NICE National Institute for Health and Care Excellence

NICE guideline

Urinary tract infection in under 16s: diagnosis and management

Clinical guideline

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Contents

This guideline is the basis of QS36 and QS64.

Introduction

In the past 30–50 years, the natural history of urinary tract infection (UTI) in children has changed as a result of the introduction of antibiotics and improvements in healthcare. This change has contributed to uncertainty about the most appropriate and effective way to manage UTI in children, and whether or not investigations and follow-up are justified.

UTI is a common bacterial infection causing illness in infants and children. It may be difficult to recognise UTI in children because the presenting symptoms and signs are non-specific, particularly in infants and children younger than 3 years. Collecting urine and interpreting results are not easy in this age group, so it may not always be possible to unequivocally confirm the diagnosis.

Current management, which includes imaging, prophylaxis and prolonged follow-up, has placed a heavy burden on NHS primary and secondary care resources. It is costly, based on limited evidence and is unpleasant for children and distressing for their parents or carers. The aim of this guideline is to achieve more consistent clinical practice, based on accurate diagnosis and effective management.

Child-centred care

This guideline offers best practice advice on the care of infants, children and young people younger than 16 years with UTI.

Treatment and care should take into account children's needs and preferences, as well as those of their parents or carers. Children with UTI should have the opportunity to make informed decisions about their care and treatment in partnership with their healthcare professionals, but this depends on their age and capacity to make decisions. It is good practice for healthcare professionals to involve children and their parents or carers in the decision-making process. Where a child is not old enough or does not have the capacity to make decisions, healthcare professionals should follow the Department of Health's advice on consent and the code of practice that accompanies the Mental Capacity Act. In Wales, healthcare professionals should follow advice on consent from the Welsh Government.

If the patient is under 16, healthcare professionals should follow the guidelines in the Department of Health's Seeking consent: working with children.

Good communication between healthcare professionals and children and their parents or carers is essential. It should be supported by evidence-based written information tailored to the person's needs. Treatment and care, and the information given about this, should be culturally appropriate. It should also be accessible to people with additional needs such as physical, sensory or learning disabilities, and to people who do not speak or read English.

Parents or carers should have the opportunity to be involved in decisions about their child's care and treatment. Parents or carers also need to give consent to their child's care.

Parents or carers should also be given the information and support they need.

Key priorities for implementation

Symptoms and signs

- Infants and children presenting with unexplained fever of 38°C or higher should have a urine sample tested after 24 hours at the latest.
- Infants and children with symptoms and signs suggestive of urinary tract infection (UTI) should have a urine sample tested for infection. Table 1 is a guide to the symptoms and signs that infants and children present with.

Urine collection

- A clean catch urine sample is the recommended method for urine collection. If a clean catch urine sample is unobtainable:
  - Other non-invasive methods such as urine collection pads should be used. It is important to follow the manufacturers' instructions when using urine collection pads. Cotton wool balls, gauze and sanitary towels should not be used to collect urine in infants and children.
  - When it is not possible or practical to collect urine by non-invasive methods, catheter samples or suprapubic aspiration (SPA) should be used.
  - Before SPA is attempted, ultrasound guidance should be used to demonstrate the presence of urine in the bladder.

Urine testing

- The urine-testing strategies shown in tables 2–5 are recommended.[1]

History and examination on confirmed UTI

- The following risk factors for UTI and serious underlying pathology should be recorded:
  - poor urine flow
  - history suggesting previous UTI or confirmed previous UTI
  - recurrent fever of uncertain origin
  - antenatally-diagnosed renal abnormality

  - family history of vesicoureteric reflux (VUR) or renal disease
  - constipation
  - dysfunctional voiding
  - enlarged bladder
  - abdominal mass
  - evidence of spinal lesion
  - poor growth
  - high blood pressure.

