

How general practitioners manage children with urinary tract infection: an audit in the former Northern Region

S VERNON

C K FOO

M G COULTHARD

SUMMARY

Background. Urinary tract infections (UTIs) in childhood are common and may be difficult to diagnose because of non-specific symptoms and technical problems with urine collection. Active management is important because UTIs may cause permanent renal scarring in young children.

Aim. To determine how general practitioners (GPs) manage children with suspected UTIs.

Method. A postal questionnaire to 494 GPs in the former Northern Region (a random selection of 26.2%) asking how they manage children with suspected UTI and their perception of their training needs.

Results. A total of 333 (67.4%) GPs replied. On weekdays, up to 22.9% of GPs treated children who had symptoms suggestive of UTI without collecting a diagnostic urine sample, and up to 64.8% did so at weekends. Urine collection was satisfactory in 73.2% of boys and girls aged under one year, but in only 50.4% of older boys and 48.0% of older girls, caused in part by the use of unreliably 'cleaned' potties in the older group. On weekdays, up to 87.2% of GPs culture the urine, but up to 4.8% use dipsticks as the sole diagnostic test; at weekends, only up to 58.6% culture urines, and up to 19.1% rely on dipsticks alone. Up to 11.0% of GPs examine urine under a microscope for bacteria to test for UTI on weekdays and at weekends. Up to 23.8% of GPs who collect urines on weekdays wait for a positive culture result before starting antibiotics. At weekends, only 3.9% of GPs build in this delay to treatment, mainly because far fewer take urine samples at all. GPs refer younger children for diagnostic imaging more readily than older ones, and boys more readily than girls at all ages. Although virtually all GPs refer all children under five years, some still do so only after recurrent infections. Over half the GPs wanted more training in managing UTI in children.

Conclusion. There is a wide variation in clinical practice by GPs. Some always appropriately collect and test urine samples, treat without delay and refer for imaging after one proven UTI. Some never collect urines, treat blindly and refer only young infants with recurrent UTIs. Many vary their standards of practice from weekdays to weekends. The provision for GPs of clear, local, practical guidelines, drawn up between paediatricians and GPs and backed up with study days, might produce a consistent improvement in standards.

Keywords: urinary tract infection; paediatric: reflux nephropathy.

S Vernon, BA, RSCN, research associate, Department of Child Health, University of Newcastle. C K Foo, MBChB, MRCP, MRCP, general practitioner, The Grove Medical Group, Newcastle upon Tyne. MG Coulthard, BSc, MBBS, DCh, FRCPCH, consultant paediatric nephrologist, Department of Paediatric Nephrology, Royal Victoria Infirmary, Newcastle upon Tyne NE1 4LP.

Submitted: 19 June 1996; accepted 28 November 1996.

© British Journal of General Practice, 1997, 47, 297-300.

Introduction

URINARY tract infection (UTI) in early childhood is important because it may lead to renal scarring, the youngest children being at the greatest risk.¹ Although first scars only occur early in life, the sequelae are typically not manifest until many years later. These include hypertension² and loss of renal function; pyelonephritis accounts for approximately 20% of all renal transplants.³

It would be of huge benefit if renal scarring could be completely prevented, but that would be very difficult to achieve. It would require primary care doctors to have a high index of clinical suspicion in every child with symptoms compatible with UTI, to diagnose and treat very promptly, and to perform renal tract imaging in every case to identify structural abnormalities, scarring, and sometimes vesicoureteric reflux; failure to follow these procedures is strongly associated with renal scarring.⁴

In 1991, a working party consisting of general practitioners (GPs), paediatric nephrologists, microbiologists, paediatric radiologists, a paediatric urologist and a general paediatrician drew up an evidence-based consensus document, *Guidelines for the management of acute urinary tract infection in childhood*, under the auspices of the Royal College of Physicians.¹ There was broad agreement on most issues. In 1990, we circulated similar guidelines to all paediatricians in the former Northern Region, aiming to produce consistent and high standards of care. Despite GPs having a key role in managing children with UTI, we did not circulate our local guidelines to them, instead we merely discussed them at GP meetings. We therefore sent GPs a questionnaire to assess their current views and practice and whether they thought local guidelines might be of value.

Methods

Questionnaires were sent to 494 GPs selected randomly from the 1886 GPs in the former Northern Region. The questions were in multiple choice format, requested separate responses for boys and girls where appropriate, invited open comments and covered the following subjects:

- Their urine collection methods for infants and potty-trained children
- How they test urine to diagnose UTI
- When they commence antibiotic treatment
- Whether they refer children for urinary tract imaging, according to age and the number of UTIs diagnosed
- Whether they would value further education on managing childhood UTI.

