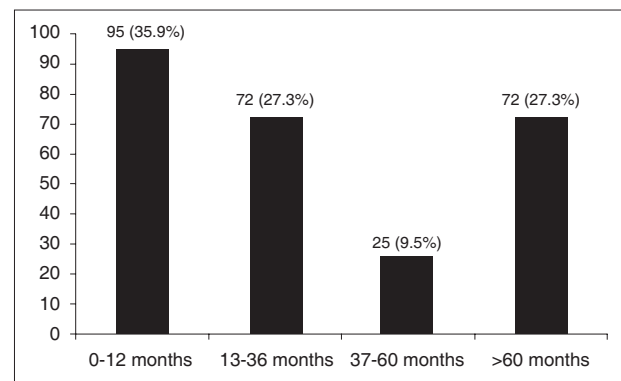


Figure 1. Age distribution of subjects

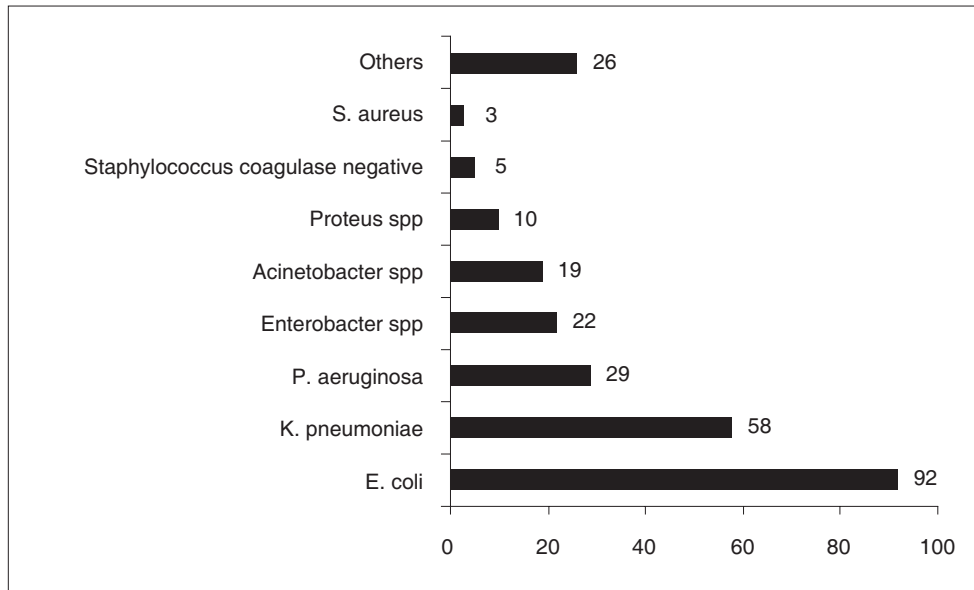


Figure 2. Distribution of microorganisms of initial urinary cultures (n = 264)

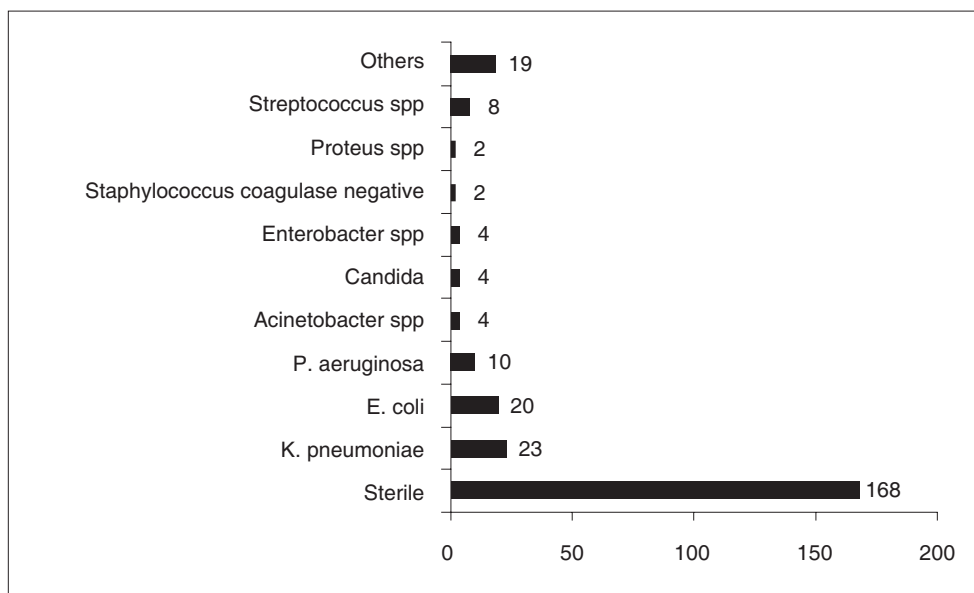


Figure 3. Distribution of microorganisms of repeat urinary cultures (n = 264)