Acute management

- Infants younger than 3 months with a possible UTI should be referred immediately to the care of a paediatric specialist. Treatment should be with parenteral antibiotics in line with Feverish illness in children(NICE clinical guideline 47).
- For infants and children 3 months or older with acute pyelonephritis/upper urinary tract infection:
  - consider referral to a paediatric specialist
  - treat with oral antibiotics for 7–10 days. The use of an oral antibiotic with low resistance patterns is recommended, for example cephalosporin or co-amoxiclav
  - if oral antibiotics cannot be used, treat with an intravenous (IV) antibiotic agent such as cefotaxime or ceftriaxone for 2–4 days followed by oral antibiotics for a total duration of 10 days.
- For infants and children 3 months or older with cystitis/lower urinary tract infection:
  - treat with oral antibiotics for 3 days. The choice of antibiotics should be directed by locally developed multidisciplinary guidance. Trimethoprim, nitrofurantoin, cephalosporin or amoxicillin may be suitable
  - the parents or carers should be advised to bring the infant or child for reassessment if the infant or child is still unwell after 24–48 hours. If an alternative diagnosis is not

made, a urine sample should be sent for culture to identify the presence of bacteria and determine antibiotic sensitivity if urine culture has not already been carried out.

Antibiotic prophylaxis

- Antibiotic prophylaxis should not be routinely recommended in infants and children following first-time UTI.

Imaging tests

- Infants and children who have had a UTI should be imaged as outlined in tables 6, 7 and 8.

[1] Assess the risk of serious illness in line with Feverish illness in children (NICE clinical guideline 47) to ensure appropriate urine tests and interpretation, both of which depend on the child's age and risk of serious illness.

1 Guidance

The following guidance is based on the best available evidence. The full guideline gives details of the methods and the evidence used to develop the guidance (see section 5 for details).

1.1 Diagnosis

1.1.1 Symptoms and signs

1.1.1.1 Infants and children presenting with unexplained fever of 38°C or higher should have a urine sample tested after 24 hours at the latest.

1.1.1.2 Infants and children with an alternative site of infection should not have a urine sample tested. When infants and children with an alternative site of infection remain unwell, urine testing should be considered after 24 hours at the latest.

1.1.1.3 Infants and children with symptoms and signs suggestive of urinary tract infection (UTI) should have a urine sample tested for infection. Table 1 is a guide to the symptoms and signs that infants and children present with.

Table 1 Presenting symptoms and signs in infants and children with UTI

Age group	Symptoms and signs Most common ----------> Least common		
Infants younger than 3 months	Fever Vomiting Lethargy Irritability	Poor feeding Failure to thrive	Abdominal pain Jaundice Haematuria Offensive urine

Infants and children, 3 months or older	**Preverbal**	Fever	Abdominal pain Loin tenderness Vomiting Poor feeding	Lethargy Irritability Haematuria Offensive urine Failure to thrive
	Verbal	Frequency Dysuria	Dysfunctional voiding Changes to continence Abdominal pain Loin tenderness	Fever Malaise Vomiting Haematuria Offensive urine Cloudy urine

1.1.2 Assessment of risk of serious illness

1.1.2.1 The illness level in infants and children should be assessed in accordance with recommendations in Feverish illness in children (NICE clinical guideline 47).

1.1.3 Urine collection

1.1.3.1 A clean catch urine sample is the recommended method for urine collection. If a clean catch urine sample is unobtainable:

- Other non-invasive methods such as urine collection pads should be used. It is important to follow the manufacturer's instructions when using urine collection pads. Cotton wool balls, gauze and sanitary towels should not be used to collect urine in infants and children.
- When it is not possible or practical to collect urine by non-invasive methods, catheter samples or suprapubic aspiration (SPA) should be used.
- Before SPA is attempted, ultrasound guidance should be used to demonstrate the presence of urine in the bladder.

1.1.3.2 In an infant or child with a high risk of serious illness it is highly preferable that a urine sample is obtained; however, treatment should not be delayed if a urine sample is unobtainable.

1.1.4 Urine preservation

1.1.4.1 If urine is to be cultured but cannot be cultured within 4 hours of collection, the sample should be refrigerated or preserved with boric acid immediately.

