

Outpatient Management of Pediatric Urinary Tract Infection

Clinical Practice Guideline

MedStar Health

These guidelines are provided to assist physicians and other clinicians in making decisions regarding the care of their patients. They are not a substitute for individual judgment brought to each clinical situation by the patient's primary care provider-in collaboration with the patient. As with all clinical reference resources, they reflect the best understanding of the science of medicine at the time of publication but should be used with the clear understanding that continued research may result in new knowledge and recommendations."

I. Scope:

Acute urinary tract infection is a common infection in children. According to the Center for Disease Control and Prevention, 8% of girls and 2% of boys will have a UTI before seven years of age. Each year, pediatric UTIs account for 1 million office visits and 13,000 admissions. Prompt diagnosis and treatment of both lower and upper urinary tract infections is important as urinary infections can be associated with permanent renal damage. Complications of renal damage/scarring from UTI can manifest as hypertension, chronic renal failure and pre-eclampsia/eclampsia in pregnancy. On the other hand, it is important to ensure that the diagnosis of UTI is accurate to avoid overtreatment with antibiotics and unnecessary imaging studies.³ Contamination during the urine collection process whether by bacteria in the urethra or surface skin has long been recognized as an issue with specimens collected by clean catch or even by catheterization. In this situation, the urine culture will generally grow nonpathogens or multiple organisms in relatively small numbers. Recent studies are revealing asymptomatic bacteriuria, which is the presence of bacteria in the urine without a host inflammatory response or no white blood cells in the urine. This inflammatory response is now being identified as the mechanism underlying renal scarring.⁴ As detailed below, the preliminary diagnosis of UTI depends on the identification of both pyuria and bacteriuria. The ultimate diagnosis will depend on the results of the urine culture.

In young children with fever — The prevalence of UTI in children <2 years presenting with fever has been the subject of several large prospective studies and a meta-analysis [2-4].

Important points that emerged from these studies include:

- The overall prevalence of UTI is approximately 7 percent in febrile infants and young children but varies by age, sex, and circumcision status.
- The prevalence is highest among uncircumcised males, particularly those who are younger than three months.
- Females have a two- to fourfold higher prevalence of UTI than do circumcised males.

[5,6].

In older children (2yo-18yo) — In pooled analysis of four studies that included children and had urinary symptoms and/or fever, the prevalence of UTI was 7.8 percent (95% CI 6.6-8.9) [4].

It is the purpose of this guideline to provide practitioners with practical knowledge and direction regarding the treatment of children of all ages with suspected or proven UTI.

II. UTI Symptoms by Age Group

Infants aged 0-2 months (Symptoms may include but are not limited to) :

- Fever
- Irritability
- Jaundice
- Poor feeding
- Vomiting
- Failure to thrive

Infants and children aged 2 months to 2 years (Symptoms may include but are not limited to):

- Fever
- Irritability
- Poor feeding
- Change in urine odor (strong/foul)
- Vomiting
- Abdominal pain

Children aged 2-18years (Additional symptoms may include--:

- Urinary symptoms (dysuria, urgency, frequency)
- New onset Enuresis
- Flank pain/back pain
- Urinary incontinence

III. Risk Factors

General Risk Factors:

- Congenital urinary tract abnormality:
 - Vesicoureteral reflux
 - Ureteropelvic junction obstruction
 - Ureterocele
 - Neurogenic Bladder
 - Posterior urethral valves
 - Prune belly syndrome
 - Urachal remnants
- Chronic constipation
- Bowel and Bladder Dysfunction
- Urinary stones
- Sexual abuse
- Children receiving antibiotics for other infections (these antibiotics may alter GI and periurethral flora increasing risk of UTI)
- Uncircumcised penis

Age Specific Risk Factors:

1. Infants birth to 2 months of age should be screened for possible UTI with any fever over 38 C (100.4 F) rectally with a urinalysis and urine culture. Because of the high risk of bacteremia/septicemia in this age group, initial evaluation should be referred to an Emergency Room.
2. Pediatric Patients aged 2 to 24 months of age with a fever over 38 C (100.4 F) rectally with no apparent source should be screened for possible UTI with a urinalysis and urine culture if antibiotic treatment is considered necessary or if they have risk factors increasing risk of UTI as source of fever.

For older children with fever without a source, evaluation underlying urinary tract infection should be considered.

