

# A Study to Determine the Incidence of Urinary Tract Infections in Infants and Children Ages 4 Months to 6 Years With Febrile Diarrhea

Global Pediatric Health  
Volume 3: 1–4  
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DOI: 10.1177/2333794X16667175  
gph.sagepub.com  


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## Abstract

**Objective:** To determine the incidence of urinary tract infections (UTIs) in infants and children (4 months to 6 years of age) with febrile diarrhea, as outpatients. **Methods:** This was a prospective institutional review board–approved study. Patients (between 4 months and 6 years of age) were enrolled in the study who presented to the pediatric emergency room with a complaint of fever (rectal temperature 101°F or more) and diarrhea (watery stools >3 in number). The patients were evaluated for state of hydration, and also urine samples were collected. For those children not toilet trained, urine specimens were collected by bladder catheterization, and for those children toilet trained, urine specimens were obtained by midstream collection method. The urine samples obtained were sent for analysis and culture. **Results:** Eighty patients were enrolled in the study. The number of specimens obtained by clean catch midstream was 20, and by bladder catheterization was 60. None of the urine specimens obtained by both methods of collection grew any organism. There was no increased incidence of infections in male children whether circumcised (10/60) or uncircumcised (50/60). The mean temperature was 102.8°F (range = 101°F to 105°F). **Statistics:** Using in silico online  $2 \times 2 \chi^2$  test by comparing both the positive and negative urine culture results, 2-tailed *P* value is <.0001. **Conclusions:** Our prospective randomized study concluded that there is no increased incidence of UTIs in infants and children (4 months to 6 years of age) with febrile diarrhea.

## Keywords

emergency medicine, general pediatrics, infectious diseases, nephrology, gastroenterology

## Introduction

Urinary tract infections (UTIs) are relatively common problems encountered in pediatric infants and children, especially more so in infants. By definition, UTI is indicated when a specimen obtained by suprapubic puncture is positive even for single colony, by bladder catheterization >20 colonies of a single bacteria, and by midstream catch >100 000 colonies/dL. There is usually higher incidence of UTIs in male infants <1 year of age, and after infancy, UTIs are more common in girls. The pediatric literature emphasizes the association of UTIs with febrile diarrhea. It is a standard of care to obtain urine specimen mainly for culture, either by suprapubic puncture or by catheterization. If not possible, a well-cleaned midstream specimen may be utilized. In this study, we have not utilized used urine samples collected by bag specimen.

In infants <4 months of age, febrile diarrhea is presumed to have UTIs and is treated like sepsis, and in our hospital, all infants were admitted in the hospital for workup and management.

Our study was conducted basically to determine whether there is need to obtain urine specimen for analysis and mainly for culture after 4 months of age in infants and children with febrile gastroenteritis.

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**Table 1.** Age-wise Distribution of Patients.

4 to 12 Months	12 to 24 Months	24 to 36 Months	36 to 48 Months	48 to 72 Months
40	22	10	0	8

**Table 2.** Male-to-Female Ratio.

Total Number of Patients	Male Patients	Female Patients
80	60	20

## Inclusion Criteria

1. Patients (4 months to 6 years of age) with febrile diarrhea (fever 101°F and above and diarrhea >3 loose stools)
2. Parents who sign informed consent forms to enroll in the study

## Exclusion Criteria

1. Infants <4 months of age with febrile diarrhea
2. Parents who refuse to sign the informed consent forms
3. Parents who insist on obtaining urine culture by bag specimen

## Methods

This was a prospective institutional review board–approved study. After obtaining informed consent, patients were enrolled in the study (between 4 months and 6 years of age) who present to the pediatric emergency room with a complaint of fever (rectal temp 101°F or more) and diarrhea (watery stools 3 times or more). The children were evaluated for state of hydration, and also urine samples were collected. For children who were not toilet trained, urine was collected by bladder catheterization, and for children who were toilet trained, urine specimens were obtained by midstream collection method. The obtained urine samples were sent for analysis and culture.

## Results

Eighty children enrolled in the study. The male-to-female ratio was 3:1 (60:20). The mean age of the children was 15 months (4 months to 6 years). The number of specimens obtained by clean catch midstream was 20, and the number of specimens obtained by bladder catheterization was 60 (see Tables 1-3 and Figures 1 and 2).

The only urine analysis abnormality noted was positive leukocyte esterase (LE) in 2 patients (2/80). None of the urine specimens obtained by either method of collections grew any organism. None of the patients of the study group was admitted as an inpatient. There was no increased incidence of infections in male children whether circumcised (10/60) or uncircumcised (50/60). The mean temperature was 102.8°F (range = 101°F to 105°F).

## Statistics

Using *in silico* online  $2 \times 2$   $\chi^2$  test by comparing both the positive and negative urine culture results, the resultant  $\chi^2$  value was 160, degree of freedom 1, and 2-tailed P value <.0001.

