

How to Treat

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UTIs in children

Background, epidemiology and risk factors

CHILDREN with possible UTIs commonly present to the GP for management and at least three-quarters of children with UTIs are treated as outpatients. Appropriate identification and management is important because UTIs can cause acute morbidity as well as long-term problems such as hypertension and renal failure due to renal parenchymal damage.

In recent years the emphasis of investigations has changed from detecting vesico-ureteric reflux to identifying children with acute pyelonephritis, in recognition that scarring rather than reflux increases the risk of long-term morbidity.

How common are UTIs in children?

About 8% of girls and 2% of boys

have had at least one UTI by age 10. For unknown reasons, in the neonatal period boys are 5-10 times more susceptible to UTIs than girls. However, UTIs are more common in girls after the first year of life, which is thought to be due to the relative shortness of the female urethra.

Risk factors for UTI

Risk factors for UTI include:

- Dilating vesico-ureteric reflux.
- Urinary stasis (due to mechanical obstruction or neurological disorders causing a neurogenic bladder).
- Bladder dysfunction.
- Chronic constipation.
- Congenital renal defects (hypoplasia or dysplasia).

Although commonly cited, there is no evidence that bubble bath, poor *cont'd page 27*

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The author



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hygiene or swimming predispose to the development of UTIs.

Vesico-ureteric reflux

Vesico-ureteric reflux (VUR) refers to retrograde flow of urine from the bladder into the ureter, which is commonly associated with UTI. It occurs in fewer than 1% of the general population but in about 30-35% of all children who present with UTI, particularly girls (32-57%) and neonates (50%).

The risk of developing VUR is about 25% in children with renal dilation on antenatal ultrasounds, 45% if a sibling has reflux, and 66% if a parent has reflux. VUR is more common in boys who develop UTIs.

VUR is graded by severity:

- Grade I — reflux of urine into the non-dilated ureter.
- Grade II — reflux into the renal pelvis and calyces without dilation.
- Grade III — reflux with mild to moderate dilation and minimal blunting of fornices.
- Grade IV — reflux with moderate ureteral tortuosity and dilation of pelvis and calyces.
- Grade V — reflux with gross dilation of ureter, pelvis and calyces, loss of papillary impressions, and ureteral tortuosity.

About 70% of children with VUR have non-dilating reflux (grades I-II). Of the remaining 30% with dilating reflux (grades III-V), most (about 70%) have bilateral reflux. The risk of UTI and renal parenchymal damage is higher in children with bilateral dilating VUR.

Most VUR resolves (or improves) with maturation of the ureterovesical junction. For example, in 80% of non-dilating VUR, the reflux will resolve by age five, and in 75% of dilating



In 80% of non-dilating VUR, the reflux will resolve by age five, and in 75% of dilating cases, by age 10.

cases, by age 10.

Resolution is more common in unilateral disease and in lower-grade reflux. However, a recent study found the spontaneous resolution rate for VUR was highest in infant boys with grade IV-V VUR and occurred in 29% in one year.¹

There is also an association between bladder dysfunction (as defined by large post-void residual volumes and large bladder capacities) and non-resolution of VUR.

Bladder dysfunction is common in children (particularly girls) and occurs in up to 50% of children with UTIs and 40% of those with VUR. It increases the risk for UTIs in children.

Non-neurogenic bladder dysfunction includes detrusor overactivity (characterised by involuntary detrusor contractions during bladder filling) and dysfunctional voiding (non-continuous urine flow rate caused by involuntary intermittent

contractions of the peri-urethral striated muscle during voiding).

Symptoms of bladder dysfunction include urgency, urge incontinence, frequency, squatting manoeuvres, incomplete bladder emptying, post-void dribbling, infrequent voids and a stop-and-start urine stream.

The diagnosis of bladder dysfunction can be made on history and confirmed by post-void bladder ultrasound and uroflow studies. Some children may need further investigation with formal urodynamic studies.

Treatment of detrusor overactivity includes increasing fluid volume, avoiding caffeine-containing beverages, and pharmacotherapy with oxybutynin (Ditropan). Treatment of dysfunctional voiding includes teaching the child voiding techniques such as how to relax the pelvic floor muscle during voiding.

The risk for UTI is higher in children with constipa-

tion (including children with dysfunctional elimination syndrome, defined as bladder instability, infrequent voiding and constipation).

The mechanism is unknown but postulated to be due to bladder distortion (from rectal distension) resulting in ureteral valve incompetence as well as stimulation of the detrusor stretch receptors, causing detrusor peroneal dyssynergism. Treating the constipation has been shown to reduce the risk of recurrent UTIs.

