



Managing
**urinary tract
infections**
in children

Urinary tract infection (UTI) in young children is not always easily recognised as symptoms are usually non-specific. Laboratory urinalysis is recommended for all suspected cases of UTI in children, however, collecting a urine sample can present difficulties. UTI should be considered when investigating a child with fever or any sign of infection without an obvious source. While UTI is usually simple to treat, if a diagnosis is missed or the infection not adequately managed, there is a significant risk of complications.

Urinary tract infection in children aged under 12 years

Urinary tract infection (UTI) affects approximately 8% of females and 2% of males during childhood.¹ UTI can occur in either the lower (cystitis) or upper (pyelonephritis) urinary tract. Typical UTI in children aged under 12 years is acute lower UTI, caused by *E.coli*, which responds promptly to antibiotics.²

Atypical UTI may be due to infection from a bacterium other than *E.coli*, e.g. *Staphylococcus spp.*, or from an underlying condition, such as a congenital renal tract abnormality. Atypical UTI and recurrent UTI in children is associated with an increased risk of complications, such as septicaemia or renal scarring.

This article will primarily address the management of typical, lower UTIs in children aged three months to 12 years.

Referral to a paediatrician or hospital care is recommended if:^{1,3}

- The child is aged under three months
- There is a high risk of severe illness (see “Identifying the risk of serious illness in children with fever”, BPJ 29 [Apr, 2010])
- Acute pyelonephritis (or other atypical UTI) is suspected (fever, loin pain or tenderness, bacteriuria)

A child who has recurrent UTI should be referred to a paediatrician for assessment for an underlying cause. Recurrent UTI is defined as three or more lower UTIs, two or more upper UTIs or one or more upper plus one or more lower UTI during childhood.²

Diagnosing UTI in children

Assess signs and symptoms

Younger children presenting with UTI usually have non-specific symptoms such as fever, lethargy, feeding difficulties or loss of appetite, nausea and vomiting, abdominal pain, waking at night, bed wetting or loss of control during daytime.³ Older children are more likely to be able to describe symptoms specific to the urinary tract such as frequent or painful urination and changes to the colour or smell of urine.³

Risk factors for UTI in children

There are several risk factors that increase the likelihood of a diagnosis of UTI, including:³

- History of recurrent fever (undiagnosed origin)
- Constipation or dehydration
- Congenital abnormality of the renal tract
- Previous history of UTI
- Family history of renal disease or vesicoureteric reflux (a condition where urine moves from the bladder back up the ureters)

Examination can help to confirm the diagnosis

Findings on examination that may indicate a diagnosis of UTI include:³

- Raised temperature
- Dehydration
- Enlarged or painful bladder upon palpation (child may feel the urge to void)
- Abdominal or loin tenderness

Atypical UTI may be suggested by the following signs and symptoms:³

- Temperature > 38°C
- Poor or minimal urine flow (as reported by parents or child)
- Septicaemia (fever, floppy, increased heart/respiratory rate)
- Palpable abdominal or bladder mass
- If initially treated as typical: failure to respond to treatment within 48 hours (strongly suggests pyelonephritis if fever remains)

Children with signs and symptoms of atypical UTI, and all children aged under three months with suspected UTI, should be referred to hospital.³ Children with recurrent UTI should be referred to a paediatrician for assessment for underlying causes.

Laboratory testing for suspected UTI

All children with suspected UTI should have a urine sample taken for analysis, ideally with microscopy and culture. Urine dipsticks can be used in children aged over three years, to support a diagnosis of UTI and help to indicate empirical treatment, but they have low sensitivity and specificity and do not provide data on the antibiotic sensitivities of the organism.

Collecting a urine sample in children

Collecting a urine sample can be difficult in young children and help from the child's parent/caregiver is essential.

Clean catch is the first-line method of urine collection in a young child in a community setting, although samples have a contamination rate of approximately 26%.⁴ The parent or caregiver is given a urine collection container to take home and is instructed to catch a sample of urine in the container when flow begins.