- **Recommend screening male or female with prior history of UTI, fever $\geq$ 2 days without a clear source.**
- FULLY TOILET TRAINED – 18 YEARS: reasons to screen

Prior history of UTI

Symptoms referable to UTI

Prolonged fever $\geq$ 5 days without apparent source

IV. PATHOGENESIS: Bacterial pathogens are the most common etiology of UTI. Specific pathogens are:

- Escherichia coli species (most common)
- Klebsiella species
- Proteus
- Enterococcus species
- Citrobacter
- Staphylococcus saprophyticus
- Group B Streptococcus
- Pseudomonas aeruginosa
- Fungal UTIs can be seen in the setting of invasive devices, immunocompromised and antibiotic exposure
- Viral UTIs are also possible (Adenovirus, Influenza, Polyomavirus BK, HSV can cause irritative voiding symptoms, hemorrhagic cystitis, urinary retention and vesicoureteral reflux. CMV, Zoster and Adenovirus cystitis can be seen in immunosuppressed children)

Infection with an organism other than *E. coli* is associated with a higher likelihood of renal scarring.

V. DIAGNOSIS OF URINARY TRACT INFECTION

Significant bacteriuria and pyuria in an appropriately collected urine specimen is highly suggestive of underlying UTI.

Urine Collection Techniques:

- **<6 months of age:** Catheterized urine specimen is ideal. **Suprapubic aspiration** is recommended with ultrasound guidance, when unable to catheterize (Due to redundant/tight foreskin or in a female with tight labial adhesions.)
- **≥6 months up until toilet trained:** Obtain urine specimen by catheterization for urinalysis and culture if suspicion for UTI is high. **Bagged urine collection for URINALYSIS ONLY** as a screening method for UTI in scenario of fever without a clear source is acceptable (decrease contamination by cleaning diaper area with betadine). **If urinalysis is abnormal on a bagged specimen, A CATHETERIZED URINE SPECIMEN is needed for repeat urinalysis and culture. DO NOT culture a bagged urinary specimen** as it will be contaminated with skin and stool bacteria.
- **Toilet trained children:** Midstream, clean catch urine collection is appropriate for children with urinary control.

Laboratory Studies:

- General Considerations: Urinalysis cannot substitute for urine culture to document the presence of UTI but needs to be used in conjunction with culture. Because urine culture results are not available for at least 24 hours, there is considerable interest in tests that may predict the results of the urine culture and enable presumptive therapy to be initiated at the first encounter.
- Urine Specimen: Urinalysis can be performed on any specimen, including one collected from a bag applied to the perineum. However, the specimen must be fresh (< 1 hour after voiding with maintenance at room temperature or < 4 hours after voiding with refrigeration).
- Interpreting a Urine DipStick:
 - Nitrite test: Not a sensitive marker for children, particularly infants, who empty their bladders frequently. The test is helpful when the result is POSITIVE, because it is highly specific.
 - Leukocyte Esterase test (a surrogate marker of pyuria): The sensitivity of the leukocyte esterase (LE) test is 94% when it is used in the context of clinically suspected UTI. The absence of pyuria in children with true UTIs is rare. Positive leukocyte esterase on a dipstick reflects the presence of white blood cells in the urine which is suggestive of a urinary tract infection.⁵ Interpretation of the significance of this test should be made in conjunction with a thorough history and physical exam as positive results can be seen in conditions other than urinary tract infection. Positive dipstick results for leukocyte esterase can be seen with urethral, perineal, penile glans or penile foreskin inflammation or irritation and may not reflect a true UTI. Other conditions that can give a positive LE test include: fever from streptococcal infections, fever from Kawasaki disease or after vigorous exercise.
- Urine Microscopy: Pyuria is defined as ≥10 WBC/hpf on enhanced urinalysis or ≥5 WBC/hpf on a centrifuged specimen.²
- Urine Culture: The diagnosis of UTI is made on the basis of quantitative urine culture results in addition to evidence of pyuria and /or bacteriuria. Urine specimens should be processed as expediently as possible. A positive urine culture is defined by >50,000 colony forming units per mL of a single urinary pathogen collected by catheterization or suprapubic catheterization in children.² In adults, over 100,000 cfu of bacteria of a single pathogen defines a bacterial UTI. Of note, currently consideration is being given in pediatric patients to lower the threshold to 10,000 cfu as indicative of a UTI in a sample obtained by suprapubic aspiration or in children who are symptomatic if the lab does not specify colony counts between 10,000 and 100,000 cfu.²

- Additional Laboratory Studies:
 - Complete blood count, BUN/Creatinine, electrolytes and blood culture should be considered when pyelonephritis is suspected.
 - Sepsis should be referred to an Emergency Department for management.