Although there is an increased risk of UTI in children with congenital renal defects (such as hydronephrosis and hypoplastic or dysplastic kidneys), significant congenital renal defects are rare in children and are usually detected on antenatal ultrasound.

Congenitally small kidneys occur in 0.2% of the population. In one study of 124 children with UTI, 8% had hydronephrosis or hydroureters, with posterior urethral valve diag-

nosed in one of those patients.

Recurrent UTIs

Up to 30% of children with UTI will have a recurrence of their infection. Most occur within the first 12 months after the primary infection. The risks for recurrence include:

- Age under six months at first UTI.
- Presence of dilating VUR.
- Renal damage detected at primary UTI, which may be congenital in origin.

Bacterial virulence and host susceptibility factors may also play a role in recurrent UTIs. Bacterial isolates from patients with acute pyelonephritis differ from those in patients with asymptomatic bacteriuria.

Other host susceptibility factors include immunosuppression and urinary stasis, caused by bladder dysfunction, renal calculi, obstructive uropathy or neurogenic bladder.

Pathogenesis

More than 80% of UTIs are caused by *E coli*. Other Gram-negative organisms such as *Klebsiella*, *Enterobacter*, *Proteus* and *Pseudomonas* account for an additional 10-15%. Although usually considered contaminants, staphylococci can also cause UTI.

Contamination is suggested by:

- Absence of symptoms.
- Recent manipulation or catheterisation of the urinary tract.
- Presence of epithelial cells or absence of leukocytes on urine microscopy.
- Culture of more than one organism or a low colony count.

Infection with an unusual organism (such as *Pseudomonas*) is commonly associated with recurrent infections (prolonged use of broad-spectrum antibiotics) or underlying pathology such as neurogenic bladder or obstructive uropathy.

Signs and symptoms

UTIs can be symptomatic or asymptomatic (eg, discovered during routine urinalysis). The presentation of symptomatic UTIs can vary, based on the child's age and the site of infection. The urine may appear cloudy or have an offensive odour, with or without the presence of haematuria.

Acute pyelonephritis (but not cystitis) is associated with renal parenchymal damage and increased risk of renal scarring. It is therefore important in any suspected UTI to identify the presence of fever because this sign is generally accepted as indicating renal parenchymal involvement. Absence of fever is a reliable indicator that there has been no parenchymal involvement.

In acute pyelonephritis, children may present with loin and/or abdominal pain as well as systemic features such as

fever, malaise and vomiting. In cystitis, when infection is limited to the lower urinary tract (urethra and bladder), fever is usually absent. Pyelonephritis occurs more commonly in younger children and cystitis more commonly in older children, particularly in girls over age two.

In the young child the presentation tends to be non-specific, such as poor weight gain, poor feeding, vomiting, fever, irritability or persistent jaundice. Five per cent of febrile infants and young children have UTIs.

Children older than two years more commonly present with symptoms referable to the urinary tract. The child may present with localising symptoms such as dysuria, frequency, urgency, enuresis and lower abdominal discomfort.



Assessment and diagnostic techniques

When to investigate

UTI should be considered in a child aged under two years who presents with an unexplained fever. Any child presenting with symptoms and signs suggestive of UTI should have a urine culture.

A valid urine specimen (see below) should be obtained before starting antibiotics. In infants and children suspected of having a UTI who appear unwell, antimicrobial therapy can be started after urine collection, while awaiting confirmation by culture, which usually takes 48-72 hours.

Diagnosis of UTI

Urine culture

The diagnosis of UTI is based on the culture of a pure growth of bacteria in an uncontaminated sample of urine. The method of urine collection (figure 1) is important for accurate diagnosis. What constitutes a significant colony count depends on the method of urine collection:

- Any growth for suprapubic aspiration.
- $>10^7$ organisms/L for transurethral catheterisation.
- $>10^8$ organisms/L of a single organism for clean-catch urine.
- At least two specimens with $>10^8$ organisms/L for bag urine.

Suprapubic aspiration is the gold standard for obtaining an uncontaminated urine specimen. Transurethral bladder catheterisation is also acceptable but has a 5% false-positive rate and 12% false-negative rate. Both suprapubic aspiration and catheterisation are preferable methods of urine collection in children aged under two years.

Although the use of bag-collected urine is convenient and non-invasive, it is insufficient for diagnosing UTI, as it has an unacceptably high false-positive rate of 85%. Bag urine collections are therefore not recommended for diagnosing UTI. However, a sterile culture from bag-collected urine is useful for excluding UTI.

