



When It Hurts to “Go”: UTIs and Children



By Marie-Claude Roy, MD, FRCPC

Due to its incidence and potential long-term renal morbidity, urinary tract infections (UTIs) represent an important health issue for physicians. Surprisingly, despite an abundant amount of literature, confusion and controversy persist with regards to many aspects of UTIs, mainly due to the weakness of the scientific evidence on which management is based. This article will review and give specific recommendations on the different steps leading to an adequate treatment and evaluation of UTIs.

It is estimated that up to 8% of children will present with a UTI before reaching adulthood.

In this article:

1. How do I diagnose UTIs?
2. How do I manage UTIs?
3. What are the precipitating factors?
4. The final word on UTIs

It is estimated that up to 8% of children will present with a UTI before reaching adulthood. It is the most frequent bacterial infection after respiratory tract infections. Most first-time UTIs happen in children less than a year old. More boys than girls will present with an episode during the first few months of life; girls predominate thereafter.

How can I diagnose a UTI?

A UTI is first suspected on clinical grounds (Table 1). The younger the child is, the less specific the presenting symptoms are. As they get older, the typical adult presentation occurs.

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The reagent strip and urine microscopic examination are useful tools to support the diag-

nosis. However, because of their suboptimal sensitivities and specificities, a urine culture should always be done to confirm or to rule out a UTI.¹ Although widely used, urine cultures from a collecting bag are not reliable; there is an 85% false-positive rate.¹ When the culture is negative, however, a UTI can be ruled out with confidence. In the incontinent child, a suprapubic aspiration or bladder

Table 1

Symptoms of UTI in children

- Fever
- Irritability
- Poor growth
- Vomiting
- Diarrhea
- Change in urine colour
- Change in urine smell
- Gross hematuria
- Pain
- Frequency
- Urgency
- Incontinence
- Dysuria

UTI: Urinary tract infection

Urine cultures from a collecting bag are not reliable: there is an 85% false-positive rate.

Table 2

Diagnostic criteria of UTI in children

Specimen	Culture	Probability of infection
Suprapubic aspiration	Gram-negative bacilli - Any count	>99%
	Gram positive cocci (> 10 ⁶ organisms/L)	>99%
Bladder catheterization	>10 ⁸ organisms/L	95%
	10 ⁷ - 10 ⁸ organisms/L	Likely
Clean midstream-specimen in boys	>10 ⁷ organisms/L	Likely
Clean midstream- specimen in girls	3 specimens (>10 ⁸ organisms /L)	95%
	2 specimens (>10 ⁸ organisms/L)	90%
	1 specimen (>10 ⁸ organisms/L)	80%
	10 ⁷ - 10 ⁸ organisms/L	Suspicious if symptomatic

UTI: Urinary tract infection.

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catheterization is suggested. In toilet trained children, a clean midstream specimen is adequate. Diagnostic criteria for UTI is illustrated in Table 2.¹ *Escherichia coli* is responsible for about 80% of all UTIs.

When a urine culture is negative and a UTI is still suspected (*e.g.*, in a child with classic symptoms who took antibiotics prior to the culture), a dimercaptosuccinic acid (DMSA) scintigraphy can help clarify the diagnosis. The assumption is that the presence of a cortical defect represents an acute pyelonephritis (APN). The sensitivity of DMSA is around 95% in animal models, but is probably lower in humans.² To avoid unnecessary investigations and treatment, some authors even recommend DMSA scintigraphy in all cases of suspected APN.

How do I manage UTIs?

When suspicion of a UTI is weak, treatment can be deferred until the final result of the culture is known. Otherwise, empirical treatment must be started. The American Academy of

Table 3

Empirical oral antibiotics for UTIs in children

- Amoxicillin
- Amoxicillin-clavulanate
- Trimethoprim-sulfamethoxazole
- Cephalexin
- Cefprozil
- Cefixime

UTI: Urinary tract infection



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Table 4

Proposed protocol for imaging studies in children with UTIs

	Ultrasound	Cystography	DMSA scintigraphy
Boys < 2 years old	All	All	See Table 7
Boys 2-5 years old	All	If suspected scar or PUV	After 1 APN (see Table 7)
Boys > 5 years old	All	If suspected scar or PUV	After 2 APN (see Table 7)
Girls < 2 years old	All	All but cystitis	See Table 7
Girls 2-5 years old	After 1 APN or 2 cystitis	If suspected scar	After 1 APN (see Table 7)
Girls > 5 years old	After 2 APN or 3 cystitis	If suspected scar	After 2 APN (see Table 7)