Results

Response

A total of 333 (67.4%) of the GPs responded. Within group practices, the response rates of partners of different seniority were

very similar (senior 71.3%, middle 71.1%, junior 70.7%), but a smaller proportion (51.1%) of single-handed practitioners replied.

Urine collection

On weekdays, 77.1% of GPs routinely obtained diagnostic samples from children with symptoms suggestive of UTI, while 11.5% sometimes did, and 11.4% never did. At weekends, just 35.2% consistently collected a urine sample before commencing treatment, while 24.4% sometimes did, and 40.4% said they never did. In the open responses, the practical difficulties of collecting urine from children and the high cost of adhesive urine bags were common themes.

Urine samples were obtained in a variety of ways (Table 1). We considered the following to be satisfactory: a mid-stream or complete voiding ('clean catch') into a sterile container or a urine taken from a sterile adhesive bag, a disposable nappy⁵ or a collection pad.⁶ We considered it unsatisfactory if the respondent advised decanting urine from a potty cleaned with Dettol or bleach or by scalding with boiling water,⁷ or gave no instructions at all. Urine squeezed from cotton wool placed inside a nappy was also considered unsuitable because its fibres are bactericidal to some organisms.⁸ Some urine collections could not be assessed because they were made by a nurse or the local hospital and the method was not specified. More GPs used unsatisfactory methods for older children than for infants. The collection method varied little with the sex of the patient.

Testing urines

On weekdays, approximately three quarters of GPs always use urine culture as their primary diagnostic test, and up to nearly 90% sometimes do; this figure falls by about half at weekends (Table 2). A small number of GPs examine urine under a microscope for bacteria to test for UTI and do so equally on weekdays and weekends; only infected samples were cultured. During the week, up to one third of GPs test urine samples with dipsticks, and 3.3–4.8% use this as their sole diagnostic test. At weekends, when fewer GPs culture urine routinely, between 9.2% and 19.1% use dipsticks as their sole diagnostic test.

Commencing antibiotics

On weekdays, 76.2% of GPs who collect urine samples from

children suspected of having a UTI always start antibiotics immediately after the sample has been obtained, but 11.7% routinely wait for a culture result before treating; the remaining 12.1% vary their practice. At weekends, only 3.9% of GPs delay treatment pending a culture result; the remainder treat at once, but in about half of the cases they do so without taking a sample.

Referral for imaging

All GPs send every child under three years of age for imaging investigations after what they consider to be sufficient UTIs to justify referral (Table 3). At least 95% refer children aged three to six years, and over 90% refer children aged six to 10 years, but the referral rate falls sharply after that, especially in girls. Most GPs refer infants after their first UTI, with boys (90.9%) being referred only slightly more readily than girls (84.5%) (Table 4). Less than 5% of GPs wait for three or more UTIs before referring an infant. As children get older their GPs are more likely to delay referral until they have had more UTIs, especially in girls. While 79.5% of boys aged five to 12 years are referred for imaging after their first UTI, only 45.2% of girls are.

Training needs

Fifty-five per cent of GPs felt that they would benefit from more training in the management of children with UTI, many requesting a study day. The commonest specific request was for a simple protocol covering diagnosis and referral for investigation. The second was for a demonstration and the practical details of urine microscopy.

Discussion

A two thirds return from a questionnaire is lower than ideal but relatively high given GPs' other commitments. The non-responders had a slightly larger proportion of single-handed practitioners, but it is unlikely that there were other important differences. In any case, the main findings are so striking that they would not be invalidated if the non-responders had all replied with an extreme position. This type of questionnaire is more likely to generate idealized answers than to identify poor standards of practice falsely.

It is of concern that GPs diagnose UTIs in children without checking a urine sample at all, and alarming that almost two

Table 1. Methods used by GPs to collect urine from infants and children with a possible UTI.

Urine collection method	Infants in nappies		Potty-trained children	
	Boys (%)	Girls (%)	Boys (%)	Girls (%)
Satisfactory				
Pad, disposable nappy, bag	43.8	46.2	–	–
Mid-stream or clean catch	18.3	16.2	45.9	42.6
Totals	62.1	62.4	45.9	42.6
Unsatisfactory				
Cotton wool inside nappy	0.6	0.6	–	–
Scalded or antiseptic-rinsed potty	–	–	17.7	21.0
No instructions for collection given	11.1	10.8	12.0	12.0
Answer unclear or missing	15.0	15.3	19.8	18.6
Totals	26.7	26.7	49.5	51.6
Could not be assessed				
Sent to hospital for collection	2.4	2.1	–	–
Another person given responsibility	8.7	8.7	4.5	5.4
Totals	11.1	10.8	4.5	5.4

Because of rounding, the columns of figures do not all total to exactly 100%.

thirds do so at weekends; a trend reported previously.⁹ It needs to be remembered that, in terms of routine laboratory services, a 'weekend' constitutes nearly 40% of the week. Symptoms are often not diagnostic of UTI in children; febrile children may have a false-positive diagnosis because of dysuria from a concentrated urine and have unnecessary imaging investigations, while children with a UTI may have no dysuria, a false-negative diagnosis and develop avoidable scarring, hypertension or renal failure.