A clean-catch MSU is adequate in the older child who is toilet trained.

Urinalysis

Rapid tests such as urinalysis and urine microscopy are often used to guide initial management.

Detection of bacteria by microscopy and Gram stain has the greatest discriminatory power for diagnosing and excluding UTI in children (sensitivity 90%, specificity 97%). However, detection by microscopy requires skilled staff and specialised equipment and is not always available.

Urinalysis is more readily available and can also be a

Figure 1: Methods of urine collection in children (in order of decreasing accuracy) include suprapubic aspiration, transurethral catheterisation, clean-catch urine and bag collection.



Table 1: Initial workup for a child with proven febrile UTI*

History	Full history including history of bladder and bowel habits and family history
Examination	Full examination including abdomen, genitals and back for spinal and neurological abnormalities, measurement of blood pressure, and urinalysis
Investigations	<ul style="list-style-type: none"> ■ Renal ultrasound on all children presenting with UTI ■ Micturating cysto-urethrography if child is aged under two years ■ DMSA scintigraphy at 6-12-month follow-up to determine permanent parenchymal damage

*Modified from Jodal and Lindberg, 1999².



Figure 2: A DMSA scan showing renal parenchymal damage.

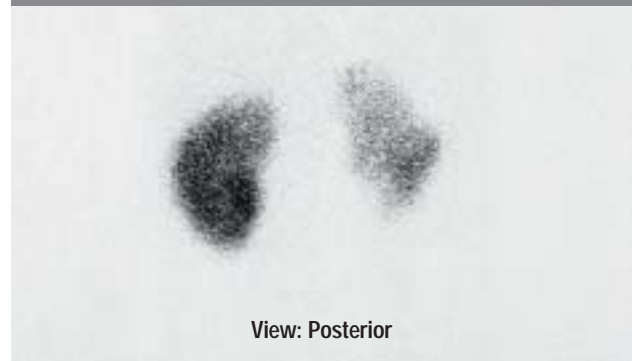


Figure 3: Micturating cysto-urethrography (MCUG) demonstrating bilateral grade V reflux with intrarenal reflux (A) and left grade V and right grade IV vesico-ureteric reflux (B).



Because of the high false-positive and false-negative rates, urinalysis alone cannot be used to diagnose or exclude a UTI.

helpful tool. The presence of both leukocyte esterase and nitrites increases the likelihood, and the absence of both decreases the likelihood, of UTI. Nitrites demonstrate higher accuracy than leukocyte esterase in detection of UTI.

Because of the high false-positive and false-negative rates, urinalysis alone cannot be used to diagnose or exclude a UTI. However, microscopy and urinalysis results suggestive of UTI in the presence of appropriate symptoms may persuade the doctor to start antimicrobial therapy while awaiting the results of the urine culture.

The role of imaging

Because UTI serves as a marker for abnormalities of the urinary tract, imaging is commonly performed to detect renal tract abnormalities, obstructive uropathy, VUR and renal parenchymal damage.

Ultrasonography

All children who present with a first UTI should have a renal ultrasound. However, as the results of ultrasonography are very operator dependent, this test should be undertaken by experienced personnel.

Ultrasonography is useful for detecting hydronephrosis, dilation of the distal ureters, bladder abnormalities and significant renal parenchymal pathology. However, it is less sensitive than DMSA scintigraphy (see next section) and detects only 40% of children found to have abnormalities on DMSA. The timing of the ultrasound after detection of a UTI is not crucial.

DMSA scintigraphy

Renal cortical scintigraphy with technetium-99m-labelled dimercaptosuccinic acid (DMSA) is the most sensitive means of identifying functional defects caused by acute changes from

pyelonephritis (which may last for months after pyelonephritis) or permanent renal scarring (either congenital scars or acquired scars seen 6-12 months after pyelonephritis) (figure 2).

It has a sensitivity of 99% and specificity of 91% for detecting acute pyelonephritis. This test is only indicated for children with febrile UTIs or renal ultrasounds suggestive of significant renal parenchymal pathology.

Extensive renal scarring may be associated with the development of hypertension, impaired renal function and end-stage renal disease. Although DMSA scans are commonly ordered by specialists when investigating UTI, there is uncertainty about the value of detecting acute DMSA changes because it does not provide sufficient prognostic information for outcome assessment.

Although acute changes detected by DMSA scan are associated with increased risk

for recurrent UTIs, children with acute changes that resolve after UTI have a low risk of renal damage, so detecting acute changes may not be that crucial.