DMSA: Dimercaptosuccinic acid, PUV: Posterior urethral valves, APN: Acute pyelonephritis, UTI: Urinary tract infection

Pediatrics (AAP) now recommends that children two months to 24 months with febrile UTIs be treated with intravenous (IV) antibiotics in the hospital when sepsis is suspected, when poor oral medication tolerability or compliance is expected, or when a child is dehydrated or suf-

fering from significant diseases.¹ Ampicillin and either an aminoglycoside or a third generation cephalosporin are usually part of the initial regimen. Gentamicin, once daily, is safe and effective in children with UTIs after the neonatal period.³

When all of the above conditions are lacking, the AAP suggests starting empirical outpatient treatment with oral antibiotics (Table 3). The choice must be influenced by local resistance. Nitrofurantoin must be avoided when bacteremia or pyelonephritis is suspected.

The AAP recommendations were based on a single prospective study of 309 young children with febrile UTIs. The study showed no significant difference in bacteriologic cure, and presence of renal scars in patients treated either with oral cefixime or IV cefotaxime.⁴

For many reasons, physicians must be prudent in applying these AAP guidelines. In

Table 5

Oral antibiotics used for UTI prophylaxis in children

Amoxicillin (neonates)	20 mg/kg/d
Trimethoprim	2 mg/kg/d - 3 mg/kg/day
Trimethoprim-sulfonamide	2 mg/kg/d - 3 mg/kg/day
Nitrofurantoin	1 mg/kg/d - 2 mg/kg/day
Cephalexin	10 mg/kg/d - 20 mg/kg/day

UTI: Urinary tract infection

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Practice Pointer

To rule out abscess, the following should be obtained in the acute phase if there is no resolution of symptoms:

- repeat urinalysis
- urine culture
- antibiotic levels (when appropriate)
- renal and bladder ultrasound

this trial, treatment was initiated in the centre based on a Gram stain with cefixime as the only choice, and within 24 hours of fever onset. Exemplary compliance was observed. Furthermore, a non-negligible proportion of young children have concomitant sepsis and their anatomy or scar status is frequently unknown. Until further data are available, I still recommend IV antibiotics in children younger than two years (the population at highest risk of having an underlying urinary tract anomaly and to develop a kidney scar). The same is recommended for all patients with known compromised kidney function. An alternative to outpatient oral antibiotics is outpatient IV antimicrobials, such as once daily IV aminoglycoside or ceftriaxone given in the centre, combined with amoxicillin for Enterococcus coverage.

No recommendations by a medical authority have been published with regards to children over two years old with a febrile UTI. Since the risk of acquired kidney damage is less in this population, we can assume

Table 6

Proposed indications for antibioprophylaxis

- Infants younger than 2
- Presence of a risk factor when scar or renal dysfunction is present
- ≥ 2 episodes/6 months

Table 7

Proposed indications to look for scars after an APN

- Age < 1 year
- VUR of grade ≥ 3
- ≥ 2 APN before 5 years of age
- Presence of urinary tract obstruction
- Neurogenic bladder

APN: Acute pyelonephritis, VUR: Vesicoureteral reflex

that the AAP suggestions could apply. When a UTI seems to be limited to the bladder, the chance of developing a renal scar is nil by definition. It is probably reasonable to treat those patients with oral antibiotics.

The antibiotics should be adjusted when the organism sensitivities are known. If initially started on IV antibiotics, a switch to oral treatment is usually considered when the child is afebrile for at least 24 hours. The optimal duration of

antibiotic administration is between seven days to 14 days. No comparative studies exist on these



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Take-home message



Diagnosis

- A urine culture should always be done to confirm or to rule out a UTI.
- In the incontinent child, a suprapubic aspiration or bladder catheterization is suggested.
- In the toilet trained child, a clean midstream specimen is adequate.
- When a urine culture is negative and a UTI is still suspected, a dimercaptosuccinic acid scintigraphy can help clarify diagnosis.