## Discussion

Urinary tract infections are a common, potentially serious, and often occult bacterial infection of childhood. The prevalence of UTI in girls may be as high as 8.1%. UTIs also represent the most commonly identified serious bacterial infection in infants presenting with a febrile illness. Of febrile infants aged 2 to 3 months, 3% to 10% have a documented UTI. While the majority of the UTIs are not associated with any significant underlying conditions, the mere presence of a UTI is worrisome to most parents.<sup>1</sup> UTI occurs in 3% to 5% of girls and in 1% in boys. In boys most UTIs occurs during the first year of life, whereas in girls the incidence is up to 10 times more than boys after 2 years of age.<sup>2</sup>

The incidence of UTI in infants ranges from 0.1% to 1.0% in newborn infants to as high as 10% in low-birth-weight infants. The most common presenting symptoms in young children are fever, vomiting or diarrhea, irritability or fussiness, poor feeding, and poor weight gain. In children older than 2 years of age, the presenting complaints of UTIs are pain or burning when urinating, frequent need to urinate, pain in the lower abdomen or over the sides of the back, and fever. In neonates the usual route of infection presumed to be hematogenous, whereas in later life, infections are usually caused by bacteria in the urinary tract. According to the American Academy of Pediatrics recommendations, for evaluation of fever one should obtain urine specimens for analysis and culture in all boys younger than 6 months of age, both circumcised or uncircumcised, and up to a year in only uncircumcised male infants, and in all girls up to 2 years of age.

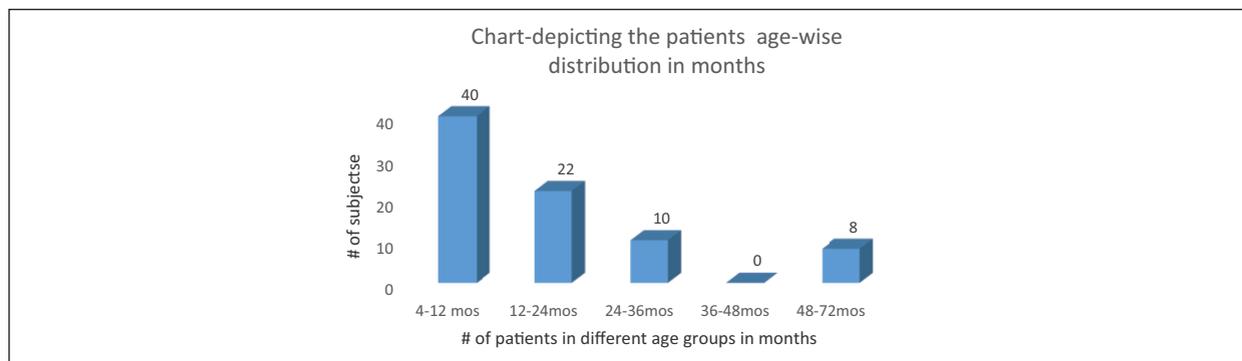
UTIs are classified into 2 major types: upper tract disease, having fever, abdominal or flank pain, and in younger children nonspecific signs of irritability, poor feeding malaise, failure to thrive, or vomiting and

**Table 3.** Urine Analysis and Culture Results<sup>a</sup>.

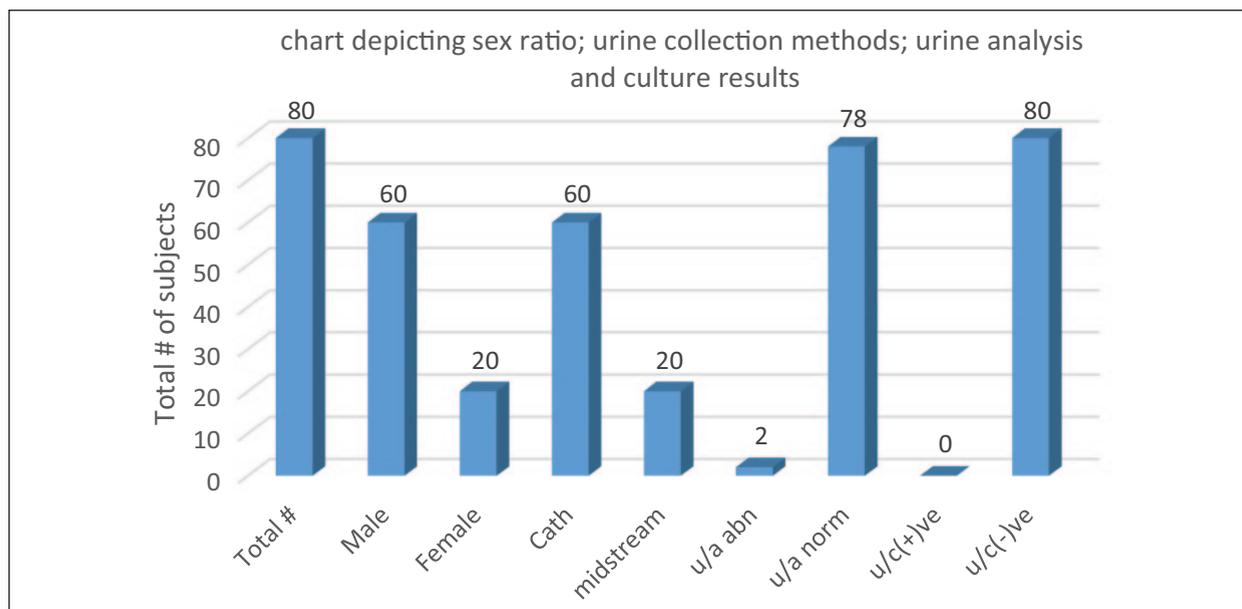
Number	Urine Specimen Collected by catheterization	Urine Specimen Collected by Midstream	Urinalysis, LE Positive	Urine Analysis, LE Negative	Urine Cultures Positive	Urine Cultures Negative
80	60	20	2	78	0	80

