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 AAP practice parameter assumes that a repeat urine culture will provide useful information that will change clinical management. However, there is no evidence to support this recommendation when there is an identified organism with antibiotic sensitivities from the initial culture. In addition, 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 are not recorded continuously in the hospital, time to defervescence was divided into 12 categories, each representing an 8-hour time block. Some patients were discharged at less than 88 hours while still febrile: they were categorized separately, as were patients who were never febrile. We also recorded the organism and sensitivities with number of CFUs on initial culture, antibiotic(s) given in the hospital, organism and sensitivities with number of CFUs on any repeat culture, presence or absence of urine leukocyte esterase or nitrite on any repeat urine dipstick, and any imaging performed and its result. Categorical data were analyzed using the \( \chi^2 \) test.

Table 1. Effect of Vesicoureteral Reflux and History of Urinary Tract Infection on Fever Duration

<table>
<thead>
<tr>
<th>Patient Age</th>
<th>All Patients</th>
<th>VUR History of UTI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Had fever beyond 48 h, %</td>
<td>32</td>
<td>35</td>
</tr>
<tr>
<td>Median time to fever resolution, h</td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>

Abbreviations: UTI, urinary tract infection; VUR, vesicoureteral reflux.

Table 2. Effect of Age on Fever Duration

<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>
</table>

* \( P = .02 \) for 0 to 12 months vs 1 to 8 years; \( P = .47 \) for 0 to 12 months vs 9 to 18 years; \( P = .59 \) for 1 to 8 years vs 9 to 18 years.

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 Klebsiella pneumonia (3.5%), Pseudomonas aeruginosa (1.92%), and Enterococcus species (1.6%).

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-
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 Bachur 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.1,14

In our study, children with fever beyond 48 hours were slightly more likely to have a repeat urine culture. Nevertheless, all cultures were negative, arguing against the utility of using prolonged fever as a criterion for obtaining a follow-up culture. This is especially relevant given the high percentage of children with fever beyond 48 hours.

Repeat urine cultures were performed on 79% of patients despite fever resolution less than 48 hours after hospitalization. While it is possible that the repeat cultures were performed because of the persistence of clinical symptoms other than fever, it is likely these were done as a matter of routine, since there was no prolonged fever to prompt a repeat culture. None of those cultures added additional useful information. It is common practice to repeat urine cultures on children with UTI to prove sterility.2,3,5-10 However, there is no clear evidence in support of this practice. In fact, routine repeat culture (in the absence of lack of expected clinical response) is not recommended in the AAP practice parameter. It is commonly assumed that a repeat culture might theoretically detect a complication of UTI, such as a renal abscess. None of our patients developed a renal abscess or other complication that might have been detected by a repeat urine culture. Furthermore, studies have shown that only about 50% of children with a renal abscess have a positive urinalysis or urine culture.16-18

Also common in the study population was the repeat urine dipstick. Among those with repeat urine dipsticks (performed at least 24 hours after initiation of therapy), the majority (59%) were still positive for leukocyte esterase. Nevertheless, all cultures were negative, arguing that a persistently positive urine dipstick has no predictive value. There is no rationale for a follow-up urine dipstick; it appears to be a reflex order when obtaining the follow-up urine culture. Elimination of follow-up urine dipsticks would result in cost savings without affecting patient care.

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 and 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.5-10 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>
</thead>
<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>
</tr>
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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.

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REFERENCES


