Duration of Fever Affects the Likelihood of a Positive Bag Urinalysis or Catheter Culture in Young Children

Hashim Bin Salleeh, MD, David McGillivray, MD, Mitch Martin, BA, and Hema Patel, MD

Objective To test the hypothesis that there will be a clinically significant rise in the proportion of positive bag urinalyses and catheter cultures in young children with increasing duration of fever.

Study design This was a prospective cohort study of 818 infants and children age 3-36 months presenting to a tertiary care emergency department with documented fever without source. Following the documentation of fever from < 1 to ≥ 5 days, bag specimens were collected for urinalysis. The primary outcome was the yield of positive bag dipsticks by day, defined as positive for nitrates or more than trace leukocyte esterase. The secondary outcome was positive catheter cultures on each day of fever.

Results Positive bag urinalyses increased with duration of fever: 14.8% (35/237) on day 1 versus 26.4% (43/163) on day 3 (relative risk [RR] = 1.8; 95% confidence interval [CI] = 1.2-2.7; *P* = .004). Positive catheter cultures increased in the same fashion: 4.8% (11/229) on day 1 versus 12.6% (20/159) on day 3 (RR = 2.6; 95% CI = 1.3-5.3; *P* = .005).

Conclusions The yield of positive bag urinalyses and catheter cultures increased significantly in children with fever of 3 days or longer duration. *(J Pediatr 2010;156:629-33)*.

Even though most well-appearing young children with fever without source (FWS) have a nonspecific self-limited viral infection, urinary tract infection (UTI) remains an important consideration.[1] The reported pooled prevalence of UTI in febrile children around age 2 years is 7.0% (95% confidence interval [CI] = 5.5%-8.4%).[2] In their technical report on UTI, the American Academy of Pediatrics (AAP) stated that approximately 5% of children with FWS will have a UTI, and recommended considering a possible diagnosis of UTI in any infant or child age 2 months to 2 years old with FWS.[3] The report and the accompanying practice parameter provided no recommendation as to the duration of FWS necessary before the initiation of an investigation.[3,4] The published data are considered insufficient to identify the optimal time for evaluating UTI in this population.[5] Subsequent to the publication of the practice parameter, some studies have looked at duration of fever as one of several variables examined in girls with suspected UTI. To the best of our knowledge, the impact of the duration of fever on detection of fever has not been addressed as the primary outcome in boys and girls.[6-8]

The primary objective of this study was to determine the proportion of positive bag urinalyses in children age 3-36 months with FWS with varying duration of fever: < 1, 2, 3, 4, or ≥ 5 days. There is solid evidence supporting bag urinalysis as a valid screening tool for UTI in young children, given the fact that a positive bag dipstick tends to overestimate the risk of UTI[9] and that a negative dipstick for nitrites and leukocytes has a likelihood ratio (LR) of 0.2 (95% CI = 0.16-0.26) for a UTI.[10] Although suprapubic bladder aspiration is the gold standard for detecting UTI in young infants, we chose to use catheterization, because it is more commonly used in the emergency department (ED) environment. Our secondary objective was to determine the proportion of positive urine catheter cultures obtained on each day of fever. Our hypothesis was that there would be a clinically significant rise in the proportion of positive bag urinalyses and catheter cultures in infants and children with increasing duration of fever.

AAP	American Academy of Pediatrics
CFU	Colony-forming units
CI	Confidence interval
ED	Emergency department
FWS	Fever without source
HPF	High-power field
LR	Likelihood ratio
RR	Relative risk
UTI	Urinary tract infection
WBC	White blood cell

From the Department of Emergency Medicine, King Khalid University Hospital, King Saud University, Riyadh, Saudi Arabia (H.B.S.) and Division of Pediatric Emergency Medicine (D.M., M.M.) and Division of General Pediatrics (H.P.), Department of Pediatrics, Montreal Children's Hospital of McGill University Health Centre, Montreal, Quebec, Canada

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Methods

We conducted a prospective cohort study of infants and children age 3-36 months presenting to a tertiary care pediatric ED with documented FWS between April 2005 and September 2007. The study received full approval from Montreal Children's Hospital's Ethics Committee and the Independent Review Board.

Bag urinalyses are ordered mainly by the nurse at triage or by a physician following assessment of a febrile, non–toilet-trained, nontoxic child age 3-36 months with FWS. At our center, nurses order approximately 80%-90% of the bag urines obtained. Urine bags are applied to the perineal area after cleansing with water. No bag urine specimens are sent for culture.