Discussion

More than one-third of our subjects were less than 1 year of age, consistent with the internationally published incidence of UTI in children. Children with genitourinary tract abnormalities tend to present with infections earlier in life. Infants

and young children presenting with UTIs have traditionally been extensively investigated, due to concern that developing kidneys are more susceptible to damage from pyelonephritis and that the probability of identifying associated urinary tract abnormalities is statistically higher in this group.¹¹

We also observed similar numbers of boys and girls with UTIs. Past studies have found the incidence of UTIs in boys under the age of 1 year to be higher than in girls. However, after the age of 1 year, girls have been observed to be much more likely to develop UTIs than boys.¹¹ Nevertheless, the AAP committee guidelines do not differentiate between genders with regards to investigation of UTIs.²

Management of UTIs in children consists of diagnosis confirmation, infection eradication (including prevention of recurrence), and urinary tract evaluation. Surgical options may be needed for obstructive uropathy, to prevent recurrent infection. Further monitoring is also warranted for children with UTIs.¹ Persistence of fever beyond 48 hours in those being treated for UTIs has led to recommendations for radiologic studies and repeat urine cultures, presumably to investigate the possibility of urologic complications, such as renal abscess or urinary obstruction.¹¹

We were able to investigate the results of repeat urine cultures in one-third of the pediatric UTI patients who visited our hospital. Although it is common practice in our institution to repeat urine cultures after treatment with appropriate antibiotics, we faced technical and patient financial issues in our attempts to repeat the urine cultures. Repeat urine cultures are uncomfortable for the patient and time-consuming for the practitioner. In addition, there is a very real but difficult-to-quantify discomfort to children who undergo invasive procedures. The financial costs of repeating a urine culture may be deduced more easily. Although not often at the forefront of medical decision-making, the financial impact of medical care to a hospital and the families may be substantial. The potential of economic savings from a policy change regarding the need for proof of bacteriologic cure is not insignificant.⁷

Routine reculturing of the urine after 2-3 days of antimicrobial therapy is generally unnecessary, if the infant or young child has had the expected clinical response and the uropathogen is determined to be sensitive to the antimicrobial being administered. Antimicrobial sensitivity testing is determined most commonly by the application of disks containing the usual serum concentration of the antimicrobial to culture plates. Because many antimicrobial agents are excreted in the urine in extremely

high concentrations, an intermediately sensitive organism may be fully eradicated. Studies of minimal inhibitory concentrations may be required to clarify the appropriateness of a given antimicrobial. If the sensitivity of the organism to the chosen antimicrobial is determined to be intermediate or resistant, or if sensitivity testing is not performed, a 'proof-of-bacteriologic cure' culture should be performed after 48-72 hours of treatment. Data is unavailable to determine if clinical response alone ensures bacteriologic cure.^{13,14} In this study, the non-sterile cases virtually showed adequate clinical responses to the antibiotics treatment with only 13.5% still had fever and 12.5% had leukocyturia in the urinalysis. Most of them (91.7%) had no underlying renal disorder. In contrast, a study by Bachur concluded that repeat urine cultures are not indicated for patients who have the expected response to therapy.¹² No data available of the method of obtaining urine specimens for cultures in this study raised the question of whether this factor played a significant role in the problem of non-sterile cases with adequate clinical responses. The recent AAP recommendation in September 2011 confirms that urine specimen should be obtained through catheterization or suprapubic aspiration for culture and urinalysis since the diagnosis of UTI cannot be established reliably through culture of urine collected in a bag.²

Our study revealed that most repeat urine cultures were sterile after antibiotic treatment. This observation was compared to a study by Bachur who analyzed 288 children with UTI from whom repeat urine cultures were obtained. Sterile results were seen in 93% of their patients.¹² In another study by Currie *et al.*, 291 of 364 (80%) identified children with UTI had negative repeat urine cultures.¹⁴ Oreskovic *et al.* found only 1 of 328 children with UTI to have a positive repeat urine culture after therapy.⁷ Our preliminary study in 2010 showed similar result to this study with follow-up urine cultures revealed sterile in 82 (60.7%) cases.¹⁰ These studies taken together give a more complete picture of UTIs and UTI treatment among children. Therefore, though our study showed fewer negative culture results, it adds to this body of evidence, by suggesting that repeat urine cultures are unnecessary.

In conclusion, mostly negative repeat urine cultures will probably obviate the need of this test in daily routine practice.

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