Follow-up Urine Cultures and Fever in Children With Urinary Tract Infection

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Background: The American Academy of Pediatrics practice parameter for urinary tract infection suggests a repeat urine culture if the expected clinical response is not achieved within the first 48 hours of therapy. The utility of repeat urine cultures and clinical significance of fever at 48 hours is unclear.

Objectives: To determine the frequency of positive repeat urine cultures in children admitted to the hospital with urinary tract infection, and to describe the fever curves of children admitted to the hospital with urinary tract infection.

Design and Methods: We reviewed all cases of urinary tract infection in children 18 years and younger who were admitted during a 5-year period to Children's Hospital of Wisconsin (Milwaukee). We recorded temperatures from hospital admission to discharge, age, sex, initial and follow-up culture results, antibiotics received, imaging performed, and medical history.

Results: Urinary tract infection was identified in 364 patients, and 291 (79.9%) had follow-up urine cultures. None were positive. Follow-up cultures produced $21,388.50 in patient charges. Fever lasted beyond 48 hours in 32% of patients. Older children were more likely to have fever beyond 48 hours.

Conclusions: Follow-up urine cultures were of no utility in children hospitalized for urinary tract infection, including those with fever lasting beyond 48 hours or those with an underlying urologic disease. Fever beyond 48 hours is common and should not be used as a criterion for obtaining a repeat urine culture. These conclusions are valid for children with vesicoureteral reflux. Such an approach would result in significant cost savings.


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Many articles on UTI in children recommend routine repeat cultures to ensure sterility of urine at some point after beginning treatment. The American Academy of Pediatrics (AAP) practice parameter for children aged 2 months to 2 years with first-time febrile UTI suggests a repeat urine culture if the expected clinical response (usually defined as fever) is not achieved within the first 48 hours of therapy. The AAP practice parameter implies that fever beyond 48 hours is abnormal and should prompt investigation. A previous study indicated that 11% of children 2 years and younger hospitalized for UTI were still febrile at 48 hours.

There are no previous studies defining the utility of follow-up urine cultures and the fever curves of all patients younger than 19 years hospitalized for UTI. The objectives of this study are to determine the frequency of positive repeat urine cultures in children with UTI and to describe the fever curves of children admitted to the hospital with UTI.

METHODS

The Children's Hospital of Wisconsin (Milwaukee) institutional review board approved this study. We retrospectively reviewed hospital records for all patients 18 years and younger who were discharged from Children's Hospital of Wisconsin with a principal diagnosis of UTI or pyelonephritis (using International Classification of Diseases, Ninth Re-
A UTI was defined as a body temperature of 38.0°C for axillary temperatures. Since temperatures in each 8-hour time block after hospital admission, with fever being recorded if temperature exceeded 38.0°C for the first time after admission. Fever was defined as having a temperature of 38.0°C for rectal or oral temperatures and 37.0°C for axillary temperatures.11–13

<table>
<thead>
<tr>
<th>Patient Age</th>
<th>0-12 mo</th>
<th>1-8 y</th>
<th>9-18 y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Had fever beyond 48 h, %</td>
<td>27</td>
<td>41</td>
<td>34</td>
</tr>
<tr>
<td>Median time to fever resolution, h</td>
<td>32</td>
<td>48</td>
<td>40</td>
</tr>
</tbody>
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Abbreviations: UTI, urinary tract infection; VUR, vesicoureteral reflux.

Among the medical records reviewed, 364 patients met all inclusion criteria. Their ages ranged from 1 week to 18 years, with a median age of 7 months and a mean age of 31 months. Two hundred twenty-two patients (61%) were younger than 1 year, 103 (28%) were aged 1 to 8 years, and 39 (11%) were aged 9 to 18 years. Seventy-six percent were girls. This varied from 72% in children younger than 1 year, 86% in children aged 1 to 8 years, and 74% in children aged 9 to 18 years. Preexisting diagnoses in the study population included 84 patients with VUR (36 of those had grades III, IV, or V), 54 with previous UTI, 16 with sickle cell disease, 6 with a history of renal transplantation, and 2 with posterior urethral valves. The most common organism was \( E\) coli (87%), followed by \( K\)lebsiella pneumonia (3.5%), \( P\)seudomonas aerug\( i\)nosa (1.92%), and \( E\)nterococcus species (1.64%).

Of the 364 patients identified, 291 (79.9%) had follow-up urine cultures done within 72 hours of hospital admission. None met positive culture criteria, and there were no significant differences in the percentage of patients afebrile at 48 hours between patients with and without VUR (\( P = .28\)). Fever after 48 hours occurred in 42% of the children with a history of UTI and in 30% of those without a history of UTI (\( P = .13\)).

Table 2 compares fever characteristics by age. A fever beyond 48 hours was present in 27% of the children younger than 1 year and in 39% of the children older than 1 year (\( P = .03\)).

Of the 291 patients with follow-up cultures, 256 (88%) had follow-up urine dipsticks. Two were positive for nitrites, and 172 (59%) were positive for leukocyte esterase.

The percentage of children who had repeat urine cultures during each year of the study is presented in Table 3. Repeat urine cultures were performed in 86% of the patients who were febrile beyond 48 hours and 79% who were afebrile at 48 hours (\( P = .14\)).