An automated Clinitek 100/200 analyzer (Bayer, Pittsburgh, Pennsylvania) and Multistix 10 SG reagent strip urine dipsticks (Bayer) were used for analysis of leukocyte esterase and nitrites. A positive result was defined as greater than trace amounts of leukocyte esterase or a positive nitrite test. A positive catheter urine culture was defined as growth of $\geq 10^7$ colony-forming units (CFU)/L or $\geq 10^4$ CFU/mL of a single pathogenic organism. Multiple organisms were not considered positive even if $>10^7$ CFU/L were present. These definitions are based on the AAP practice parameter for the diagnosis, treatment, and evaluation of initial UTI in febrile infants and young children.[4]

If the bag dipstick urinalysis was positive, then a catheter sample was obtained for urinalysis and culture. If the bag dipstick urinalysis result was negative, then no further testing was done.

Children who met all of the following criteria were eligible for study entry: age 3-36 months, rectal temperature of ≥ 38 °C recorded in the ED or by parental report, FWS, and bag urinalysis initiated by the nurse at triage or requested by the child's physician. Exclusion criteria included toxic appearance, known renal disease, immunocompromised status, the need to proceed directly to catheterization, and antibiotic use in the previous 10 days. Data collected included age, sex, race, circumcision status in males, highest reported fever by the parents or documented in the ED, duration of fever, laboratory results on the bag urine specimen (leukocyte esterase and nitrites on dipstick), and the culture results obtained on all catheter urine specimens.

Definitions

FWS was defined as either fever with no identified etiology following a detailed history and physical examination, or fever with equivocal etiology where the potential source of fever was either nonspecific (eg, early viral illness) or of low clinical severity (eg, mild gastroenteritis or otitis media).

Fever was defined as a rectal temperature of ≥ 38 °C recorded in the ED or by parental report. Parental report was used to categorize duration of fever in days, from < 1 day to ≥ 5 days. This was considered a practical and realistic measurement tool. In a population of 244 infants, Bonadio et al[11] reported a 92% concordance between home-reported fever and hospital-measured rectal fever as long as the home-reported temperature was a rectal temperature.[11]

Statistical Analyses

The primary outcome was the proportion of positive bag urinalyses by fever duration, that is, < 1 day, 2, 3, 4, or ≥ 5 days of fever. We also studied infants and children with fever of ≤ 2 days versus ≥ 3 days duration based on work by Gorelick, Shaw, and coworkers.[6,7] The secondary outcome was the proportion of positive urine catheter cultures by duration of fever. A sensitivity analysis was conducted to evaluate the significance of those infants who had a positive bag urinalysis but did not have a urine culture. The χ^2 test was used to compare the proportions of positive bag urinalyses and catheter cultures for the 5 different durations of fever, the proportions for fever of 1 day versus fever of 3 days, and the proportions for the dichotomized time periods (≤ 2 days vs ≥ 3 days of fever). The level of significance used was $P < .05$. Relative risk (RR) and 95% confidence intervals (CIs) were calculated. The statistical program used for this study was SPSS version 11.0 (SPSS, Chicago, Illinois).

Results

Of the 818 bag urine dipsticks analyzed in this study, 152 (19%) were positive. As shown in Table I, there were no significant differences in duration of fever by sex, circumcision status, age 3-12 months, Caucasian female, Caucasian race, or mean temperature. A significant increase in positive bag urinalysis results over time was observed ($P = .02$; Figure 1). Patients with fever of 3 days duration had the highest proportion of positive urinalyses. On day 1, 14.8% (35/237) of the urinalyses were positive, compared with 26.4% (43/163) on day 3 (RR = 1.8; 95% CI = 1.2-2.7; $P = .004$). When duration of fever was dichotomized into ≤ 2 days versus ≥ 3 days of fever, the children with longer duration of fever had a greater risk of having a positive bag urinalysis (14.6% [64/438] vs 23.2% [88/380]; RR = 1.6; 95% CI = 1.2-2.1; $P = .002$).

A total of 120 patients (79%) with a positive bag urinalysis had a urine culture obtained by catheterization. The proportion of positive catheter urine cultures based on the total number of bag urines collected showed a significant increase over

Table I. Characteristics of patients by days of fever

	Duration of fever, days				
	< 1	2	3	4	> 5
Number of children/day	237	201	163	99	118
Female sex, %	42	47	53	41	56
Uncircumsized, %	66	71	69	88	86
Caucasian race, %	62	54	52	60	46
Caucasian female, %	26	22	29	36	24
Age 3-12 months, %	46	43	44	46	37
Average temperature, °C	39.1	39.3	39.1	39.1	39.1