

View this article online at: [patient.info/doctor/childhood-urinary-tract-infection](http://patient.info/doctor/childhood-urinary-tract-infection)

# Childhood Urinary Tract Infection

The diagnosis of urinary tract infection (UTI) in young children is important as a marker for urinary tract abnormalities. It may be associated with life-threatening sepsis in the newborn. UTIs are the most common bacterial infection in children under 2 years old.

## Definitions

- **Bacteriuria:** bacteria in urine uncontaminated by urethral flora. It may have occult, ie few, or unreported, symptoms. It should be considered significant in infants/early school-age children where it may lead to renal scarring.
- **Symptomatic bacteriuria:** this term is synonymous with UTI, which may involve different urinary tract sites.
- **Chronic pyelonephritis:** this is an histological/radiological diagnosis. Juxtaposition of a renal cortical scar and a dilated calyx is the key to its diagnosis. It is a major cause of renal failure. During micturition, urine flow may be retrograde up the ureters. This is called reflux, and it is identified by a micturating cystourethrogram (MCUG).

## Epidemiology

- Febrile UTI is the most common serious bacterial infection in childhood.<sup>[1]</sup>
- In the first three months, UTIs are present in 7.5% of girls, 2.4% of circumcised males and 10% of uncircumcised males who present with a fever.<sup>[2]</sup>
- In the first year of life (mostly the first three months), UTI is more common in boys than in girls, after which the incidence changes, to approximately 3% of pre-pubertal girls and 1.1% of pre-pubertal boys.<sup>[3]</sup>

## Risk factors

- Any condition that leads to urinary stasis (renal calculi, obstructive uropathy, vesico-ureteric reflux (VUR) - or family history of, voiding disorders) or poor urine flow - eg, phimosis.
- History suggestive of, or confirmed previous, UTI.
- Constipation.
- Evidence of spinal lesion.
- Antenatally diagnosed renal abnormality.
- Poor growth.
- High blood pressure.

## Presentation

- Symptoms in neonates differ to those in older children. They are more likely to develop urosepsis.
- Infections in neonates are less likely to be due to *Escherichia coli*.
- **Infants younger than 3 months:** fever, vomiting, lethargy and irritability are common. Poor feeding and failure to thrive may occur. Abdominal pain, jaundice, haematuria and offensive urine are less common.<sup>[4]</sup>
- **Infants and preverbal children aged 3 months or older:** these commonly have a fever. Fewer also have abdominal pain, loin tenderness, vomiting and poor feeding. Lethargy, irritability, haematuria, offensive urine and failure to thrive are less common.
- **Children aged over 2 years:** these most commonly present with frequency, dysuria and suprapubic, abdominal or lumbar pain. Dysfunctional voiding and changes to continence are less common. Fever, malaise, vomiting, haematuria, offensive urine and cloudy urine are least likely to be seen in this group.
- **Gastroenteritis** may co-exist with UTI, although true incidence of this is unknown, due to urine sample contamination.

## Differential diagnosis

- Vulvovaginitis
- Urethritis
- Irritation (use of soaps and bubble baths, and poor hygiene)
- Threadworm infestation
- Balanitis

## Classification of urinary tract Infection

UTIs may be classified as a first episode or recurrent, or according to severity (simple or severe).<sup>[5]</sup>

Recurrent UTI may be subclassified into three groups:

- **Unresolved infection:** subtherapeutic level of antimicrobial, non-compliance with treatment, malabsorption, resistant pathogens.
- **Bacterial persistence:** may be due to a nidus for persistent infection in the urinary tract. Surgical correction or medical treatment for urinary dysfunction may be needed.
- **Re-infection:** each episode is a new infection acquired from periurethral, perineal or rectal flora.

Severe and simple forms of UTIs should be differentiated, as to some extent the severity of symptoms dictates the degree of urgency with which investigation and treatment are to be undertaken.

Clinical classification of UTIs in children	
Severe UTI	Simple UTI
Fever $\geq 39^{\circ}\text{C}$	Mild pyrexia
Persistent vomiting	Good fluid intake
Serious dehydration	Slight dehydration
Poor treatment compliance	Good treatment compliance

However, when a low level of compliance is expected, such a child should be managed as one with a severe UTI.