1.1.4.2 The manufacturer's instructions should be followed when boric acid is used to ensure the correct specimen volume to avoid potential toxicity against bacteria in the specimen.

1.1.5 Urine testing

1.1.5.1 The urine-testing strategies shown in tables 2–5 are recommended.[2]

As with all diagnostic tests there will be a small number of false negative results; therefore clinicians should use clinical criteria for their decisions in cases where urine testing does not support the findings.

Table 2 Urine-testing strategy for infants younger than 3 months

All infants younger than 3 months with suspected UTI (see table 1) should be referred to paediatric specialist care and a urine sample should be sent for urgent microscopy and culture. These infants should be managed in accordance with the recommendations for this age group in Feverish illness in children (NICE clinical guideline 47).

Table 3 Urine-testing strategies for infants and children 3 months or older but younger than 3 years

Urgent microscopy and culture is the preferred method for diagnosing UTI in this age group; this should be used where possible.	
If the infant or child has specific urinary symptoms	Urgent microscopy and culture should be arranged and antibiotic treatment should be started. When urgent microscopy is not available, a urine sample should be sent for microscopy and culture, and antibiotic treatment should be started.

If the symptoms are non-specific to UTI	• For an infant or child with a high risk of serious illness: the infant or child should be urgently referred to a paediatric specialist where a urine sample should be sent for urgent microscopy and culture. Such infants and children should be managed in line with Feverish illness in children (NICE clinical guideline 47). • For an infant or child with an intermediate risk of serious illness: if the situation demands, the infant or child may be referred urgently to a paediatric specialist. For infants and children who do not require paediatric specialist referral, urgent microscopy and culture should be arranged. Antibiotic treatment should be started if microscopy is positive (see table 5). When urgent microscopy is not available, dipstick testing may act as a substitute. The presence of nitrites suggests the possibility of infection and antibiotic treatment should be started (see table 4). In all cases, a urine sample should be sent for microscopy and culture. • For an infant or child with a low risk of serious illness: microscopy and culture should be arranged. Antibiotic treatment should only be started if microscopy or culture is positive.

Table 4 Urine-testing strategies for children 3 years or older

Dipstick testing for leukocyte esterase and nitrite is diagnostically as useful as microscopy and culture, and can safely be used.	
If both leukocyte esterase and nitrite are positive	The child should be regarded as having UTI and antibiotic treatment should be started. If a child has a high or intermediate risk of serious illness and/or a past history of previous UTI, a urine sample should be sent for culture.
If leukocyte esterase is negative and nitrite is positive	Antibiotic treatment should be started if the urine test was carried out on a fresh sample of urine. A urine sample should be sent for culture. Subsequent management will depend upon the result of urine culture.

If leukocyte esterase is positive and nitrite is negative	A urine sample should be sent for microscopy and culture. Antibiotic treatment for UTI should not be started unless there is good clinical evidence of UTI (for example, obvious urinary symptoms). Leukocyte esterase may be indicative of an infection outside the urinary tract which may need to be managed differently.
If both leukocyte esterase and nitrite are negative	The child should not be regarded as having UTI. Antibiotic treatment for UTI should not be started, and a urine sample should not be sent for culture. Other causes of illness should be explored.

Table 5 Guidance on the interpretation of microscopy results

Microscopy results	Pyuria positive	Pyuria negative
Bacteriuria positive	The infant or child should be regarded as having UTI	The infant or child should be regarded as having UTI
Bacteriuria negative	Antibiotic treatment should be started if clinically UTI	The infant or child should be regarded as not having UTI

1.1.6 Indication for culture

1.1.6.1 Urine samples should be sent for culture:

- in infants and children who have a diagnosis of acute pyelonephritis/upper urinary tract infection (see 1.1.8.1)
- in infants and children with a high to intermediate risk of serious illness
- in infants and children under 3 years
- in infants and children with a single positive result for leukocyte esterase or nitrite
- in infants and children with recurrent UTI
- in infants and children with an infection that does not respond to treatment within 24–48 hours, if no sample has already been sent

- when clinical symptoms and dipstick tests do not correlate.