A DMSA scan performed at least six months after UTI has greater prognostic value, as changes detected 6-12 months after UTI are more likely to be associated with permanent renal scarring and renal sequelae.

Micturating cysto-urethrography

Micturating cysto-urethrography is the gold standard for detecting vesico-ureteric reflux (figure 3). Newer methods for detecting VUR include voiding urosonography, which has lower radiation exposure, but is also less accurate in defining anatomical detail.

Micturating cysto-urethrography is a relatively simple procedure in experienced hands, requiring catheterisation of the child. Children beyond infancy often find catheterisation a traumatic experience and a few may need sedation for the procedure. (See Online resources, page 30, for a parent fact-sheet.)

Micturating cysto-urethrography is only indicated for children with febrile UTIs. Some paediatricians do not routinely perform micturating cysto-urethrography in children older than five years who present with UTI, because the procedure is unpleasant for the child and diagnosis of VUR does not alter management.

Although children can have pyelonephritis without reflux, those with dilating VUR are at increased risk of pyelonephritis and scarring from UTI.

Traditionally the procedure is performed 4-6 weeks after an acute UTI, although there is no evidence to support this practice. While awaiting the results, many authorities recommend placing the child on prophylactic antibiotics (see table 1).

Abdominal X-rays

Abdominal X-rays are occasionally used in managing children with UTIs to diagnose renal calculi or confirm the presence of constipation that may cause bladder dysfunction.

General practice therapy and treatment modalities

PROMPT diagnosis leading to early treatment with antibiotics is the primary aim of management. Delay in instituting appropriate treatment for acute pyelonephritis increases the risk of kidney damage.

Symptomatic UTIs

Most authorities recommend starting parenteral antibiotics in infants and young children with suspected acute pyelonephritis. A single large, randomised controlled trial has demonstrated no significant differences between oral and IV therapy in the duration of fever, bacteriological cure and risk of persistent renal parenchymal injury.³

Appropriate first-line empirical treatment in children includes parenteral therapy with gentamicin, amoxicillin/ampicillin, cefotaxime and ceftriaxone and oral therapy with trimethoprim-sulfamethoxazole, amoxicillin-clavulanate, cephalexin, trimethoprim and nitrofurantoin (table 2).

More than 85% of the commonly isolated organisms are sensitive to these antibiotics. There is emerging resistance of *E coli* to amoxicillin and ampicillin, so these agents cannot be used alone.

Standard length of antibiotic treatment for pyelonephritis is 7-10 days, although the optimal duration of treatment for pyelonephritis has not been determined.

In young children with afebrile UTIs, treatment with parenteral antibiotics is advised because of the increased risk of bacteraemia. In children older than six months, oral antibiotics are usually sufficient.

A meta-analysis of randomised controlled trials has shown that short-course therapy (2-4 days) is as effective as standard-course therapy (7-14 days) for cystitis.⁵ A short course of antibiotics is preferable for children, as it enhances compliance. At least two days of antibiotic therapy are essential, as single-dose therapy has been shown to be less effective.

Asymptomatic bacteriuria

The prevalence of asymptomatic bacteriuria (significant number of bacteria in the urine of a child with no UTI symptoms) is 1.8% in school-girls aged 4-11. It is much less



A meta-analysis of randomised controlled trials has shown that short-course therapy (2-4 days) is as effective as standard-course therapy (7-14 days) for cystitis.

common in boys and is estimated at 0.03%. Girls with untreated asymptomatic bacteriuria are not at higher risk of renal scarring or deterioration in renal function even in the presence of renal scarring.

Asymptomatic bacteriuria in children is considered a benign condition that should not be treated with antibiotics. Eliminating asymptomatic bacteriuria with antibiotics predisposes the child to UTI recurrence, including symptomatic UTIs. It also increases the risk of developing antibiotic resistance.

Follow-up

A follow-up urine culture after the conclusion of antibiotic therapy is commonly advised although sometimes omitted on the grounds that

Table 2: Antibiotics for empirical treatment of UTI in children*

Antibiotic	Dose
Gentamicin (IV/IM) and Amoxicillin or ampicillin	7.5mg/kg/day in < 10-year-olds, 6mg/kg/day in >10-year-olds 25mg/kg/day up to 1g in four divided doses
Cefotaxime (IV/IM)	50mg/kg/day up to 1g in three divided doses
Ceftriaxone (IV/IM)	50mg/kg/day up to 1g daily
Trimethoprim-sulfamethoxazole	4+20mg/kg/day up to 160+800mg in two divided doses
Amoxicillin-clavulanate	22.5+3.2mg/kg/day up to 875+125mg in two divided doses
Cephalexin	12.5mg/kg/day up to 500mg in four divided doses
Trimethoprim (tablet only)	6mg/kg/day up to 300mg daily

*Therapeutic Guidelines Antibiotic Writing Group, 2003.⁴

asymptomatic bacteriuria should not be treated.