Mid-stream urine may be obtained from older children who can pass urine when asked. The child can collect their own specimen or can be assisted by a parent or caregiver. The initial few drops of urine should be passed into the toilet, and then a sample collected in a labelled collection container.

Urine collection bags are a non-invasive method of urine collection that may be used when other methods of urine sampling are not possible.^{3,5} However, this method is associated with a contamination rate of approximately 46%.⁴ Parents or


caregivers can be instructed in how to collect the sample at home. To apply a urine collection bag, first clean, rinse and dry the infant's perineum and genital area. The bag should then be placed over the genitals and the adhesive attached to the skin. A nappy can then be applied in the usual way. The bag should be checked frequently and removed immediately after the infant voids. The urine should then be drained from the bag into a urine collection container.

Catheter sample or suprapubic aspiration are associated with less contamination than clean catch or urine collection bags, however, these methods are more invasive and may not be acceptable to some parents. These procedures should only be carried out by General Practitioners experienced in their use.

Catheter sampling is slightly less invasive than a suprapubic aspiration and is therefore preferable, despite a higher contamination rate (12% compared to 1% with suprapubic aspiration).^{4, 5} The infant should be well hydrated prior to catheterisation. The infant should be placed on their back in the "frog leg" position. Clean the urethral opening. Insert a lubricated foley catheter into the urethra and into the bladder. Urine should flow immediately; discard the first few drops and then capture a sample in a urine collection container.⁶

Suprapubic aspiration ideally requires use of an ultrasound to confirm that urine is present in the bladder.³ Urine is likely to be obtained in 80–90% of procedures with prior ultrasound, compared to approximately 50% when not used.⁶ The infant should be placed on their back with legs extended. A collection container should be kept at hand if the infant voids prior to or during the procedure, particularly when first removing the nappy. Apply a topical anaesthetic cream to the lower abdomen. Wipe the skin with alcohol and then insert a 23G needle on the mid-line of the lower abdominal crease.⁷ Insert perpendicular to the skin and aspirate gently as you advance the needle.⁷ If unsuccessful, withdraw the needle to just under the skin and then advance again with the needle angled away from the pelvis.⁷

Parents should be informed that there may be a small amount of blood in the infant's urine the following day, and asked to return if large amounts of blood are present.

 Full guidelines on how to perform a catheter or suprapubic aspiration are available from: www.rch.org.au

Urinalysis

Once a urine sample has been obtained, a **urine dipstick can be used in children aged over three years** to assess for

leukocytes and nitrites. If the dipstick is positive, or if it is negative but UTI is still strongly suspected, the sample should be sent for microscopy and culture. Dipsticks are not reliable enough to guide treatment in children aged under three years,³ therefore all samples from children in this age group should be sent for microscopy and culture. The method of urine sampling should be indicated on the laboratory request form. Urine samples should be sent for analysis within four hours of collection. If this is not possible, samples may be refrigerated for a maximum of 24 hours. Some laboratories supply urine containers with boric acid as a preservative.

If a urine sample is unable to be reliably obtained, and there is a strong suspicion of UTI, consider referral to a paediatrician for sample collection and assessment.

Treatment of UTI in children

Start empiric treatment with antibiotics

Empiric antibiotics should be started in:³

- Children with specific urinary symptoms, e.g. painful and frequent urination
- Children aged > 3 months to < 3 years with non-specific symptoms that may be suggestive of UTI, e.g. fever, lethargy, abdominal pain
- Children aged > 3 years with urine dipstick positive for nitrites
- Children aged > 3 years with urine dipstick positive for leukocytes only, and urinary symptoms

Antibiotics for UTI should not be started in children aged > 3 years, with dipstick negative for nitrites and no specific urinary symptoms, until the results of urine culture and microscopy are available. Laboratory culture results are quantitative and organism counts of $<100 \times 10^6/L$ are not significant unless urinary symptoms are present. Asymptomatic bacteriuria in infants and children should not be treated with antibiotics.³

Selecting an antibiotic

E.coli accounts for approximately 75% of UTIs in children, therefore choice of empiric antibiotic is based on this bacterium.^{8,9} *Enterococcus spp.*, *Protius spp.*, *Staphylococcus spp.*, *Klebsiella spp.*, and *Pseudomonas spp.* account for most other cases of UTI in children.⁹ Antibiotic choice should also be guided by local resistance data.