1.1.7 History and examination on confirmed UTI

1.1.7.1 The following risk factors for UTI and serious underlying pathology should be recorded:

- poor urine flow
- history suggesting previous UTI or confirmed previous UTI
- recurrent fever of uncertain origin
- antenatally-diagnosed renal abnormality
- family history of vesicoureteric reflux (VUR) or renal disease
- constipation
- dysfunctional voiding
- enlarged bladder
- abdominal mass
- evidence of spinal lesion
- poor growth
- high blood pressure.

1.1.8 Clinical differentiation between acute pyelonephritis/upper urinary tract infection and cystitis/lower urinary tract infection

1.1.8.1 Infants and children who have bacteriuria and fever of 38°C or higher should be considered to have acute pyelonephritis/upper urinary tract infection. Infants and children presenting with fever lower than 38°C with loin pain/tenderness and bacteriuria should also be considered to haveacute pyelonephritis/upper urinary tract infection. All other infants and children who have bacteriuria but no systemic symptoms or signs should be considered to have cystitis/lower urinary tract infection.

1.1.9 Laboratory tests for localising UTI

1.1.9.1 C-reactive protein alone should not be used to differentiate acute pyelonephritis/upper urinary tract infection from cystitis/lower urinary tract infection in infants and children.

1.1.10 Imaging tests for localising UTI

1.1.10.1 The routine use of imaging in the localisation of a UTI is not recommended.

1.1.10.2 In the rare instances when it is clinically important to confirm or exclude acute pyelonephritis/upper urinary tract infection, power Doppler ultrasound is recommended. When this is not available or the diagnosis still cannot be confirmed, a dimercaptosuccinic acid (DMSA) scintigraphy scan is recommended.

1.2 Acute management

Note that the antibiotic requirements for infants and children with conditions that are outside the scope of this guideline (for example, infants and children already known to have significant pre-existing uropathies) have not been addressed and may be different from those given here.

1.2.1.1 Infants and children with a high risk of serious illness should be referred urgently to the care of a paediatric specialist.

1.2.1.2 Infants younger than 3 months with a possible UTI should be referred immediately to the care of a paediatric specialist. Treatment should be with parenteral antibiotics in line with Feverish illness in children (NICE clinical guideline 47).

1.2.1.3 For infants and children 3 months or older with acute pyelonephritis/upper urinary tract infection:

- consider referral to a paediatric specialist
- treat with oral antibiotics for 7–10 days. The use of an oral antibiotic with low resistance patterns is recommended, for example cephalosporin or co-amoxiclav

- if oral antibiotics cannot be used, treat with an intravenous (IV) antibiotic agent such as cefotaxime or ceftriaxone for 2–4 days followed by oral antibiotics for a total duration of 10 days.

1.2.1.4 For infants and children 3 months or older with cystitis/lower urinary tract infection:

- treat with oral antibiotics for 3 days. The choice of antibiotics should be directed by locally developed multidisciplinary guidance. Trimethoprim, nitrofurantoin, cephalosporin or amoxicillin may be suitable.
- the parents or carers should be advised to bring the infant or child for reassessment if the infant or child is still unwell after 24–48 hours. If an alternative diagnosis is not made, a urine sample should be sent for culture to identify the presence of bacteria and determine antibiotic sensitivity if urine culture has not already been carried out.

1.2.1.5 For infants and children who receive aminoglycosides (gentamicin or amikacin), once daily dosing is recommended.

1.2.1.6 If parenteral treatment is required and IV treatment is not possible, intramuscular treatment should be considered.

1.2.1.7 If an infant or child is receiving prophylactic medication and develops an infection, treatment should be with a different antibiotic, not a higher dose of the same antibiotic.

1.2.1.8 Asymptomatic bacteriuria in infants and children should not be treated with antibiotics.

1.2.1.9 Laboratories should monitor resistance patterns of urinary pathogens and make this information routinely available to prescribers.