Highlights:

- Obtain urinalysis (UA) and urine culture before antibiotic initiation if child has signs and symptoms suggestive of a UTI (e.g., dysuria, urgency, frequency, suprapubic pain, fevers with no known source, fevers and emesis, costovertebral angle tenderness, irritability without an alternate explanation)
- Routine UA and urine culture should NOT be obtained in asymptomatic children with indwelling urinary catheters
- For patients with spinal cord injuries who are catheter-dependent, signs and symptoms of a UTI may include new onset fevers/rigors with no alternate source or costovertebral angle tenderness
- “Foul smelling” or “cloudy” urine is very common in children without UTIs (regardless of catheter status) and should NOT be the sole criterion for obtaining a urine culture
- Although catheterized specimens are preferred in younger children, bagged specimens can be considered as the first step to evaluate for pyuria
- If a bagged urine specimen indicates pyuria, send a catheterized specimen for urine culture and repeat UA prior to antibiotics being initiated
- **Urinalysis:**
 - UA indicating pyuria requires **>10 WBC/hpf**
- **Urine culture:**
 - A positive urine culture is defined as **≥50,000 cfu/mL** from a catheterized specimen, **≥100,000 cfu/mL** from a clean catch, and **≥1000 cfu/mL** from a suprapubic aspiration
 - Urine culture from a patient with an indwelling urinary catheter with **≥1000 cfu/mL** can be clinically significant
 - Urine cultures with more than one organism (in patients without indwelling catheters) are unlikely to be clinically significant.
- Patients already on antibiotics at the time urine cultures were obtained may have lower colony counts
- Prediction of renal scarring after first UTI — Predictors of renal scarring after a first UTI were investigated in a meta-analysis of individual patient data from nine studies including 1280 children (0 to 18 years) who underwent renal scintigraphy at least five months after their first UTI. Renal scarring was present in 15.5 percent of children. Predictors of renal scarring included:
 - **VUR – VUR**, especially high-grade VUR, was associated with the development of renal scars (Grade I and II [odds ratio (OR) 1.8, 95% CI 1.2-2.8] and Grade IV and V VUR [OR 22.5, 95% CI 11.3-44.8])
 - **Abnormal renal bladder ultrasonography (RBUS)**; OR 3.8, 95% CI 2.6-5.5)
 - **Elevated inflammatory markers** including a C-reactive protein of >40 mg/L (4 mg/dL; OR 3.0, 95% CI 2.0-4.6) or a polymorphonuclear cell count >60 percent (OR 1.9, 95% CI 1.3-2.8)
 - **Temperature ≥39°C (102.2°F)** (OR 2.3, 95% CI 1.6-3.3)
 - **UTI caused by organism other than *E. coli*** (OR 2.2, 95% CI 1.3-3.6)

- Children with an abnormal RBUS finding or with a combination of high fever ($\geq 39^{\circ}\text{C}$ [102.2°F]) and an etiologic organism other than *E. coli* (which constituted 21.7 percent of the sample) represent a particularly high-risk group in whom the risk for renal scarring is 30.7 percent. Whether more aggressive management (eg, antibiotic prophylaxis, use of adjuvant corticosteroids, further imaging with [dimercaptosuccinic acid](#) or VCUG, and timely treatment of recurrent UTI) reduces the risk of renal scarring requires further study.

Imaging Studies:

- **RENAL BLADDER ULTRASOUND:** indicated after resolution of the first febrile UTI in children. Children at the highest risk for chronic kidney damage are those with significant congenital abnormalities of the kidney and urinary tract.³
- **VOIDING CYSTOURETHROGRAM (VCUG):** indicated if the Renal/Bladder Ultrasound is abnormal with evidence of hydronephrosis, scarring, or other findings suggestive of high-grade vesicoureteral reflux, obstructive uropathy or complex renal abnormalities.² VCUG is no longer recommended after the first febrile UTI if the Renal/Bladder Ultrasound is normal.

VI. Bladder and Bowel Dysfunction (BBD): a condition comprised of lower urinary tract symptoms accompanied by constipation and/or encopresis.