Trimethoprim is the first-line treatment for typical UTI in children, however, a liquid formulation is not available in New

Zealand. Co-trimoxazole (trimethoprim + sulphamethoxazole) is therefore an appropriate first choice (see Table 1 for dose regimen). Depending on local resistance data, second-line options include cephalexin, cefaclor and amoxicillin clavulanate.^{10, 11} When the results of the urine culture are available, other antibiotics, such as amoxicillin, may be appropriate (see "Reviewing treatment").

N.B. Amoxicillin clavulanate is not recommended for treating UTI in adults but is usually well tolerated in children and is appropriate where local resistance data is available. Nitrofurantoin is used as a second-line option for UTI in adults, but this antibiotic is not commonly used in children in New Zealand.

Table 1: Antibiotic regimens for treatment of mild, uncomplicated UTI^{5,10}

Medicine	Dose
Co-trimoxazole	4+20 mg/kg (0.5 mL), twice daily, for three days
Cefaclor	10 mg/kg, two times daily, for three days
Cephalexin	12.5 mg/kg, two times daily, for three days
Amoxicillin clavulanate	10 mg/kg, three times daily, for three days

N.B. Trimethoprim may be suitable for older children who are able to swallow tablets. The recommended dose for children aged 6 – 12 years is 150 mg, once daily (before bed), for three days.

For more severe infections, antibiotic doses may need to be increased or IV antibiotics used. However, it is recommended that children with severe UTI are referred to hospital.

Treat for three days in children

Oral antibiotics can be used for three days to treat typical UTI in children. Short courses have been shown to be as effective as traditional longer courses (e.g. seven days) in children.^{3,8,12}

"Drink plenty and don't hold on"

Constipation and dehydration are significant contributing factors to UTI in children. Parents should be advised to ensure that the child drinks sufficient fluids in frequent, small amounts.³ The child should also be encouraged not to "hold on" and to go to the toilet as needed.

Parents should also be given advice on correct toileting techniques, e.g. always wiping from front to back for girls. The bladder requires regular, complete emptying and this is best taught with a potty or a supported small toilet seat and step so the feet are able to rest on a surface.

Increasing fibre in the diet will help to avoid and alleviate constipation. If constipation persists or is significant, pharmacological management can be considered, e.g. lactulose.


Reviewing treatment once culture results are available

A review of treatment is recommended at 48 hours, when the culture results are available and the child's response to treatment can be assessed. If the child's symptoms have not improved, the initial diagnosis and antibiotic choice may need to be reviewed.

When the result of the urinary culture indicate a resistant strain of bacteria, but the child's condition is improving, the antibiotic course can be continued and a "test of cure" urine culture requested once the course is completed.² If the child's

condition is not improving, change the antibiotic and consider discussion with, or referral to, a paediatrician.

Where symptoms have improved and culture indicates an appropriate antibiotic has been given, test for cure is not necessary.

 Advise parents that they should bring the child back for reassessment if the child's condition worsens or if symptoms have not improved after 48 hours of treatment.

Antibiotic prophylaxis to prevent reoccurrence

In children with typical first-time UTI there is little benefit to prophylactic antibiotic use and it is therefore not recommended.¹³ Long-term antibiotics may be required in children with underlying renal tract abnormalities or severe recurrent UTIs to prevent reoccurrence.

In children already receiving prophylactic antibiotics, new occurrences of UTI should be treated with a different antibiotic, and not a higher dose of the prophylactic antibiotic.³


Could UTI be a sign of sexual abuse?

UTI is only very rarely a sign of sexual abuse, but if other risk factors are present, it is important to consider this possibility.