Despite requiring more effort and more help from community and local paediatric staff, more GPs collect satisfactory urine samples from infants than from older children. This probably reflects their awareness of their greater risk of reflux nephropathy. It must be remembered that, even with 'satisfactory' methods, there is a chance of contamination, which could appear as a false-positive result, except perhaps from suprapubic puncture, which is impractical in general practice.

The high cost and impracticality of adhesive urine bags (fre-

quently noted by GPs) has been solved by urine collection pads,⁶ which are cheap, easy to use and available from National Health Service supplies. We were surprised that about one fifth of GPs were advising that urine could be collected in a potty that had been 'scalded' or steeped in Dettol or bleach, because these cleaning methods have not been validated; subsequent testing has shown them to be unsatisfactory, whereas simply washing a potty in hot water and washing-up liquid is highly effective.⁷

Urine culture is the test GPs use most widely to diagnose childhood UTI. Results can be interpreted by commonly agreed diagnostic criteria¹ and provide the additional information of antibiotic sensitivity. In general practice, however, urine culture is problematic. Samples need rapid transportation or storage so that bacteria neither multiply nor die before reaching the laboratory. These difficulties probably account for a reluctance to collect urine samples for culture at weekends. There is no ideal storage technique. Refrigeration is simple and effective, but is not widely used. Inoculation onto agar-covered dip-slides is more popular, but has a high failure rate.¹⁰ A common solution is to use bottles containing boric acid crystals, but false-negative results can occur as pathogens may be killed by high concentrations;¹¹ this commonly happens when the bottles are only partly filled,¹⁰ which is often seen in paediatrics. Smaller boric acid collection bottles are available.

The prevalent use of dipsticks as the sole diagnostic screen at weekends is of concern because they are unreliable, both in over- and underdiagnosing UTIs. Dipsticks to detect just blood and protein are of low sensitivity and specificity. Nitrite sticks only become positive after sufficient bacterial metabolism, which may take hours,¹² limiting their value in children with UTI and frequency of micturition. Leucocyte esterase sticks cannot diagnose UTI because urinary leucocyte concentrations are also raised in about 10% of pyrexial children,¹³ and UTI may be seen without leucocytes.^{14,15} Thus, urine dipstick results should not deter a GP from performing a urine culture.

Although UTIs can be diagnosed reliably by examining urine for bacteria using a microscope,¹⁶ few GPs use this method routinely. Advantages reported include making a rapid and confident diagnosis and not culturing negative urines; being limited to the surgery was inconvenient.

When treating a child suspected of having a UTI, it is logical to start antibiotic treatment immediately after collecting a diagnostic urine sample.¹ Subsequent culture results (which may take three to five days for the doctor to receive) allow the course of antibiotic to be stopped, continued or changed according to sensitivity results. This strategy is driven by Ransley and Risdon's 'big bang theory',¹⁷ which warns that vulnerable kidney segments may be permanently destroyed after only a few days of a UTI and in the presence of vesicoureteric reflux. This model allows no complacency; the time for a vulnerable child to acquire chronic renal failure is frighteningly short. Despite this, up to a fifth of GPs operate a weekday management strategy that builds in a routine delay. At weekends, fewer GPs delayed treatment

Table 2. Primary methods of urine analysis used by GPs to diagnose UTIs in children.

Method	Percentage of GPs using each method (range)	
	On a weekday	At weekends
Microscopy in surgery	6.6–10.5	5.4–11.0
Dipstick alone	3.3–4.8	9.2–19.1
Culture in laboratory	76.2–87.2	34.5–58.6

For each range, the lower value is the percentage of GPs who always use the method, and the upper value also includes those who sometimes do.

Table 3. Percentage of GPs that will refer boys and girls for imaging after a UTI, according to age.

Age (years)	Boys (%)	Girls (%)
1	99.9	99.9
2	99.9	99.9
3	99.5	99.5
4	99.2	98.9
5	98.9	98.3
6	95.7	94.5
7	94.8	93.5
8	94.2	92.9
9	93.2	92.0
10	93.2	92.0
11	90.7	87.2
12	90.7	87.2
13	77.4	64.1
14	76.8	61.9
15	72.0	54.4

Table 4. Percentage of GPs that referred children for imaging after UTIs, according to the number of UTIs and the child's sex.