- Commonly associated with recurrent urinary tract infections and vesicoureteral reflux.⁴
- Persistent dysuria, urgency, hesitancy, frequency, daytime incontinence, enuresis, straining despite adequate treatment for UTI (or in the absence of UTI) suggestive of BBD.
- Treatment involves management of constipation/encopresis and urotherapy including adequate hydration, timed voiding and pelvic floor awareness and may require specialist involvement when severe or associate with recurrent UTI.⁴

VII. ADOLESCENTS AND STI CONSIDERATIONS:

Adolescents are more likely to present with typical urinary symptoms (e.g. dysuria, urgency, frequency). Adolescent girls with vaginitis or sexually transmitted infection (STI) may present with similar symptoms. Adolescent girls who are diagnosed with cystitis may have concurrent vaginitis due to STI.

- Document a sexual history
- Perform an external genitourinary exam if clinically indicated
- Bimanual exam in females if clinically indicated (e.g., in cases of pelvic pain)
- Consider testing urine for Gonococcus (GC) and Chlamydia. The preferred specimen is a non-clean catch urine for testing by nucleic acid amplification.
- If GC/Chlamydia positive, consider syphilis screen
- HSV: Culture visible lesions or cervical culture if indicated
- Annual HIV Screen
- Pregnancy testing in females

VIII. General Treatment Principles:

- Always review previous urine culture results (if available) to assist with selection of empiric therapy
 - Narrow antibiotics (if possible) or stop therapy (if urine cultures reveal no organisms) once culture results are finalized (e.g., if E. coli susceptible to Ampicillin and the patient has shown clinical improvement, transition to PO Amoxicillin)
 - It is unclear how well Ceftriaxone susceptibility correlates with oral 3rd generation cephalosporin susceptibilities (e.g., Cefdinir, Cefixime, Cefpodoxime); if isolate is Cefazolin and Cefuroxime resistant but susceptible to Ceftriaxone, can consider using oral 3rd generation cephalosporin for treatment if neither TMP/SMX nor Ciprofloxacin is a treatment option
 - A short duration of bacteremia from a urinary source should not preclude conversion to enteral therapy when patient is showing clinical improvement
 - If S. aureus recovered in urine culture, obtain blood culture to evaluate for bacteremia

IX. Empiric Therapy:

Category	Definition	Empiric Therapy
Asymptomatic bacteriuria	Presence of a positive urine culture, regardless of the presence of pyuria, in the absence of signs or symptoms of a UTI Obtaining routine cultures in asymptomatic patients (regardless of presence of a catheter) is NOT recommended	None
Cystitis	Dysuria, urgency, frequency, or suprapubic pain in the absence of fever or other systemic symptoms <u>AND</u> pyuria (>10 WBC/hpf) <u>AND</u> positive urine culture ≥50,000 cfu/mL from a catheterized specimen. ≥100,000 cfu/mL from a clean catch specimen. ≥1000 cfu/mL from a suprapubic aspiration specimen	•Nitrofurantoin PO •Cephalexin PO OR Cefadroxil PO •Cefdinir PO •Cefixime PO•TMP/SMX PO History of Pseudomonas • Ciprofloxacin PO Duration: 3 days, max 5 days
Pyelonephritis	Fever, flank pain, or ill appearance <u>AND</u>	<2 month:

	pyuria (>10 WBC/hpf) AND positive urine culture - If no indwelling catheter: ≥50,000 cfu/mL from a catheterized specimen. ≥100,000 cfu/mL from a clean catch specimen. ≥1000 cfu/mL from a suprapubic aspiration specimen - If catheter-associated UTI (i.e., indwelling catheter): ≥1000 cfu/mL	Refer to ED for evaluation and management of febrile UTI ≥2 month: Cephalexin PO OR Cefadroxil PO •Amox/clav PO •Cefdinir PO •Cefixime PO • Ciprofloxacin PO (if history of pseudomonas or catheter dependent) TMP/SMX PO (if penicillin allergy) Duration: 7 days (if clinical improvement by day 3), max 10 days
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X. Antibiotic Dosing:

Antibiotic	Dosing for beyond the neonatal period, assuming normal renal function
Amoxicillin	40 mg/kg/day PO divided q8h (max 500 mg/dose)
Amoxicillin/ clavulanate	40 mg/kg/day of Amoxicillin PO divided q8h (max 500 mg of Amoxicillin/dose) using the 125 mg/5mL or 250 mg/5mL suspension or 500 mg tablet
Cefadroxil	15 mg/kg/dose PO q12h (max 1000 mg/dose)
Ceftriaxone	50-75 mg/kg/dose IV/IM q24h (max 2000 mg/dose)
Cefuroxime	10-15 mg/kg/dose PO q12h (max 500 mg/dose)
Cephalexin	25 mg/kg/dose PO q6-8h (max 1000 mg/dose)
Cefdinir	14 mg/kg/day in divided doses every 12 to 24 hours (max daily dose: 600 mg/day)
Cefixime	8 mg/kg/day in divided doses every 12 to 24 hours (max daily dose: 400 mg/day)

Ciprofloxacin	20 mg/kg/dose PO q12h (max 750 mg/dose PO)
Nitrofurantoin (NOT for pyelonephritis)	1 month to <12 years: Macrochantin 1.75 mg/kg/dose PO q6h (max 100 mg/dose). ≥12 years: Macrocrystal/monohydrate (Macrobid) 100 mg PO q12h
TMP/SMX	5 mg/kg/dose of TMP IV/PO q12h (max 160 mg of TMP/dose)

XI. DURATION OF TREATMENT: Uncomplicated bacterial cystitis generally responds well to short duration (3 – 5 days) of first-generation cephalosporin, trimethoprim-sulfamethoxazole, or nitrofurantoin.
Oral antibiotic therapy for 7 – 10 days is adequate for uncomplicated febrile UTI presumed to be acute pyelonephritis that responds well to treatment.

XII. Antibiotic Prophylaxis
Antibiotic Prophylaxis is no longer recommended for the prevention of renal scarring after a first or second symptomatic or febrile UTI in otherwise healthy children.³ The decision to start a pediatric patient on antibiotic prophylaxis should be made in conjunction with a pediatric urologist.

XIII. MINIMIZING ANTIMICROBIAL RESISTANCE

1. Antibiotic exposure selects for antibiotic resistance; therefore, **limiting exposure to any antibiotic**, whenever possible, is preferred.
2. **Limiting the spectrum of activity of antimicrobials** to that specifically required to treat the identified pathogen is preferred.
3. **Using the proper dosage of antimicrobial** to be able to achieve a minimal effective concentration at the site of infection is important to decrease the development of resistance.
4. **Treatment for the shortest effective duration** will minimize exposure of both pathogens and normal microbiota to antimicrobials and minimize the selection for resistance.

XIV. CRITERIA FOR REFERRAL TO UROLOGY

1. Any circumcised male with a documented UTI.
2. Any child with recurrent UTIs.
3. Any child with abnormal imaging: Anatomic abnormality detected on Ultrasound or VCUG.
 - If uncertain if the patient's medical condition requires Urology management, please consult a Urologist to discuss further.

XV. PATIENT EDUCATION

1. **When to seek help** – if your child has any of the following, make an appointment with his or her doctor.

- Fever – fever (temperature higher than 100.4 F or 38 C may be the only symptom of urinary tract infection in infants and young children.
- Urine becomes red or changes to a dark color. It is difficult or painful for your child to urinate.
- Sudden or frequent need to urinate.
- Pain in the lower back or just below the ribs.
- Abdominal (belly) pain.
- Change in the smell of the urine – strong or “bad” smelling.

2. **Urinary Tract Infection Prevention** – About 8% – 30% of children who have a urinary tract infection (UTI) develop another UTI. This usually happens within the first six months after the first infection and is more common in girls

- Bubble bath products, detergents, shampoos or shower gels should not be used in bath water because they can irritate the urinary opening.
- Do not use colored or scented toilet paper.
- Teach your child to go to the bathroom and empty the urinary bladder as soon as the urge is felt, rather than trying to hold the urine in.
- Drinking plenty of liquids, especially water, (6-8 glasses a day) will help “flush out” wastes from the urinary system.
- Children should be taught to keep their genital area clean and to change their underwear every day.
- Treatment of constipation will also help prevent UTIs.
- **SPECIAL TIPS FOR GIRLS**
 - After using the toilet, your child should always wipe from front to back. If this is not done, bacteria from the bowel movement material can get into the opening where the urine comes out and cause an infection.
 - If your child has an accident (soils or wets her underpants), the skin area should be cleaned, and the underpants changed as soon as possible to keep bacteria away from the urinary opening.
 - It is best for your child to wear underpants made of cotton rather than synthetic materials. Cotton allows the air to flow more freely. This helps to keep the area around the urinary opening dry. Germs do not multiply as fast in a dry area as they do in a moist area.

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