All children with renal scarring should be reviewed annually, including assessment of blood pressure, and urinalysis for detecting proteinuria. They should also have follow-up investigations by DMSA scan after one year if acute DMSA changes were found on the initial investigation, to evaluate progression of renal damage.

Preventing UTI

Managing vesico-ureteric reflux

Since the 1960s, when Hodson demonstrated an association between VUR and scarred kidneys, there has been a focus on diagnosing and treating VUR. Initially children with dilating reflux underwent surgical ureteric reimplantation. There is now evidence of no difference in outcomes between children who are treated by surgical compared with medical strategies (prophylactic antibiotics).⁶

Children with VUR are commonly treated with long-term prophylactic antibiotics (such as trimethoprim, trimethoprim-sulfamethoxazole and nitrofurantoin), particularly for dilating VUR. Traditionally this is continued until the reflux resolves or until the child reaches five years of age, when the risk of pyelonephritis is lower.

Problems with prophylactic antibiotics include formulation for young children (nitrofurantoin and

trimethoprim are not available in suspensions), side effects of the medication (including increased risk of thrush), concerns regarding the promotion of resistant organisms and high break-through UTI rates (40-60%).

Although there is a slight reduction in the risk of UTI recurrence with prophylactic antibiotics, the evidence supporting this practice is weak. Because prevention strategies are largely ineffective, the emphasis should be placed on early detection and treatment of pyelonephritis to prevent renal scarring.

Circumcision

Circumcision is associated with a tenfold reduction in the incidence of UTI during the first year of life. This means that 100 boys in the general population would have to be circumcised to prevent 2-3 UTIs. In the highest-risk children (such as those with recurrent UTIs), 30 (or more) UTIs can be prevented for every 100 children circumcised.

Recurrent UTI

There is no consensus about the management of recurrent UTIs in children. Some experts advocate the use of prophylactic antibiotics for 3-6 months. As recurrent UTIs are common in girls with bladder dysfunction, treatment of the bladder dysfunction may reduce the incidence of recurrent UTI.

Prognosis

RENAL scarring predisposes to hypertension, impaired renal function and end-stage renal disease. Infants and young children with pyelonephritis, children with UTI and dilating reflux, and children with recurrent UTIs are at increased risk of renal scarring.

Acute pyelonephritis results in acute changes seen on DMSA in 20-90% of children. Most of these resolve but permanent renal scarring is seen in 5% of children with pyelonephritis,



particularly those with multiple episodes of UTI.

Most girls with scarring

develop it in association with recurrent febrile UTIs but not dilating VUR. In contrast, most infant boys with scarring have congenital renal dysplasia with dilating reflux and may not develop UTIs.

In series of selected patients hypertension affects at least 10% of children with renal scars. However, in long-term population-based studies of children presenting with UTI and found to have renal damage, the risk of hyper-

tension is much lower.

Reflux nephropathy (whether congenital or acquired) accounts for 7-17% of end-stage renal disease worldwide. In Australia there are about 75-80 new cases caused by reflux nephropathy each year.

Future developments

Emerging research is challenging the way UTI in children is traditionally managed. The new focus is on prevention and early treat-

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Summary

- Risk factors for UTI include vesico-ureteric reflux (VUR), urinary stasis, bladder dysfunction, chronic constipation and congenital renal defects (level IV evidence).
- Risk factors for recurrence includes age < six months at first UTI, presence of dilating VUR and renal damage detected at primary UTI (level IV evidence).
- There is no difference in outcomes between surgical ureteric reimplantation and use of prophylactic antibiotics in the management of VUR (level I evidence).
- Children with VUR are commonly treated with prophylactic antibiotics although data are currently inadequate to determine whether this reduces the risk of further UTI and renal damage (level I evidence).

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ment of pyelonephritis in children, regardless of the presence or absence of VUR.

The importance of dilating VUR in the pathogenesis of acute pyelonephritis and renal damage has been downgraded in recognition that congenital renal dysplasia is the main risk factor for renal failure.

The role of surgery has also changed, with the declining place for ureteric reimplantation surgery for reflux and recognition of the role of circumcision in high-risk infant boys.

The role of antibiotic prophylaxis remains uncertain and a multicentre, randomised controlled trial to determine the effectiveness of prophylactic antibiotics in preventing recurrent UTIs in children is underway in Australia.

