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## Pediatric Urinary Tract Infection: Ages 2 months to 2 years

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### General Information:

- Urinary tract infection (UTI) should be considered in any febrile child 2 months to 2 years of age who has no fever source evident from history or physical examination.
- Fever is defined as a temperature greater than or equal to 102.2° F (39° C).
- UTI is the most common occult bacterial infection in febrile infants, with an overall prevalence rate of 5%.
- Caucasian girls under 24 months without a definite source of fever have the highest prevalence rate (16%).
- The prevalence of UTI in febrile girls age 2 months to 2 years is more than twice that in boys, and the rate in uncircumcised boys is up to 20 times higher than in circumcised boys.
- The vast majority of febrile young children with UTI have pyelonephritis, putting them at risk for renal scarring and the long term sequelae of hypertension and renal failure.
- If the diagnosis of UTI is not made because it was not suspected or a test of insufficient sensitivity was used, three consequences may result:
  - The first is the lost opportunity to find a urinary tract abnormality that could result in renal damage. Up to 50% of infants have an underlying structural or physiologic abnormality of the urinary tract detected at the time of their first UTI.
  - The second is the formation of new renal scars. Repeat UTI leads to scarring, and progressive scarring is associated with hypertension and end stage renal disease.
  - The third consequence is possible bacteremia and urosepsis. Up to 23% of children less than 2 months of age and 3% of children between 2 months and 36 months of age are bacteremic with UTI. Urosepsis occurs in up to 9% of patients.
- Therefore, all children between the ages of 2 months and 24 months with a temperature greater than 102.2° F (39° C) with no obvious cause of infection should be evaluated for UTI, specifically, girls under 24 months and boys under 12 months of age.
- Children older than 2 years are excluded because they are more likely to have symptoms referable to the urinary tract, are less likely to have factors predisposing them to renal damage, and are at lower risk of developing renal damage.

### Risk factors for the development of UTI include:

- a previous history of UTI,
- siblings who have a history of UTI,
- being female,
- an indwelling urinary catheter,
- an intact prepuce in boys, and
- structural abnormalities of the kidneys and lower urinary tract.



**Symptoms:**

**Fever alone is the most common symptom of UTI in the infant**, and the presence of fever is considered a clinical marker of renal parenchymal involvement (pyelonephritis). Specific clinical signs and symptoms of UTI are uncommon in children and the presence of another potential source of fever (such as a URI or ear infection) is not reliable in excluding UTI. Children can present with pyelonephritis without preceding symptoms typical of lower tract infection.

The clinical manifestations are highly variable. Infants commonly present with fever and irritability, but may present with poor feeding, and lethargy. Older children may present with fever, chills, nausea, abdominal, suprapubic, or flank pain, in addition to typical signs of lower tract disease such as dysuria, urgency, and increased urinary frequency. Flank pain, fever, and vomiting occur more commonly in patients who have pyelonephritis than in those who have lower tract disease, but these findings are neither specific nor sensitive for pyelonephritis. **As many as 25% of children who have no classic signs or symptoms of pyelonephritis are ultimately confirmed to have upper urinary tract disease.**

**Evaluation:**

The current pediatric emergency medicine and infectious disease **consensus opinion is to obtain urine cultures in boys younger than 1 year and in girls younger than 2 years of age with fever without a documented source.** UTI should not be diagnosed by a bagged specimen because of its low specificity and poor positive predictive value. Over 85% of positive urine cultures obtained from a bag are falsely positive.

Urine culture should be obtained by transurethral catheterization in children under 2 years of age. In older children, midstream clean catch of spontaneously voided urine after appropriate cleansing of the urinary meatus is acceptable. A boy with moderate or severe phimosis may require a suprapubic bladder aspiration.

The urine should be evaluated for nitrite (many gram-negative organisms reduce nitrates to nitrites in the urine. A positive nitrite test is an insensitive but relatively specific test for UTI), leukocyte esterase (an enzyme produced by white blood cells.) A positive leukocyte esterase test usually corresponds to at least 5 WBC/HPF, with a sensitivity of 70% to 95%), and microscopy for white blood cells. More than 5 white blood cells per high-power field represents pyuria. Similar to the leukocyte esterase test, the presence of white blood cells in the urine is a sensitive but nonspecific test for UTI. *The exception* is the finding of **white blood cell casts**, which, in the absence of significant hematuria, usually is diagnostic of pyelonephritis. The presence of bacteria in a spun urine sample is neither specific nor sensitive enough to use clinically.

