GUIDELINES

Diagnosis and management of urinary tract infection in children: summary of NICE guidance

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This is one of a series of *BMJ* summaries of new guidelines, which are based on the best available evidence; they will highlight important recommendations for clinical practice, especially where uncertainty or controversy exists

Members of the Guideline Development Group and further information about the guidance are on bmj.com

Why read this summary?

Although urinary tract infection affects at least 3.6% of boys and 11% of girls, establishing the diagnosis is difficult in early childhood owing to the lack of specific urinary symptoms, difficulty in urine collection, and contamination of samples. Most children have a single episode and recover promptly. Current imaging, prophylaxis, and prolonged follow-up strategies place a heavy burden on patients, families, and NHS resources and carry risks without evidence of benefit. This article summarises the most recent guidance from the National Institute for Health and Clinical Excellence (NICE) on how to provide consistent clinically and cost effective practice for the diagnosis, treatment, and further management of urinary tract infection in childhood.[1]

Recommendations

NICE recommendations are based on systematic reviews of best available evidence. When minimal evidence is available, a range of consensus techniques is used to develop recommendations. In this summary, recommendations derived primarily from consensus techniques are indicated with an asterisk (*).

Assessment and diagnosis

- Consider a diagnosis of urinary tract infection in all infants and children with:

(a) unexplained fever of 38°C or higher after 24 hours at the latest

(b) symptoms and signs suggestive of urinary tract infection, including:
  – fever[2]
  – non-specific symptoms, such as lethargy, irritability, malaise, failure to thrive, vomiting, poor feeding, abdominal pain, jaundice (in infants)
  – specific symptoms, such as frequency, dysuria, loin tenderness, dysfunctional voiding, changes to continence, haematuria, and offensive or cloudy urine.

- Collect a urine sample:

(a) do this preferably by clean catch, but if this is not possible, use a urine collection pad but not cotton wool balls, gauze, or sanitary towels.

(b) if non-invasive techniques are not possible, use a catheter sample or suprapubic aspirate with ultrasound guidance.

- Test the urine sample: for infants younger than 3 months, refer to a paediatric specialist, who should send urine for urgent microscopy and culture; for children 3 months or older but younger than 3 years, see box 1; for children 3 years or older, see box 2.
- Send urine for culture when any of the following apply*:
  - age younger than 3 years
  - clinical diagnosis of acute pyelonephritis or upper urinary tract infection

Box 1 | Initial management of children 3 months or older but younger than 3 years: use urgent microscopy and culture to diagnose urinary tract infection

Specific urinary symptoms
- Send urine sample for urgent microscopy and culture; if urgent microscopy is not available, send a urine sample for microscopy and culture
- Start antibiotic treatment

Non-specific symptoms

High risk of serious illness
- Refer child urgently to paediatric specialist care
- Send urine sample for urgent microscopy and culture
- Manage in line with NICE clinical guideline on feverish illness in children[2]

Intermediate risk of serious illness
- Consider urgent referral to a paediatric specialist (see NICE guideline[2])
- When specialist paediatric referral is not required:
  - arrange urgent microscopy and culture
  - start antibiotic treatment if microscopy is positive
  - consider dipstick testing if urgent microscopy is not available
  - start antibiotic treatment if nitrites are present (these suggest the possibility of infection)
- In all cases, a urine sample should be sent for microscopy and culture

Low risk of serious illness:
- Send urine sample for microscopy and culture
- Start antibiotic treatment if microscopy or culture is positive

Box 2 | Initial management of children 3 years or older: use dipstick test to diagnose urinary tract infection

If leucocyte esterase and nitrite are positive
- Start antibiotic treatment for urinary tract infection
- If child has high or intermediate risk of serious illness or a history of infection, send urine sample for culture

If leucocyte esterase is negative and nitrite is positive
- Start antibiotic treatment if fresh sample was tested
- Send urine sample for culture