Practice points

- Bag urine collections are not recommended for diagnosing UTI (level III evidence).
- Urinalysis cannot substitute for urine culture in diagnosing UTI (level I evidence).
- All children with renal scarring should be reviewed annually (level IV evidence).
- Circumcision is associated with a tenfold reduction in the incidence of UTI (level I evidence).
- Asymptomatic bacteriuria in children is considered a benign condition that should not be treated with antibiotics (level IV evidence).

Take-home messages

- The emphasis of investigations has changed from detecting VUR to identifying children with acute pyelonephritis (level III evidence).
- Prompt diagnosis leading to early treatment with antibiotics is the primary aim of management. Delay in treating acute pyelonephritis increases the risk of kidney damage (level IV evidence).
- Infants and young children with pyelonephritis, children with UTI and dilating reflux and children with recurrent UTIs are at increased risk of renal scarring (level IV evidence).

What not to miss

- The presence of UTI should be considered in any child aged < two years who presents with an unexplained fever (level III evidence).
- Recurrent UTIs occur in one-third of children with UTI, mostly within the first 12 months after the primary infection (level III evidence).
- In the young child, presentation of UTI tends to be non-specific. In older children symptoms are more commonly referable to the urinary tract (level IV evidence).

Levels of evidence based on NHMRC 1999 guidelines

- Level I evidence obtained from a systematic review of all relevant randomised controlled trials
- Level II evidence obtained from at least one properly designed randomised controlled trial
- Level III evidence obtained from well-designed, pseudo-randomised controlled trials or comparative studies with controls
- Level IV evidence obtained from case series

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Online resources

Parent fact-sheet on micturating cysto-urethrography (from the Children's Hospital at Westmead): www.chw.edu.au/parents/factsheets/ptcystog.htm
 Parent fact-sheet on urinary tract infection in children (from the Children's Hospital at Westmead): www.chw.edu.au/parents/factsheets/uritracj.htm

Therapeutic guidelines on antibiotic use in urinary tract infections: <http://etg.hcn.net.au> (available through the Clinical Information Access Program [CIAP]: www.ciap.health.nsw.gov.au)

Management of UTI in children. From *The Children's Hospital at Westmead Handbook*, available through CIAP: www.use.hcn.com.au/content.%2Ffile.pdf?I3=chw%2FrenalMedicine%2FUrinary_tract_infection.pdf

Author's case studies

Kelly

KELLY, age three months, presented with her first episode of febrile UTI. She had been unwell for 36 hours, with irritability, poor feeding and a temperature of 38.9°C. On presentation to hospital, a urine sample was collected by suprapubic aspiration. Urinalysis was positive for nitrates, protein and leukocyte esterase.

Kelly was admitted to hospital and administered IV gentamicin and ampicillin. Urine culture three days later confirmed *E Coli* UTI, which was sensitive to trimethoprim-sulfamethoxazole. Kelly was discharged and continued on oral antibiotics for seven days.

Subsequent investigations, including renal ultrasound and DMSA scan, were normal. However, micturating cysto-urethrography confirmed bilateral VUR (grade I on the right and grade III on the left). Kelly was placed on prophylactic antibiotics.

Prompt recognition of UTI symptoms is important.

Karl

Karl, age three years, has recurrent UTI. He had his first UTI at age five months. Micturating cysto-urethrography at the time confirmed left-sided grade III VUR. There is a family history of kidney disease and hypertension on Karl's father's side.

Karl's DMSA scan at age eight months demonstrated bilateral cortical defects. He was placed on prophylactic antibiotics and seen again at three years. He developed five further episodes of UTI despite prophylactic antibiotics, and circumcision was offered. Karl will need repeat DMSA scan and close monitoring.

Break-through UTI may occur despite use of prophylactic antibiotics. Children with renal damage should be reviewed annually.

Kim

Kim, age five years, presented with a two-day history of daytime incontinence and dysuria. She was afebrile and otherwise well. A urine culture



Symptoms suggestive of UTI may have other causes, for example, skin irritation.

taken by her GP confirmed an *E Coli* UTI, which was treated with oral trimethoprim-sulfamethoxazole for one week.

Kim represented 10 days later with a recurrence of her symptoms. A repeat urine culture was negative for UTI. On examination there was mild inflammation of the skin around the perineal area. The parents were reassured that Kim did not have a UTI. The symptoms resolved after application of a barrier cream for three days.

A negative urine culture excludes UTI. Symptoms suggestive of UTI may have other causes, for example, skin irritation.