1.2.2 Prevention of recurrence

1.2.2.1 Dysfunctional elimination syndromes and constipation should be addressed in infants and children who have had a UTI.

1.2.2.2 Children who have had a UTI should be encouraged to drink an adequate amount.

1.2.2.3 Children who have had a UTI should have ready access to clean toilets when required and should not be expected to delay voiding.

1.2.3 Antibiotic prophylaxis

1.2.3.1 Antibiotic prophylaxis should not be routinely recommended in infants and children following first-time UTI.

1.2.3.2 Antibiotic prophylaxis may be considered in infants and children with recurrent UTI.

1.2.3.3 Asymptomatic bacteriuria in infants and children should not be treated with prophylactic antibiotics.

1.3 Imaging tests

1.3.1.1 Infants and children with atypical UTI (see box 1) should have ultrasound of the urinary tract during the acute infection to identify structural abnormalities of the urinary tract such as obstruction, as outlined in tables 6, 7 and 8. This is to ensure prompt management.

1.3.1.2 For infants younger than 6 months with first-time UTI that responds to treatment, ultrasound should be carried out within 6 weeks of the UTI, as outlined in table 6.

1.3.1.3 For infants and children aged 6 months and older with first-time UTI that responds to treatment, routine ultrasound is not recommended unless the infant or child has atypical UTI, as outlined in tables 7 and 8.

1.3.1.4 Infants and children who have had a lower urinary tract infection should undergo ultrasound (within 6 weeks) only if they are younger than 6 months or have had recurrent infections.

1.3.1.5 A DMSA scan 4–6 months following the acute infection should be used to detect renal parenchymal defects, as outlined in tables 6, 7 and 8.

1.3.1.6 If the infant or child has a subsequent UTI while awaiting DMSA, the timing of the DMSA should be reviewed and consideration given to doing it sooner.

1.3.1.7 Routine imaging to identify VUR is not recommended for infants and children who have had a UTI, except in specific circumstances, as outlined in tables 6, 7 and 8.

1.3.1.8 When a micturating cystourethrogram (MCUG) is performed, prophylactic antibiotics should be given orally for 3 days with MCUG taking place on the second day.

1.3.1.9 Infants and children who have had a UTI should be imaged as outlined in tables 6, 7 and 8.

Table 6 Recommended imaging schedule for infants younger than 6 months

Test	Responds well to treatment within 48 hours	Atypical UTIa	Recurrent UTI[a]
Ultrasound during the acute infection	No	Yes[c]	Yes
Ultrasound within 6 weeks	Yes[b]	No	No
DMSA 4–6 months following the acute infection	No	Yes	Yes
MCUG	No	Yes	Yes

[a] See box 1 for definition

[b] If abnormal consider MCUG

[c] In an infant or child with a non-*E. coli*-UTI, responding well to antibiotics and with no other features of atypical infection, the ultrasound can be requested on a non-urgent basis to take place within 6 weeks

Table 7 Recommended imaging schedule for infants and children 6 months or older but younger than 3 years

Test	Responds well to treatment within 48 hours	Atypical UTIa	Recurrent UTI[a]
Ultrasound during the acute infection	No	Yes [c]	No

Ultrasound within 6 weeks	No	No	Yes
DMSA 4–6 months following the acute infection	No	Yes	Yes
MCUG	No	No[b]	No[b]

[a] See box 1 for definition

[b] While MCUG should not be performed routinely it should be considered if the following features are present:

- dilatation on ultrasound
- poor urine flow
- non-*E. coli*-infection
- family history of VUR.

[c] In an infant or child with a non-*E. coli*-UTI, responding well to antibiotics and with no other features of atypical infection, the ultrasound can be requested on a non-urgent basis to take place within 6 weeks

Table 8 Recommended imaging schedule for children 3 years or older

Test	Responds well to treatment within 48 hours	Atypical UTI[a]	Recurrent UTI[a]
Ultrasound during the acute infection	No	Yes[b c]	No
Ultrasound within 6 weeks	No	No	Yes[b]
DMSA 4–6 months following the acute infection	No	No	Yes
MCUG	No	No	No

[a] See box 1 for definition

[b] Ultrasound in toilet-trained children should be performed with a full bladder with an estimate of bladder volume before and after micturition.