If leucocyte esterase is positive and nitrite is negative
- Send urine sample for microscopy and culture
- Only start antibiotic treatment for urinary tract infection if there is good clinical evidence of such infection
- Result may indicate infection elsewhere
- Treat depending on results of culture

If leucocyte esterase and nitrite are negative
- Do not start treatment for urinary tract infection
- Explore other causes of illness
- Do not send urine sample for culture unless recommended (see recommendations on urine culture

- high to intermediate risk of serious illness[2]
- history of recurrent urinary tract infection
- single positive dipstick result for leucocyte esterase or nitrite
- infection does not respond to treatment within 24-48 hours, if no sample has already been sent
- clinical symptoms and dipstick tests do not correlate.

*Localising site of urinary tract infection**
- Consider any child with bacteriuria and fever of 38°C or higher as having acute pyelonephritis or upper urinary tract infection.
- Consider any child with fever lower than 38°C, loin pain or tenderness, and bacteriuria as having acute pyelonephritis or upper urinary tract infection.
- Consider all other children with bacteriuria but no systemic symptoms or signs as having cystitis or lower urinary tract infection.

History, examination, and documentation
- Ensure history and examination, and document the presence or absence of features of atypical illness and markers of underlying pathology.*

Box 3 | Main characteristics of patients with atypical or recurrent urinary tract infection

Atypical (any of the following)
- Septicaemia or patient who looks seriously ill (see NICE guideline[2])
- Poor urine flow
- Abdominal or bladder mass
- Raised creatinine concentration
- Failure to respond to treatment with suitable antibiotics within 48 hours
- Infection with non-Escherichia coli organisms

Recurrent (any of the following)
- Two or more episodes of urinary tract infection with acute pyelonephritis or upper urinary tract infection
- One episode of urinary tract infection with acute pyelonephritis or upper urinary tract infection plus one or more episode of urinary tract infection with cystitis or lower urinary tract infection
- Three or more episodes of urinary tract infection with cystitis or lower urinary tract infection

Antibiotic treatment
- Children with a high risk of serious illness[2] and/or younger than 3 months: refer immediately to secondary care
- Children aged 3 months and older with acute pyelonephritis or upper urinary tract infection:
  - consider referral to secondary care
  - treat with 10 days of oral antibiotics, or if child is unable to tolerate oral antibiotics, start treatment with intravenous antibiotics until oral intake is possible
  - repeat culture if no response within 24-48 hours
- Children aged 3 month and over with cystitis or lower urinary tract infection:
  - treat with three days of oral antibiotics according to local guidance
  - advise carers to return for review if the child remains unwell after 24-48 hours.

Preventing recurrence
- Do not prescribe antibiotic prophylaxis routinely.

Imaging strategies*
- Children of all ages with atypical urinary tract infection (box 3): perform ultrasonography of the urinary tract during the acute infection to identify structural abnormalities of the urinary tract.
- Infants younger than 6 months with first time urinary tract infection that is responsive to treatment: do ultrasonography within six weeks of the infection.
- Children younger than 3 years with atypical and/or recurrent urinary tract infection (box 3): do a DMSA (dimercaptosuccinic acid) scan 4-6 months after the acute infection to detect renal parenchymal defects.
- Do not do routine imaging to identify vesicoureteral reflux.

Referral and follow-up*
- Referral to paediatric care specialist for children with abnormal imaging findings and after recurrent urinary tract infection.

Information and advice for children, young people, and parents or carers*
- Appropriate information and advice must be provided at each stage, including:
  - the possibility of a urinary tract infection recurring
  - the need to be vigilant and seek prompt treatment from a healthcare professional for any suspected reinfection.

Overcoming barriers

Despite strongly held views by some clinicians about the role of intensive imaging strategies and prophylactic antibiotic treatment in preventing renal failure after urinary tract infection, current evidence shows no such benefit. The most useful strategy for reducing morbidity

from urinary tract infection and preventing subsequent renal parenchymal defects is the prompt diagnosis and treatment of the infection. This is particularly important in infants and young children, in whom the diagnosis can easily be missed.