	Sensitivity (%)	Specificity (%)
Leukocyte esterase	70 to 95	65 to 90
Nitrite	15 to 80	90 to 100
WBCs on microscopy	30 to 100	45 to 100
Bacteria on microscopy	15 to 100	10 to 100

Many children with pyelonephritis have elevated peripheral white blood cell counts or nonspecific markers of inflammation such as an increased ESR or C-reactive protein, but these laboratory tests are neither sensitive nor specific enough to confirm or exclude pyelonephritis. The most effective means of diagnosing a UTI is by performing a urinalysis with microscopy. If the UA is positive (see above), then a urine culture should be performed and antimicrobial

**Evaluation - Continued:**

therapy begun. If the UA is negative, antibiotics can be withheld pending the urine culture. The gold standard for diagnosis of UTI is culture. Urine obtained by catheterization has a sensitivity of 95% and a specificity of 99%. Remember, a negative urinalysis does not rule out a UTI. The ultimate diagnosis of UTI requires a culture of the urine.

*[\*See algorithm on page 5 (suitable for printing and posting)]*

**Treatment:**

Escherichia coli is the most common pathogen, isolated in up to 90% of initial UTIs and in more than two thirds of patients who have recurrent UTI.

Antibiotic selection and route of administration should be guided by local microbial resistance patterns and the ability of the patient to take and retain oral agents. While many commonly used antibiotics are concentrated in the urine and are useful in treating lower tract disease, renal parenchymal antibiotic levels more closely resemble blood-stream levels. Since the vast majority of febrile young children with UTI have pyelonephritis, it is important to use an appropriate antibiotic. For example,



- **Nitrofurantoin** is a good drug for the treatment of lower UTI in adults, as it is concentrated in the urine, but it achieves negligible levels in the blood, and is therefore a poor choice for pyelonephritis.
- **TMP-SMX** should not be used for empiric therapy of pyelonephritis if local resistance to the drug in *E coli* exceeds 10% to 20%. Alternatives to TMP-SMX include first-, second-, and third-generation oral cephalosporins (Keflex®, Cefzil®, Omnicef®) or penicillin/beta-lactamase inhibitor combinations (Augmentin®).
- **Therapy for 10 to 14 days** is adequate for uncomplicated pyelonephritis. Almost 90% of infants who have febrile UTIs and presumed pyelonephritis were afebrile within 48 hours of initiation of antibiotics. Patients should follow-up with their primary care physicians if they have not become afebrile in 48 hours.

The goals of treatment of acute UTI are to eliminate the acute infection, to prevent urosepsis, and to reduce the likelihood of renal damage. Patients who are toxic-appearing, dehydrated, or unable to retain oral intake (including medications) should receive an antimicrobial parenterally, and should be hospitalized until they are improved clinically and are able to retain oral fluids and medications. The parenteral route is recommended because it ensures optimal antimicrobial levels in these high-risk patients. Parenteral antibiotics should be considered when compliance with obtaining and/or administering an antimicrobial orally cannot be ensured. Hospitalization is necessary if patients have clinical urosepsis or are considered likely to have bacteremia based on clinical or laboratory evaluation.

For children who do not appear toxic but who are vomiting, or when noncompliance is a concern, options include beginning therapy in the hospital or administering an antimicrobial parenterally on an outpatient basis in consultation with their primary care physicians. The route of administration is changed to oral when the child is no longer vomiting, and compliance appears to be ensured.

**Key Points:**

- All febrile [102.2° F (39° C) or higher] girls under 24 months and all febrile boys under 12 months with no obvious cause of infection should be evaluated for UTI.
- Specific clinical signs and symptoms of UTI are uncommon in children, and the presence of another potential source of fever (such as a URI or ear infection) is not reliable in excluding UTI.
- The vast majority of febrile young children with UTI have pyelonephritis.
- Urinalysis with microscopy and urine culture should be obtained, preferably by catheterization.
- A negative urinalysis does not rule out a UTI. The ultimate diagnosis of UTI requires a culture of the urine.
- Appropriate oral antibiotics include first-, second-, and third-generation oral cephalosporins (Keflex®, Cefzil®, Omnicef®) or penicillin/beta-lactamase inhibitor combinations (Augmentin®). Rocephin® (ceftriaxone) is the parenteral drug of choice.
- If the patient appears toxic, dehydrated, or is unable to retain oral intake, initial anti-microbial therapy should be administered parenterally and the patient should be hospitalized.