[c] In a child with a non-*E. coli*-UTI, responding well to antibiotics and with no other features of atypical infection, the ultrasound can be requested on a non-urgent basis to take place within 6 weeks

Box 1 Definitions of atypical and recurrent UTI

Atypical UTI includes:

- seriously ill (for more information refer to Feverish illness in children [NICE clinical guideline 47])
- poor urine flow
- abdominal or bladder mass
- raised creatinine
- septicaemia
- failure to respond to treatment with suitable antibiotics within 48 hours
- infection with non-*E. coli* organisms.

Recurrent UTI:

- two or more episodes of UTI with acute pyelonephritis/upper urinary tract infection, or
- one episode of UTI with acute pyelonephritis/upper urinary tract infection plus one or more episode of UTI with cystitis/lower urinary tract infection, or
- three or more episodes of UTI with cystitis/lower urinary tract infection.

1.4 Surgical intervention

1.4.1.1 Surgical management of VUR is not routinely recommended.

1.5 Follow-up

1.5.1.1 Infants and children who do not undergo imaging investigations should not routinely be followed up.

1.5.1.2 The way in which the results of imaging will be communicated should be agreed with the parents or carers or the young person as appropriate.

1.5.1.3 When results are normal, a follow-up outpatient appointment is not routinely required. Parents or carers should be informed of the results of all the investigations in writing.

1.5.1.4 Infants and children who have recurrent UTI or abnormal imaging results should be assessed by a paediatric specialist.

1.5.1.5 Assessment of infants and children with renal parenchymal defects should include height, weight, blood pressure and routine testing for proteinuria.

1.5.1.6 Infants and children with a minor, unilateral renal parenchymal defect do not need long-term follow-up unless they have recurrent UTI or family history or lifestyle risk factors for hypertension.

1.5.1.7 Infants and children who have bilateral renal abnormalities, impaired kidney function, raised blood pressure and/or proteinuria should receive monitoring and appropriate management by a paediatric nephrologist to slow the progression of chronic kidney disease.

1.5.1.8 Infants and children who are asymptomatic following an episode of UTI should not routinely have their urine re-tested for infection.

1.5.1.9 Asymptomatic bacteriuria is not an indication for follow-up.

1.6 Information and advice for children, young people and parents or carers

1.6.1.1 Healthcare professionals should ensure that when a child or young person has been identified as having a suspected UTI, they and their parents or carers as appropriate are given information about the need for treatment, the importance

of completing any course of treatment and advice about prevention and possible long-term management.

1.6.1.2 Healthcare professionals should ensure that children and young people, and their parents or carers as appropriate, are aware of the possibility of a UTI recurring and understand the need for vigilance and to seek prompt treatment from a healthcare professional for any suspected reinfection.

1.6.1.3 Healthcare professionals should offer children and young people and/or their parents or carers appropriate advice and information on:

- prompt recognition of symptoms
- urine collection, storage and testing
- appropriate treatment options
- prevention
- the nature of and reason for any urinary tract investigation
- prognosis
- reasons and arrangements for long-term management if required.

[2] Assess the risk of serious illness in line with Feverish illness in children (NICE clinical guideline 47) to ensure appropriate urine tests and interpretation, both of which depend on the child's age and risk of serious illness.

2 Notes on the scope of the guidance

NICE guidelines are developed in accordance with a scope that defines what the guideline will and will not cover.

The guideline has been developed with the aim of providing guidance on several aspects of UTI in infants and children from birth up to the age of 16 years, including: when to consider the diagnosis of UTI in sick and/or symptomatic infants and children who were previously healthy; urine collection for the diagnosis of UTI in infants and children; tests to establish or exclude UTI; treatment, including symptomatic reinfection; use of prophylactic antibiotics and investigations to assess the structure and function of the urinary tract; referral to secondary and tertiary care; surgical intervention; long-term follow-up; and advice to give to parents or carers, including what to do if another UTI occurs.