NICE has developed tools to help organisations implement the guidance (see www.nice.org.uk/page.aspx?o=tools).

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1 National Institute for Health and Clinical Excellence. *Urinary tract infection in children*. London: NICE, 2007. (http://guidance.nice.org.uk/CG054)
2 National Institute for Health and Clinical Excellence. *Feverish illness in children*. London: NICE, 2007. (http://guidance.nice.org.uk/CG47).

LESSON OF THE WEEK

Milk alkali syndrome without the milk

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Milk alkali syndrome is easily missed and should be considered in all patients who present with hypercalcaemia

Milk alkali syndrome is **the third commonest cause of hospital admissions for hypercalcaemia,**[1 2] but the diagnosis is often missed.[2-5] Misdiagnosis can lead to unnecessary and potentially invasive investigations and inappropriate treatment

Case report

A 76 year old woman was referred to a gastroenterology outpatient clinic with altered bowel habit. She had a six month history of alternating constipation and diarrhoea, and she admitted to polydipsia, polyuria, and nocturia. She had no nausea, vomiting, abdominal pain, or weight loss. Her regular prescriptions included salbutamol inhaler, a calcium channel blocker, and ibuprofen for chronic obstructive pulmonary disease, hypertension, and osteoarthritis. She had a history of dyspepsia caused by gastric erosions noted on gastroscopy. She denied taking vitamin supplements or other over the counter medications.

Clinical examination was unremarkable, but routine investigations showed hypercalcaemia (table). She was admitted for immediate treatment with intravenous fluids and intravenous infusion of disodium pamidronate 90 mg. On the second day after admission, her serum calcium concentration was normal. The results of additional investigations taken before disodium pamidronate was started became available later (table). There was no clinical evidence of acidosis, such as Kussmaul's respiration, though we did not test her arterial pH. Results of chest radiography, abdominal computed tomography, bone scan, and mammography were all normal. Her serum calcium concentrations remained normal without further need for disodium pamidronate infusions or intravenous fluids.

After we had treated her hypercalcaemia, careful review of her drug history showed that for the previous two years she had been taking six to eight indigestion tablets daily (equal to 5.5 g calcium carbonate a day) to alleviate her dyspepsia. She denied any concomitant consumption of milk or milk products. The patient was advised to discontinue these tablets and the ibuprofen. Her dyspepsia did not recur, and she did not require further gastrointestinal investigations or the introduction of proton pump inhibitors. She was discharged with normal calcium concentrations (2.35 mmol/l) six days after admission. Three months later,

Laboratory test results (serum concentrations unless stated otherwise) from patient with milk alkali syndrome

At presentation	Result (normal range)
Calcium (mmol/l)	3.45 (2.25-2.7)
Phosphate (mmol/l)	1.36 (0.8-1.44)
Creatinine (mol/l)	124 (65-120)
Intact parathyroid hormone (ng/l)	8 (5-60)
25 (OH)D3* (nmol/l)	59 (10-50)
Urine calcium/creatinine ratio (mmol)	1.03 (0-0.7)
Free thyroxine (pmol/l)	18 (11-23)
Thyroid stimulating hormone (mU/l)	1.76 (0.3-4.7)
Random cortisol (nmol/l)	611
Angiotensin converting enzyme (U/l)	19 (8-52)
Day 2	
Calcium (mmol/l)	2.55 (2.25-2.7)
Creatinine (mol/l)	111 (65-120)
Day 6	
Calcium (mmol/l)	2.35 (2.25-2.7)
Creatinine (mol/l)	94
Three months after discharge from hospital	
Calcium (mmol/l)	2.46 (2.25-2.7)
Creatinine (mol/l)	83 (65-120)
Intact parathyroid hormone (ng/l)	25 (5-60)

*25 hydroxycholecalciferol.