## Examination

The temperature of the child should always be taken and recorded. The following should also be examined:

- Throat and cervical lymph nodes
- Abdomen - to look for constipation, tender or palpable kidney
- Back - to look for stigmata of spina bifida or sacral agenesis
- Genitalia - to look for phimosis, labial adhesions, vulvitis or epididymo-orchitis

## Investigations

### Collecting the urine sample

Ideally, a urine sample should always be taken prior to starting any antibiotics. This can be obtained in various ways, depending on the age of the child and also the clinical presentation of the child.

A clean catch urine sample is the method for urine collection recommended by the National Institute for Health and Care Excellence (NICE). The child is placed in the lap of a parent or member of the nursing staff, who holds a sterile foil bowl underneath the infant's genitalia. The infant is offered oral fluids and urine collection is awaited. Although this is time-consuming, there seems to be a good correlation between the results of urine culture obtained by this method and suprapubic aspiration (SPA), with a false-positive rate of only 5% and false-negative rate of 12%.<sup>[6]</sup> This technique is obviously much easier in toilet-trained children.

If a clean catch urine sample is not possible:

- A plastic bag attached to cleaned genitalia can be used. However, if the genitalia are not cleaned and culture is delayed, there can be a high incidence of false-positive results (85-99%).<sup>[7]</sup>
- Use other non-invasive methods such as urine collection pads, but do not use cotton wool balls, gauze or sanitary towels.
- Alternatively, a catheter sample or SPA of urine may be collected where sufficient experience and resources exist. The decreased contamination rate offered by either of these methods can offset the disadvantage of being an invasive procedure. They may be most appropriate in:
  - Pre-toilet-trained children with fever and no focus, or where UTI is considered likely.
  - Children with a history of UTI/vesico-ureteric reflux (VUR)/on UTI prophylaxis/having renal tract anomalies.
  - Very sick children.

If the sample needs to be cultured but cannot be cultured within four hours of collection, either refrigerate or preserve it with boric acid immediately.

### Dipstick testing

Nitrites are not a very sensitive dipstick test in infants. This is because not all urinary pathogens reduce nitrate to nitrite. However, false negatives are rare.

If there is a positive dipstick test then the MSU sample should be sent for urine culture.

### Urine testing<sup>[4]</sup>

- Aged <3 months: if UTI is suspected clinically, refer to a paediatrician.
- Aged >3 months but <3 years: send a sample for urgent microscopy and culture. Await the result before starting treatment, unless they are very systemically unwell.
- Aged >3 years: use dipstick test to diagnose UTI:
  - If leukocyte esterase and nitrite are positive: start antibiotic treatment for UTI and, if the child has a high or intermediate risk of serious illness or a history of infection, send urine sample for culture.
  - If leukocyte esterase is negative and nitrite is positive: start antibiotic treatment if a fresh sample was tested and send urine sample for culture.
  - If leukocyte esterase is positive and nitrite is negative: send urine sample for microscopy and culture. Only start antibiotic treatment for UTI if there is good clinical evidence of such infection.
  - If leukocyte esterase and nitrite are negative: do not start treatment for UTI, and explore other causes of illness.

### Imaging

These are based on NICE guidelines, but there is still some debate. These are usually arranged by secondary care.

### Imaging guidelines for children less than 6 months old:

Test	Responds well to treatment within 48 hours	Atypical UTI: <ul style="list-style-type: none"> <li>• Seriously ill.</li> <li>• Raised creatinine.</li> <li>• Septicaemia.</li> <li>• Failure to respond to treatment within 48 hours.</li> <li>• Infection with non-<i>E. coli</i> species.</li> </ul>	Recurrent UTI: <ul style="list-style-type: none"> <li>• Two or more episodes of UTI with acute pyelonephritis/infection of the upper urinary tract.</li> <li>• Three or more episodes of UTI with cystitis/lower urinary tract infection.</li> </ul>
Ultrasound during the acute infection.	No	Yes	Yes
Ultrasound within six weeks.	Yes	No	No
Dimercaptosuccinic acid (DMSA) 4-6 months following the acute infection.	No	Yes	Yes
Micturating cystourethrogram (MCUG).	No - consider if ultrasound is abnormal.	Yes	Yes