Management

- For APN, I recommend IV antibiotics in children younger than two years, as well as in patients with known compromised kidney function or damage.
- Older children can be treated with oral antibiotics if not septic, not vomiting, and medication compliance is expected.
- An alternative to outpatient oral antibiotics is outpatient IV antimicrobials, such as once daily IV aminoglycoside or ceftriaxone given in the centre, combined with amoxicillin for Enterococcus coverage.
- The patient can be switched from IV antibiotics to oral treatment when the child is afebrile for at least 24 hours. The optimal duration of antibiotic administration is between seven days to 14 days.
- Children with cystitis can be treated with oral antibiotics.
- The ultimate goal in the management of UTIs is the prevention of renal scars that may lead to hypertension or renal failure.

different lengths of treatment.⁵ To rule out abscess, repeat urinalysis, urine culture, antibiotic levels (when appropriate), and renal and bladder ultrasound, should be obtained in the acute

phase if there is no resolution of symptoms.

What are the precipitating factors?

The ultimate goal in the management of UTIs is the prevention of renal scars that might lead to hypertension or renal failure. Unfortunately, there are no large scale prospective population studies to estimate the real incidence or significance of renal scars after an APN. It is thought that by preventing further renal infections, the chance of developing kidney damage will decrease. Many recommendations are, therefore, suggested to fulfill that objective, such as repeated urine tests, various imaging studies to detect urinary tract anomalies, antibioprophyllaxis, and vesicoureteral reflux (VUR) treatment. Doubts persist about the value of these recommendations since none of these strategies were ever assessed by prospective randomized trials with renal scars

as a primary outcome.⁶

Asymptomatic bacteriuria does not cause kidney scars and its treatment does not prevent an APN from occurring.⁷ Routine urine tests, there-

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fore, should not be done. It may be more beneficial to teach parents when to bring their child to medical attention for a urine culture when a UTI is suspected.

Young children have an increased susceptibility to renal scars and are more likely to have an underlying anatomic anomaly that predisposes

Patients with repeated APN are at a higher risk of kidney damage.


them to other episodes. VUR is detected in about 25% to 40% of children. Patients with repeated APN are at higher risk of kidney damage.¹ These patients in particular should have a more extensive imaging workup. The relationship between VUR and scars is weaker as the child ages. Keeping in mind that renal damage should guide the management, if damage is not present, it might not be worthwhile to look for and treat VUR.⁸

Posterior urethral valves (PUV) sometimes need to be ruled out in boys.

Recommendations pertaining to imaging modalities are given in Table 4. A voiding cystourethrography is suggested in boys and girls with evidence of bladder lesion or dysfunction. In other cases, a radionuclide cystography can be done. The cystography can be done as soon as bladder symptoms have disappeared and urine culture is negative.⁹


Antibioprophylaxis (Table 5) certainly decreases the number of UTI recurrences, but the long-term implications have not been established.¹⁰ Antibioprophylaxis should be considered when a child is estimated to be at the highest risk for scars, or to avoid the repeated morbidity associated with acute infections (Table 6).

Constipation and bladder dysfunction are the most frequent causes of UTI in older children and should be sought carefully during the interview by a detailed review of the patient's voiding and stooling habits. Special attention should be



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HPA-axis function and hematological status should be assessed periodically. Height should also be regularly monitored in children and adolescents receiving prolonged treatment with inhaled corticosteroids.

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Constipation and bladder dysfunction are the most frequent causes of UTI in older children.

given to the spine and the neurologic lower limbs assessment to rule out a neurogenic bladder. Abdominal or spinal plain films, and renal and bladder ultrasound may be required to clarify the diagnosis. When appropriate, regular bladder and bowel emptying may need to be suggested.

DMSA scintigraphy is the best test to rule out scars and should be done six months after a pyelonephritis to avoid false-positive results. Which population should be screened and if it modifies the long-term prognosis are a matter of debate. Children with the greatest risk of scars might benefit the most (Table 7). To detect the above complications, yearly blood pressure measurements and urinalysis should be done in all children after an APN, unless it is clear there are no secondary scars.

The Final Word on UTIs

UTIs are frequent in the pediatric population. Avoiding kidney damage should be the goal pursued by the treating physician. All steps in the management and treatment of the patient should also be oriented towards this aim. Further stud-

ies are needed to better categorize the child at risk, and to establish what interventions are necessary. [CME](#)

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