At our institution, the charge for a urine culture is $73.50. The total charges for repeat urine cultures in these patients were $21,388.50.
The AAP practice parameter for the diagnosis, treatment, and evaluation of the initial UTI in febrile infants and young children recommends repeat urine culture when the child does not achieve the expected clinical response in the first 2 days of antimicrobial therapy. While the strength of evidence is classified as “good,” there is little published data supporting this recommendation. Although “expected clinical response” is not explicitly defined in the AAP parameter, it is generally accepted in the medical community to represent the resolution of fever. One can raise 2 questions from this statement. First, what is the typical length of fever for children admitted to the hospital with UTI? In other words, is it reasonable to expect resolution of fever within 48 hours of therapy? Second, what additional information does a repeat culture add, given that organism and sensitivities are available from the initial culture?

The study by Bachur11 provided us with some of these answers. He showed that of 288 children 2 years and younger, 11% were still febrile beyond 48 hours of therapy. Among the 93% of his patients that had repeat urine cultures, all were negative.

In our study, 32% of children had fever beyond 48 hours. There are a number of possible explanations for the higher percentage of patients in our study who were still febrile at 48 hours when compared with the study by Bachur (11%). That study only included patients younger than 2 years and excluded patients with a history of UTI. We found that older age was a risk factor for fever beyond 48 hours. In addition, we did not exclude children with other medical problems, including a diagnosis of VUR, sickle cell disease, posterior urethral valves, or a history of renal transplantation. While our definition of fever was the same as that of Bachur, it is possible that there are variations in measuring or recording temperatures between the 2 hospitals.

The majority of our patients were girls and more than 80% of the infections were due to *E coli*, as has been observed in other studies of children with UTI. In our study, 32% of children had fever beyond 48 hours. There are a number of possible explanations for the higher percentage of patients in our study who were still febrile at 48 hours when compared with the study by Bachur (11%). That study only included patients younger than 2 years and excluded patients with a history of UTI. We found that older age was a risk factor for fever beyond 48 hours. In addition, we did not exclude children with other medical problems, including a diagnosis of VUR, sickle cell disease, posterior urethral valves, or a history of renal transplantation. While our definition of fever was the same as that of Bachur, it is possible that there are variations in measuring or recording temperatures between the 2 hospitals.

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Our patients were admitted to the hospital during a 5-year period, 1997 to 2001. In 1999, the AAP practice parameters were published, recommending against routine follow-up urine cultures unless the expected clinical response did not occur within 48 hours. Yet, in our medical record review, we observed no change in physician behavior regarding obtaining follow-up urine cultures in 2000 or 2001. Almost all of the physicians caring for patients at Children’s Hospital of Wisconsin are pediatricians and the majority are members of the AAP. This emphasizes that practice parameters do not necessarily change physician behavior. One obstacle to acceptance of the AAP recommendation is the presence of numerous review articles that advocate routine repeat urine cultures in children with UTI. A second difficulty with the AAP practice parameter is that it is restricted to children aged 2 months to 2 years. Similarly, the study by Bachur only includes children younger than 2 years and excludes many patients who are commonly admitted for UTI (ie, patients with known VUR or a history of UTI). Our study, by including all patients younger than 19 years, argues for the universality of the recommendation that follow-up urine cultures are not needed, even in the child who is still febrile at 48 hours.

Another obstacle to acceptance of the AAP practice parameter is the recommendation that a culture is necessary if the expected clinical response does not occur within 48 hours. Waiting 48 hours before obtaining the repeat culture may commit the patient to an additional 24 to 48 hours in the hospital before the culture is negative. This may lead to obtaining the repeat culture prior to 48 hours so that an early “proof of cure” can be documented, permitting more expeditious discharge from the hospital.

### Table 3. Percentage of Children With Repeat Urine Culture by Year

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>1997</td>
<td>83</td>
</tr>
<tr>
<td>1998</td>
<td>84</td>
</tr>
<tr>
<td>1999</td>
<td>77</td>
</tr>
<tr>
<td>2000</td>
<td>81</td>
</tr>
<tr>
<td>2001</td>
<td>80</td>
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**COMMENT**
The AAP practice parameter for the diagnosis, treatment, and evaluation of the initial UTI in febrile infants and young children recommends repeat urine culture when the child does not achieve the expected clinical response within the first 2 days of antimicrobial therapy. Although repeat urine cultures, both routine and owing to prolonged fever, are commonly performed, there are no previous studies defining the utility of follow-up urine cultures and the fever curves of patients younger than 19 years hospitalized with a UTI.

We found that most children admitted to the hospital with a UTI had a repeat urine culture, but none were positive. Moreover, fever beyond 48 hours was common. This argues that routine follow-up urine cultures are unnecessary and that fever beyond 48 hours is not an appropriate criterion for obtaining a repeat urine culture.

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What This Study Adds

Based on our findings, the routine use of repeat urine culture in hospitalized children younger than 19 years with UTI when an initial positive culture with sensitivities is available is not justified. There is no evidence that the procedure provides any additional useful information (in patients with or without prolonged fever). Fever beyond 48 hours is common and is therefore not an appropriate criterion for justifying either repeat culture or prolonging hospitalization.