Karen

Karen, 10, has had 12 episodes of UTI since age two years. Her UTIs were sometimes associated with fever. She initially tried prophylactic antibiotics for six months but found her UTIs recurred when she stopped them. She restarted but finally stopped them again after an episode of break-through UTI.

On further history it was discovered that Karen had frequency and occasional daytime incontinence. She did not drink much because she was worried she would need to go to the toilet all the time. She described a stop-and-start urine stream, dribbling of urine after completion of voiding, and feelings of incomplete bladder emptying. She also had constipation.

Karen's constipation was treated with laxatives and dietary changes. She was advised to increase her fluid intake to 1.5 L/day and reduce her cola intake. She was taught to relax her pelvic floor muscles whenever she voided or opened her bowels. Her constipation and daytime incontinence resolved after one month of treatment and she did not have further problems with UTI.

This case illustrates the problems of break-through UTIs in patients taking prophylactic antibiotics. Constipation and bladder dysfunction may contribute to recurrent UTIs.

GP's contribution



DR MARCELA COX
Leichhardt, NSW

Case study

JESSICA had just turned three when she presented with acute onset of dysuria. She had no significant past history of note, in particular no history of renal tract problems. There was no family history. Jessica was not constipated and did not seem to have symptoms consistent with bladder dysfunction.

Examination showed Jessica to be afebrile with normal blood pressure and no loin tenderness. A clean-catch MSU showed a pure growth of *E coli* and she was treated with cephalexin for five days.

At follow-up investigations, Jessica's renal ultrasound revealed no abnormality of the renal parenchyma, but mild prominence of the pelvicalyceal system was noted bilaterally (the diameter of the calyces was 3-4mm).

On the basis of the ultra-

sound result, the radiologist suggested Jessica undergo micturating cysto-urethrography, which she had the same day. This proved to be normal with no evidence of vesicoureteric reflux.

Jessica is now 7 and has had no further UTIs.

Questions for the author

You mention DMSA scanning in the table of investigations, which is an investigation not done for Jessica. Should a DMSA scan be performed in all cases of UTI or only after a febrile UTI?

As afebrile UTIs have a negligible risk of renal damage and scarring, a DMSA scan can only detect congenital scarring, which does not affect management. I usually only perform DMSA scans on children with febrile UTIs.

Jessica had not been initially referred for micturating cysto-urethrography and thus had this test performed without prophylactic antibiotic cover. What do you usually recommend regarding antibiotic cover for this procedure — full or half dose and for how many doses?

Radiologists usually insist on antibiotic cover for mic-



turating cysto-urethrography because of the very small risk of UTI from the procedure. Antibiotics are given at a treatment dosage (ie, bd) for a total of three days (ie, six doses), beginning the day before the test.

If Jessica were to develop another afebrile UTI, would she require any further investigation at that point? If she had previously only had the ultrasound, would this influence the need for further tests?

I usually do not perform micturating cysto-urethrography for the investigation of first presentation of afebrile UTIs. However, if Jessica had recurrent afebrile UTIs, many

would recommend micturating cysto-urethrography.

I think the most important thing is to take a careful history from the mother and child to ensure relevant information has not been missed, as often these children have problems with constipation or pelvic floor overactivity and incomplete bladder emptying, which predisposes to recurrent UTI.

General questions for the author

You mention that all children with their first UTI need an ultrasound scan. Is there a clear age for girls at which this is no longer necessary and they can be treated the same

as adult women with UTIs?

There is no clear age. As UTI is often the first indication of renal pathology and because ultrasounds are non-invasive and readily available, I do not hesitate to perform an ultrasound in girls who present with their first UTI. However, in girls who are sexually active, the causes of UTIs would be similar to those in adult women.

If a GP chooses to manage bladder dysfunction in a child, what dose and what titration regimen would you advise for using Ditropan?

Management of bladder dysfunction would depend on the cause. In children with detrusor instability, my first treatment is to ensure adequate fluids. I would only add Ditropan (2.5mg bd to 5mg tds) when the child has tried fluids for several weeks without success. In children with pelvic floor overactivity, management would be teaching them to relax their pelvic floor muscles for voiding and defecating.

Where do you refer children for assistance with learning to relax their pelvic floor muscles?

Children can be referred to physiotherapists or continence advisors for help with learning to relax their pelvic floor muscles. GPs can easily manage this in their rooms by teaching the child correct positioning and leg support when sitting on the toilet, and how to relax the pelvic floor muscles by gently pushing out their lower abdominal muscles as they void or defecate.

Can over-the-counter symptomatic treatments for dysuria, such as Ural, be safely used in children?