Areas not addressed by the guideline include children with urinary catheters in situ, children with neurogenic bladders, children already known to have significant pre-existing uropathies, children with underlying renal disease (for example, nephrotic syndrome), immunosupressed children, and infants and children in intensive care units. It also does not cover preventive measures or long-term management of sexually active girls with recurrent UTI.

How this guideline was developed

NICE commissioned the National Collaborating Centre for Women's and Children's Health to develop this guideline. The Centre established a Guideline Development Group (see appendix A), which reviewed the evidence and developed the recommendations. An independent Guideline Review Panel oversaw the development of the guideline (see appendix B).

There is more information about how NICE clinical guidelines are developed on the NICE website. A booklet, 'How NICE clinical guidelines are developed: an overview for stakeholders, the public and the NHS' is available.

3 Implementation in the NHS

The Healthcare Commission assesses the performance of NHS organisations in meeting core and developmental standards set by the Department of Health in 'Standards for better health', issued in July 2004. Implementation of clinical guidelines forms part of the developmental standard D2. Core standard C5 says that national agreed guidance should be taken into account when NHS organisations are planning and delivering care.

NICE has developed tools to help organisations implement this guidance (listed below).

- Slides highlighting key messages for local discussion.
- Costing tools
    - Costing report to estimate the national savings and costs associated with implementation.
    - Costing template to estimate the local costs and savings involved.
- Implementation advice on how to put the guidance into practice and national initiatives that support this locally.
- Audit criteria to monitor local practice.

The National Collaborating Centre for Women's and Children's Health and the Guideline Development Group have also devised an algorithm.

4 Research recommendations

The Guideline Development Group has made the following recommendations for research, based on its review of evidence, to improve NICE guidance and patient care in the future. The Guideline Development Group's full set of research recommendations is detailed in the full guideline (see section 5).

4.1 Diagnosis

Further investigation of leukocyte esterase and nitrite dipstick tests alone and in combination, stratified by age and method of urine collection, is required to determine their accuracy in diagnosing UTI.

Why this is important

Traditionally, the diagnosis of UTI has been dependent on microscopy and culture over 24–48 hours. Microscopy can be carried out immediately, but results are not always reported until culture is available. Microscopy at the bedside is effective but requires skills that are not widely available and requires quality assurance. This means that infants and children with distressing symptoms have often been left untreated for 2–3 days while awaiting treatment. Dipsticks for nitrite and leukocyte esterase have been shown to be as effective as microscopy and much easier to use. There is a risk of missing a proportion of cases of acute UTI in infants and children younger than 3 years when using dipsticks. This is because frequent bladder emptying leads to a lack of urinary nitrate. Contaminated urine is common in non-invasive samples collected from infants and children who are not toilet trained. The effect of this on microscopy and dipstick needs to be evaluated.

4.2 Antibiotic prophylaxis

Well-designed randomised, double-blind, placebo-controlled trials are required to determine the effectiveness of prophylactic antibiotics for preventing subsequent symptomatic UTIs and renal parenchymal defects in children.

Why this is important

A high proportion of girls and a minority of boys with UTI develop further infections which may be acutely distressing, associated with systemic illness and possible subsequent renal damage. Renal damage is most likely in children with high grade VUR and this is the reason for some of the imaging

tests previously recommended. Prophylactic antibiotics have been used on the assumption that they prevent these problems. However, chronic antibiotic use has a number of disadvantages for the individual as well as the population as a whole. Formal evaluation of whether prophylactic antibiotics can prevent the distressing symptoms and scarring associated with recurrent UTI would affect not only the use of antibiotics, but also the imaging investigations recommended.

4.3 Surgical intervention

Well-designed randomised placebo-controlled trials are required to determine the effectiveness of prophylaxis or various surgical procedures for the management of VUR in preventing recurrent UTI or renal parenchymal defects.