**Reference/Further Reading:**

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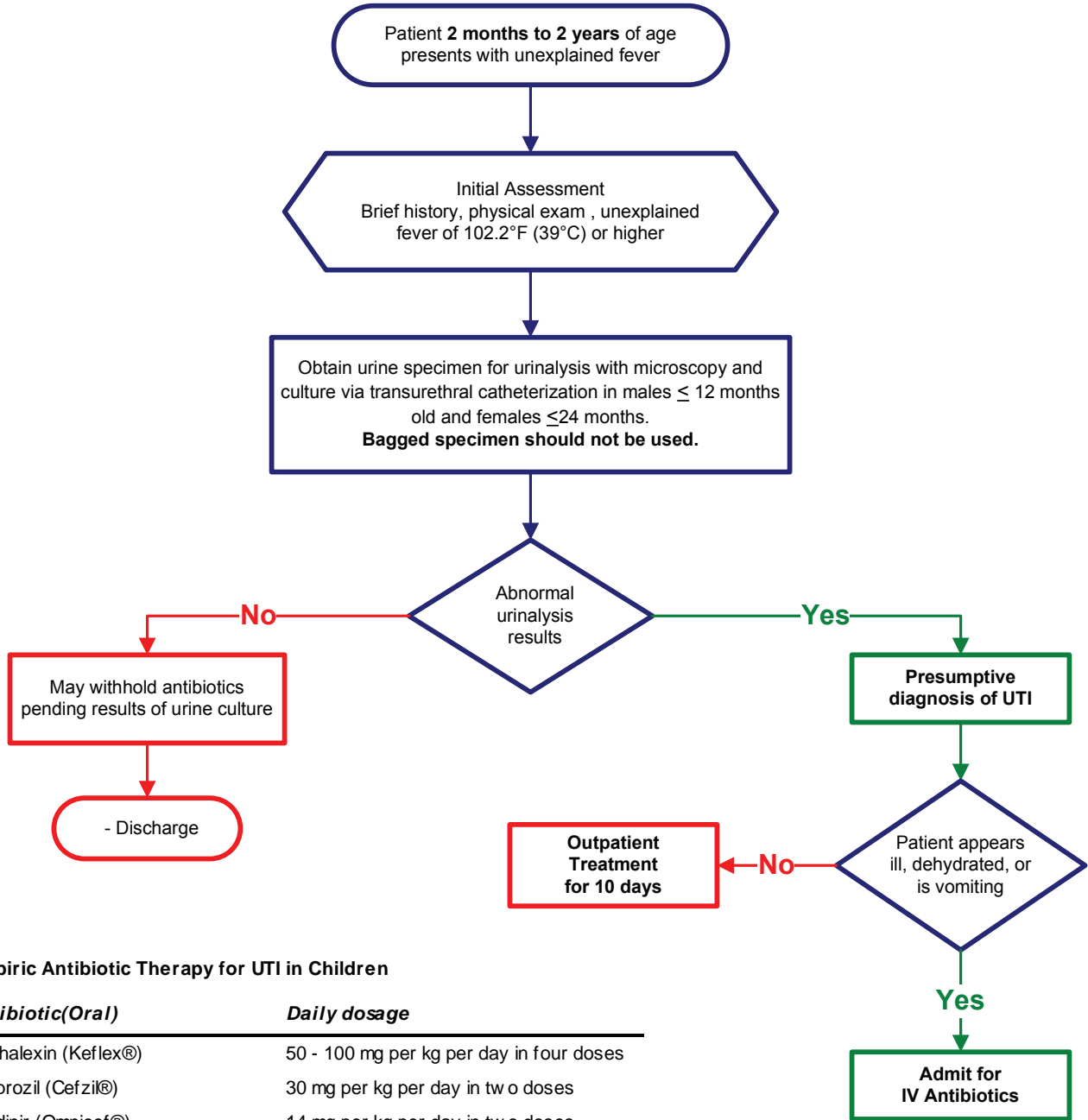
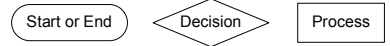
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The information contained herein addresses emergency medical practice in general, but is not a substitute for the physician's judgment, knowledge, and skill in the care and treatment of any individual patient. This information is a guide to assist the physician in a wide variety of circumstances and is not intended to establish a standard of care.

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# Pediatric Urinary Tract Infection Physician Clinical Guideline



## Empiric Antibiotic Therapy for UTI in Children

<b>Antibiotic(Oral)</b>	<b>Daily dosage</b>
Cephalexin (Keflex®)	50 - 100 mg per kg per day in four doses
Cefprozil (Cefzil®)	30 mg per kg per day in two doses
Cefdinir (Omnicef®)	14 mg per kg per day in two doses
Amoxicillin/clavulanate (Augmentin®)	45 mg per kg per day in two doses
<b>Intramuscular / Intravenous</b>	
Ceftriaxone (Rocephin®)	50 - 75 mg per kg per day in two doses
	Total daily dose not to exceed 2 grams

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