#### Imaging guidelines for children between 6 months and 3 years old:

Test	Responds well to treatment within 48 hours	Atypical UTI	Recurrent UTI
Ultrasound during acute infection.	No	Yes	No
Ultrasound within six weeks.	No	No	Yes
DMSA 4-6 months after infection.	No	Yes	Yes
MCUG.	No	No	No

#### Imaging guidelines for children older than 3 years:

Test	Responds well to treatment within 48 hours	Atypical UTI	Recurrent UTI
Ultrasound during acute infection.	No	Yes	No
Ultrasound within six weeks.	No	No	Yes
DMSA 4-6 months after infection.	No	No	Yes
MCUG.	No	No	No

- **Ultrasound:** [8] [8]
  - Can accurately assess renal size and outline and identify most congenital abnormalities, renal calculi and hydronephrosis or hydroureter, indicating the presence of obstruction or severe reflux.
  - It is less effective in detecting mild or moderate vesico-ureteric reflux in children with UTIs.

- **Micturating cystography:**<sup>[8]</sup>
  - Is the gold standard investigation for reflux and is the only imaging technique that provides information about the urethra.
  - Should be performed by a skilled radiologist with experience in acquiring and interpreting the images.
  - The disadvantage of micturating cystography is its invasiveness, as it requires catheterisation.
- **DMSA scintigraphy:**<sup>[8]</sup>
  - Is the gold standard for detecting renal parenchymal defects.
  - Study renal function using a radio-pharmaceutical such as technetium <sup>99m</sup>.
  - The isotope is concentrated in the proximal renal tubules, and its distribution correlates with functioning renal tissue.

## Management

### General principles

- The aims of treatment are to:
  - Eliminate symptoms and eradicate bacteriuria
  - Prevent renal scarring
  - Prevent recurrent UTIs
  - Correct any associated urological lesions
- Children with a high risk of serious illness and/or aged younger than 3 months should be referred immediately to secondary care. This should be assessed in accordance with NICE Guidance '*Feverish illness in children*'.<sup>[9]</sup>
- Do not delay treatment if the sample cannot be obtained and the infant or child is at high risk of serious illness.

Carefully assess the degree of toxicity, dehydration and ability to maintain oral fluid intake. Encourage fluids, avoid or correct constipation, and encourage full voiding.

### Pharmacological

- Consider referral to secondary care for children aged 3 months and older with acute pyelonephritis or upper UTI but, if appropriate, treat with 10 days of oral antibiotics.
- If the child is unable to tolerate oral antibiotics, start treatment with intravenous (IV) antibiotics until oral intake is possible.
- Children aged 3 months and over with cystitis or infection of the lower urinary tract should be treated with three days of oral antibiotics according to local guidance.<sup>[4]</sup>
- However, there is some evidence that outcomes of short courses (1-3 days) are inferior to those of 7- to 14-day courses.<sup>[3]</sup>
- In addition, a Cochrane review has found that 10-day antibiotic treatment is more likely to eliminate bacteria from the urine than single-dose treatments.<sup>[10]</sup>
- There is little evidence to favour a particular antimicrobial:
  - Trimethoprim 50 mg/5 ml, 50 mg bd orally is commonly used; however, it is not recommended for patients with renal insufficiency.
  - Other agents used include cefalexin (expensive, some resistance), amoxicillin (not useful for empirical treatment, as there are high resistance rates, but good for known sensitive organisms), and co-amoxiclav, which is a useful second-line agent. **NB:** quinolones should be avoided due to safety concerns.
- The choice of antibiotic should be determined by local guidelines. The antibiotic may need to be adjusted according to the MSU results.

### Acute pyelonephritis

- Use oral cephalosporins or short courses of IV therapy (2-5 days), followed by oral therapy. Total length of treatment is usually 10-14 days.
- Paracetamol can help to relieve pain and high temperature.

- Repeat MSU after treatment.

## Prognosis

Most children recover quickly and completely with antibiotic treatment. Recurrence of UTI is more likely in:

- Younger children, ie aged less than 6 months.
- Girls compared with boys.
- VUR grade 3-5, compared with reflux grade 1-2, or no reflux.
- Dysfunctional voiding syndrome; this is an abnormality of emptying, due either to a small-capacity, unstable bladder or a large-capacity, poorly emptying bladder.