Why this is important

Management strategies for children with recurrent UTI have been based on the assumption that prevention of UTI and/or renal parenchymal defects by surgery or prophylaxis is more effective in preventing renal damage than treating symptomatic infections promptly whenever they occur. In addition, there have been recent developments in minimally invasive surgery which have been shown to be relatively safe and effective in reducing or eliminating VUR. Studies comparing these interventions with adequate controls are recommended to establish the benefit of surgery in preventing recurrent symptomatic infection and renal damage.

4.4 Long-term risk

A well designed cohort study investigating long-term outcomes including renal scarring and renal function of children who have had UTI should be conducted in the UK.

Why this is important

UTI and VUR in young children have been shown to be associated with both congenital and acquired renal damage. Progressive scarring is well documented in children with high grade VUR and recurrent UTI. Scarring has been associated with severe hypertension, proteinuria, complications in pregnancy and progression to established renal failure (ERF). These risks are likely to be greater in children with bilateral renal parenchymal defects. However, the frequency and magnitude of these risks for children with unilateral and bilateral renal damage are unclear. Knowledge of the risk of serious or progressive complications would be useful to determine the management of children with first-time and recurrent UTIs.

5 Other versions of this guideline

5.1 Full guideline

The full guideline, Urinary tract infection: diagnosis, treatment and long-term management of urinary tract infection in children, contains details of the methods and evidence used to develop the guideline. It is published by the National Collaborating Centre for Women's and Children's Health.

5.2 Information for the public

NICE has produced information for the public explaining this guideline.

We encourage NHS and voluntary sector organisations to use text from this information in their own materials.

6 Related NICE guidance

Feverish illness in children: assessment and initial management in children younger than 5 years. NICE clinical guideline 47 (2007).

7 Updating the guideline

NICE clinical guidelines are updated as needed so that recommendations take into account important new information. We check for new evidence 2 and 4 years after publication, to decide whether all or part of the guideline should be updated. If important new evidence is published at other times, we may decide to do a more rapid update of some recommendations.

Appendix A: The Guideline Development Group

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Appendix B: The Guideline Review Panel

The Guideline Review Panel is an independent panel that oversees the development of the guideline and takes responsibility for monitoring adherence to NICE guideline development processes. In particular, the panel ensures that stakeholder comments have been adequately considered and responded to. The Panel includes members from the following perspectives: primary care, secondary care, lay, public health and industry.

Dr Robert Walker – Chair
General Practitioner, Workington, Guideline Review Panel Chair from June 2006

Dr John Young
Medical Director, Merck Sharp & Dohme Ltd

Dr John Harley
Clinical Governance and Prescribing Lead and General Practitioner, North Tees PCT

Mrs Ailsa Donnelly
Patient Representative

About this guideline

NICE clinical guidelines are recommendations about the treatment and care of people with specific diseases and conditions in the NHS in England and Wales.

The guideline was developed by the National Collaborating Centre for Women and Children's Health. The Collaborating Centre worked with a group of healthcare professionals (including consultants, GPs and nurses), patients and carers, and technical staff, who reviewed the evidence and drafted the recommendations. The recommendations were finalised after public consultation.

The methods and processes for developing NICE clinical guidelines are described in The guidelines manual.

We have produced information for the public explaining this guideline. Tools to help you put the guideline into practice and information about the evidence it is based on are also available.

Changes after publication

June 2012: minor maintenance

Novmber 2013: minor maintenance

Your responsibility

This guidance represents the view of NICE, which was arrived at after careful consideration of the evidence available. Healthcare professionals are expected to take it fully into account when exercising their clinical judgement. However, the guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and/or guardian or carer, and informed by the summary of product characteristics of any drugs they are considering.

Implementation of this guidance is the responsibility of local commissioners and/or providers. Commissioners and providers are reminded that it is their responsibility to implement the guidance, in their local context, in light of their duties to avoid unlawful discrimination and to have regard to promoting equality of opportunity. Nothing in this guidance should be interpreted in a way that would be inconsistent with compliance with those duties.

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