Signs and symptoms that can indicate sexual abuse include:

- Unusual or excessive genital itching
- Bruising, redness, swelling or bleeding in the genital area
- Age inappropriate sexual play, knowledge or interest
- Fear of certain people or places

If sexual abuse is suspected, refer immediately to a paediatrician and inform Child, Youth and Family.

 For further information see: "Detecting child abuse in general practice", BPJ 38 (Sept, 2011).



Investigating for an underlying cause of UTI after treatment has been initiated

A predisposing abnormality is present in approximately one-third of children presenting with first-time, typical UTIs. Renal ultrasound in a hospital setting is used to identify these abnormalities.²

It is not necessary to refer children aged over six months with a typical, first-time UTI for imaging.³ However, children aged under six months with a typical UTI should be referred approximately six weeks after the infection has cleared. Children aged over six months with more than one confirmed UTI should also be referred for imaging.

Children aged under three months and those with severe infection will have been referred to hospital for treatment of their UTI, and are likely to have undergone renal ultrasound at this time.

Potential complications with UTI in children

A small number of children who have an acute UTI will develop long-term complications. A meta-analysis assessing the complications of UTIs in children found that approximately 15% had renal scarring post infection.¹⁴ Renal scarring can have long-term effects on morbidity and mortality, including increased rates of hypertension and proteinuria, decreased renal function and increased end-stage kidney disease.

The likelihood of complications increases in children with upper UTI, recurrent UTI, vesicoureteral reflux or undiagnosed UTI. Early diagnosis and optimal management greatly reduces the likelihood of long-term complications.

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References

1. Jadresić LP. Diagnosis and management of urinary tract infections in children. *Paediatr Child Health* 2010;20(6):274–8.
2. Clinical Knowledge Summaries (CKS). Urinary tract infection - children. CKS; 2009. Available from: www.cks.nhs.uk (Accessed May, 2012).
3. National Institute for Health and Clinical Excellence (NICE). Urinary tract infection in children: Diagnosis, treatment, and long-term management. NICE; 2007. Available from: www.nice.org.uk (Accessed May, 2012).
4. Tosif S, Baker A, Oakley E, et al. Contamination rates of different urine collection methods for the diagnosis of urinary tract infection in young children: An observational cohort study. *J Pediatr Child Health*; In Corrected Proof: DOI 110.1111/j.1440-1754.2012.
5. Starship Children's Health Clinical Guidance. Urinary tract infection. Auckland; 2007. Available from: www.adhb.govt.nz/starshipclinicalguidelines/_Documents/Urinary%20Tract%20Infection.pdf (Accessed May, 2012).
6. Dartmouth-Hitchcock Medical Centre. Collection instructions: Urine. Dept. Pathology, Hanover, USA; 2011. Available from: <http://labhandbook.hitchcock.org/microUrine.html> (Accessed May, 2012).
7. The Royal Children's Hospital. Suprapubic aspirate guideline. Melbourne, Australia; 2012. Available from: www.rch.org.au/clinicalguide/cpg.cfm?doc_id=5246 (Accessed May, 2012).
8. Larcombe J. Urinary tract infection in children. *Am Fam Physician* 2010;62(10):1252-4.
9. Sheerin NS. Urinary tract infection. *Medicine* 2011;39(7):384–9.
10. BMJ Group. British national formulary for children 2011-2012. London: Royal Pharmaceutical Society; 2011.
11. Australian Medicines Handbook Pty Ltd, 2011. Australian medicines handbook. Adelaide: Australian Medicines Handbook Pty Ltd; 2011.
12. Michael M, Hodson E, Craig J, et al. Short versus standard duration oral antibiotic therapy for acute urinary tract infection in children. *Cochrane Database Syst Rev* 2010;(1):CD003966.
13. Williams G, Craig J. Long-term antibiotics for preventing recurrent urinary tract infection in children. *Cochrane Database Syst Rev* 2011;(3):CD001534.
14. Shaikh N, Ewing A, Hoberman A. Risk of renal scarring in children with a first urinary tract infection: a systematic review. *J Pediatr* 2010;126(6):1084–91.