## Prevention

Relief of voiding dysfunction, good hygiene, wiping from front to back after micturition in girls, avoiding constipation, bubble baths, chemical irritants and tight clothing are sensible recommendations.

NICE recommends the following regarding prophylaxis:<sup>[4]</sup>

- Antibiotic prophylaxis should not be routinely recommended in infants and children following first-time UTI.
- Antibiotic prophylaxis may be considered in infants and children with recurrent UTI.
- Asymptomatic bacteriuria in infants and children should not be treated with prophylactic antibiotics.

Antibiotic prophylaxis may also be used after an acute episode of UTI until the diagnostic work-up is completed.<sup>[5]</sup> The most common antibiotics are nitrofurantoin, trimethoprim, cefalexin and cefaclor.

## Further reading & references

- [Mori R, Lakhanpaul M, Verrier-Jones K](#); Diagnosis and management of urinary tract infection in children: summary of NICE guidance. *BMJ*. 2007 Aug 25;335(7616):395-7.
  - [Urinary tract infection in infants, children and young people under 16](#), NICE Quality Standards (July 2013)
  - [Diagnosis of UTI \(a quick reference guide for Primary care\)](#), GOV.UK (2014)
1. [Buonsenso D, Cataldi L](#); Urinary tract infections in children: a review. *Mnerva Pediatr*. 2012 Apr;64(2):145-57.
  2. [Shaikh N, Morone NE, Bost JE, et al](#); Prevalence of urinary tract infection in childhood: a meta-analysis. *Pediatr Infect Dis J*. 2008 Apr;27(4):302-8. doi: 10.1097/INF.0b013e31815e4122.
  3. [Guidelines on Paediatric Urology](#); European Association of Urology (Mar 2013)
  4. [Urinary tract infection in children: diagnosis, treatment and long-term management](#); NICE Clinical Guideline (2007)
  5. [Guidelines on Urological Infections](#); European Association of Urology (Mar 2013)
  6. [Roberts KB](#); Urinary tract infection: clinical practice guideline for the diagnosis and management of the initial UTI in febrile infants and children 2 to 24 months. *Pediatrics*. 2011 Sep;128(3):595-610. doi: 10.1542/peds.2011-1330. Epub 2011 Aug 28.
  7. [Ma JF, Shortliffe LM](#); Urinary tract infection in children: etiology and epidemiology. *Urol Clin North Am*. 2004 Aug;31(3):517-26, ix-x.
  8. [Davis A, Obi B, Ingram M](#); Investigating urinary tract infections in children. *BMJ*. 2013 Jan 30;346:e8654. doi: 10.1136/bmj.e8654.
  9. [Feverish illness in children - Assessment and initial management in children younger than 5 years](#); NICE Guideline (May 2013)
  10. [Fitzgerald A, Mori R, Lakhanpaul M, et al](#); Antibiotics for treating lower urinary tract infection in children. *Cochrane Database Syst Rev*. 2012 Aug 15;8:CD006857. doi: 10.1002/14651858.CD006857.pub2.

**Disclaimer:** This article is for information only and should not be used for the diagnosis or treatment of medical conditions. EMIS has used all reasonable care in compiling the information but make no warranty as to its accuracy. Consult a doctor or other health care professional for diagnosis and treatment of medical conditions. For details see our [conditions](#).

Original Author:  
Dr Hayley Willacy

Current Version:  
Dr Louise Newson

Peer Reviewer:  
Dr Helen Huins

Document ID:  
457 (v7)

Last Checked:  
22/06/2013

Next Review:  
21/06/2018

View this article online at: [patient.info/doctor/childhood-urinary-tract-infection](http://patient.info/doctor/childhood-urinary-tract-infection)

Discuss Childhood Urinary Tract Infection and find more trusted resources at [Patient](http://Patient).

---

## Ask your doctor about Patient Access

---

- 🔑 Book appointments
- 🔑 Order repeat prescriptions
- 🔑 View your medical record
- 🔑 Create a personal health record (iOS only)



Simple, quick and convenient.  
Visit [patient.info/patient-access](http://patient.info/patient-access)  
or search 'Patient Access'