Abbreviation: LE, leukocyte esterase.

<sup>a</sup>The only urine analysis abnormality noted was LE positive in 2 patients.



**Figure 1** Age-wise incidence of UTI(in months).



**Figure 2.** Chart depicting sex ratio, urine collection methods, urine analysis, and culture results.

Legend: Series 1: total number of cases = 80; Series 2: incidence of male sex = 60; Series 3: incidence of female sex = 20; Series 4: urine specimen obtained by bladder catheterization = 60; Series 5: urine specimen obtained by midstream = 20; Series 6: urine analysis positive for LE = 2/80; Series 7:urine analysis negative for LE=78/80; Series 8: urine culture positive growth for any organisms = 0; Series 9: urine culture negative growth for any organisms = 80.

diarrhea with elevated C-reactive protein values and positive DMSA scan. Usually lower urinary tract disease does not cause fever. A diagnosis of UTI is indicated by any number of colonies with suprapubic puncture, with a bladder catheterization 10,000, and

with a bag specimen 100,000 and above. According to a technical report, 3 test strategies for UTIs are indicated. First the gold standard for evaluation for UTIs is urine culture obtained by suprapubic tap, or bladder catheterizations, which has 100% specificity. Second,

obtaining culture from the bag specimen has 70% specificity. The third strategy for UTI diagnosis uses the cheaper but less reliable reagent strip as a test. A positive LE test result, a positive nitrite test result, or both is considered a positive test result. The sensitivity and specificity of this strategy are 92% and 70%, respectively. The incidence of false positive urine culture with bag specimen was roughly 85%, contributing to unnecessary antibiotic usage. Using culture of urine specimens obtained by catheterization or tap offers the lowest risk of death, because all children at risk for urosepsis are identified and there are no unnecessary treatments or treatment-related deaths. The cost for obtaining a urine culture is \$21.53 (range = \$20 to \$26), and the cost of urine analysis is \$6.77 (range = \$5 to \$15). The cost of treatment with standard amoxicillin or Septa costs about \$10 for a course, whereas the newer broad-spectrum oral therapy costs about \$40 for a 10-day course. And finally, the cost of intramuscular ceftriaxone costs \$125 per injection. In addition, the return visit to the physician, if considered, costs approximately \$100 per visit.

Diarrhea can be defined by measured stool volume (greater than 10 mL/kg/day), but in a clinical setting a more appropriate definition is the passage of loose or watery stools, usually at least 3 times in 24 hours.<sup>3</sup>

The urinary tract impinges directly on the digestive tract, particularly where the bladder is in contact with the lower parts of the colon and rectum. Thus, an inflammatory process in the bladder will directly affect these structures. One theory is that heat resulting from the inflammatory process increases the motility in the intestines at points of contact or mediators of inflammation released in the urinary tract find their way through locally shared blood pools to the digestive tract. The effect in either case will be increased secretions and motility in the intestines, leading to diarrhea.<sup>4</sup>

## Conclusions

Our prospective study concluded that there is no increased incidence of UTIs in infants and children (4 months to 6 years of age) with febrile diarrhea. Obtaining urine specimens may be unnecessary either by way of midstream clean catch or by bladder catheterization in infants and children (4 months to 6 years of age) with febrile diarrhea, thereby reducing the pain and suffering associated with bladder catheterization, and it also minimizes the expenses incurred.

## Acknowledgments

Dr Sukumar and Dr Bharati helped in the preparation of the abstract.

## Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Funding

The author received no financial support for the research, authorship, and/or publication of this article.

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