Although Ural can be used safely in children, it only provides symptomatic relief and does not eradicate the organism. Therefore children with symptomatic UTI still need to be treated with antibiotics.

Is there any evidence that cranberry juice helps prevent UTIs in children?

There is some evidence that cranberry juice can prevent UTIs in women. The effectiveness in children is unknown. However, the high drop-out rates in adult studies suggest that this treatment may not be acceptable over a long period.



How To Treat Quiz

UTIs in children — 22 April 2005

INSTRUCTIONS

Complete this quiz to earn 2 CPD points and/or 2 PDP points by marking the correct answer(s) with an X on this form. Fill in your contact details and return to us by fax or free post.

FAX BACK	FREE POST
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www.australiandoctor.au/cpd for immediate feedback

1. Which ONE factor is least likely to increase the risk of UTI in children?

- a) Urinary stasis
- b) VUR
- c) Poor hygiene
- d) Congenital renal defects

2. Ella, six months, has a 24-hour history of fever and vomiting. Examination is normal apart from fever. Which THREE factors would alert you to the possibility of pyelonephritis?

- a) Ella's father has diabetic nephropathy
- b) White cells on urinalysis of a bag-collected urine sample
- c) Unexplained fever
- d) A past history of pyelonephritis

3. A urine culture is obtained. Which ONE result is LEAST likely to signify infection in a urine sample?

- a) >10⁷ organisms/L on a transurethral catheterisation sample
- b) >10⁸ organisms/L on a single bag-collected sample
- c) >10⁸ organisms/L on a clean-catch sample

d) Any growth on a suprapubic aspiration sample

4. An *E coli* UTI is confirmed and appropriate antibiotic therapy is completed. A renal ultrasound and MCUG show bilateral grade II VUR. Which ONE statement is correct in Ella's situation?

- a) 80% of non-dilating VUR resolves by age five years
- b) Surgical ureteric reimplantation is indicated
- c) There is a very high risk of renal parenchymal damage
- d) There is strong evidence that prophylactic antibiotics must be given until the VUR has resolved

5. Which ONE statement about DMSA scans is correct?

- a) Permanent renal scarring always occurs if there are changes on an acute DMSA scan
- b) Permanent renal scarring can be assessed one month after pyelonephritis
- c) The scans can be useful in assessing the bladder after recurrent UTIs

d) The scans have prognostic value

6. Carly, four years, has a one-day history of painful micturition. An affirmative answer to which TWO questions will identify risk factors for UTI?

- a) Has Carly had urinary frequency, urgency or dribbling after micturition, before she developed dysuria?
- b) Does she use bubble bath?
- c) Does she swim frequently?
- d) Has she been constipated?

7. A UTI is confirmed and treated. Carly continues to have frequency and some accidents. A repeat MSU is normal. Which ONE aspect of assessment is not helpful in diagnosing bladder dysfunction?

- a) MCUG
- b) History
- c) Uroflow studies
- d) Post-void bladder ultrasound

8. Ben, 7 months, is not feeding well and is unsettled. He has been afebrile. Urinalysis of a clean-catch urine sample is consistent

with a UTI. Which TWO antibiotics are appropriate?

- a) Amoxicillin
- b) Cephalexin
- c) Trimethoprim
- d) Amoxicillin-clavulanate

9. A UTI is confirmed. Which ONE statement about Ben's situation is correct?

- a) Circumcision is not associated with reduced frequency of UTIs
- b) Further investigation is not necessary, as Ben has been afebrile
- c) In the neonatal period boys are 5-10 times more susceptible to UTIs
- d) 10% of boys will have had a UTI by age 10 years

10. Which THREE conditions increase the risk of renal scarring in children?

- a) Recurrent UTIs
- b) UTI and dilating reflux
- c) Pyelonephritis in infants and young children
- d) Asymptomatic bacteriuria

CONTACT DETAILS

Dr: Phone: E-mail:

RACGP QA & CPD No: and /or ACRRM membership No:

Address: Postcode:

The mark required to obtain points is 80%. Please note that some questions have more than one correct answer. Your CPD activity will be updated on your RACGP records every January, April, July and October.

NEXT WEEK The next How to Treat explores androgens and the ageing male. The authors are Dr Carolyn Allan, a consultant endocrinologist at Monash Medical Centre and The Jean Hailes Medical Centre for Women, and a clinical research fellow at Prince Henry's Institute of Medical Research, Melbourne, and Professor Robert McLachlan, deputy director of endocrinology at Monash Medical Centre and a principal senior research fellow at Prince Henry's Institute of Medical Research.

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