Number of UTIs	Aged under one year		Aged 1–5 years		Aged 5–12 years	
	Boys	Girls	Boys	Girls	Boys	Girls
1	90.9	84.6	88.3	71.3	79.5	45.2
2	12.5	16.1	11.7	21.7	15.8	35.6
3	3.6	4.6	4.9	9.1	6.1	15.3
4	0.0	1.3	0.3	1.3	1.6	2.5
5	0.3	1.3	0.3	1.0	1.0	1.6
6	0.3	0.3	0.7	0.6	0.3	1.0

while awaiting urine culture results, but this was mainly because far fewer collected urine samples.

Since Ransley and Risdon¹⁷ proposed their model of reflux nephropathy, there has been an increasing emphasis on all young children (boys and girls) having urinary tract imaging after a single UTI rather than being investigated only after recurrent infections.¹ Although data from intravenous urography has been interpreted as suggesting that children may develop their first scar up to the age of 10 years,¹⁸ the risk may be limited to a much younger age. Many argue that there should be no age limit for imaging children after their first recognized UTI, which may not be their first actual UTI. Although virtually all GPs do refer children aged under five years for imaging, it is of concern that some still do so only after recurrent infections, even if aged under one year. The difference in referral pattern between boys and girls increases with age; under half the GPs refer girls aged five to 12 years after their first UTI, whereas about 80% refer boys.

UTI in childhood is common, and active management is worthwhile because it may prevent permanent sequelae. This audit highlights the widely differing standards in general practice regarding the collection and testing of urine samples, starting antibiotics and referral for imaging. We recognize a widespread uncertainty among GPs about what constitutes best practice. This might be tackled best by the provision of clear, local, practical guidelines drawn up jointly by paediatricians and GPs, and backed up by study days. These would encourage urine collection from all children with symptoms compatible with a UTI, using urine collection pads, washed-up potties or mid-stream urines, according to age. They would advise starting antibiotics straight away unless microscopy instantly excluded the diagnosis, and using refrigeration or small boric acid bottles when urine storage was necessary. Finally, they would recommend referral of all children for imaging after their first recognized UTI. We believe that applying local guidelines could lead to a consistent improvement in standards.

References

- Royal College of Physicians Research Unit Working Group. Guidelines for the management of acute urinary tract infection in childhood. *J R Coll Phys Lond* 1991; **25**: 36-42.
- Jacobson SH, Eklof O, Eriksson CG, *et al.* Development of hypertension and uraemia after pyelonephritis in childhood: 27 year follow up. *BMJ* 1989; **299**: 703-706.
- Wing AJ, Brunner FP. Twenty-three years of dialysis and transplantation in Europe: experiences of the EDTA registry. *Am J Kidney Dis* 1989; **14**: 341-346.
- Smellie JM, Poulton A, Prescod NP. Retrospective study of children with renal scarring associated with reflux and urinary infection. *BMJ* 1994; **308**: 1193-1196.
- Ahmad T, Vickers D, Campbell S, *et al.* Urine collection from disposable nappies. *Lancet* 1991; **338**: 674-676.
- Vernon S, Redfeare A, Pedler SJ, *et al.* Urine collection on sanitary towels. *Lancet* 1994; **344**: 612.
- Rees J, Vernon S, Pedler SJ, Coulthard MG. Collecting urine from washed-up potties. *Lancet* 1996; **348**: 197.
- Shea Y. Specimen collection and transport. In: Isenberg H (ed.). *Clinical microbiology procedures handbook*. Washington: American Society for Microbiology, 1992.
- Jadresic L, Cartwright K, Cowie N, *et al.* Investigation of urinary tract infection in childhood. *BMJ* 1993; **307**: 761-764.
- Jewkes FEM, McMaster DJ, Napier WA, *et al.* Home collection of urine specimens – boric acid bottles or dipslides? *Arch Dis Childhood* 1990; **65**: 286-289.
- Johnston HH, Moss MV, Guthrie GA. The use of boric acid for the preservation of clinical urine specimens. In: Meers PD (ed). *The bacteriological examination of urine: report of a workshop on needs and methods*. London: HMSO, 1978.
- Powell HR, McCredie DA, Ritchie MA. Urinary nitrite in symptomatic and asymptomatic urinary infection. *Arch Dis Childhood* 1987; **62**: 138-140.
- Turner GM, Coulthard MG. Fever can cause pyuria in children. *BMJ* 1995; **311**: 924.
- Kumar RK, Turner GM, Coulthard MG. Don't count on urinary white cells to diagnose childhood urinary tract infection. *BMJ* 1996; **312**: 1359.
- Stansfeld JM. The measurement and meaning of pyuria. *Arch Dis Childhood* 1962; **37**: 257-262.
- Vickers D, Ahmad T, Coulthard MG. Diagnosis of urinary tract infection in children: fresh urine microscopy or culture? *Lancet* 1991; **338**: 767-770.
- Ransley PG, Risdon RA. Reflux and renal scarring. *Br J Radiol* 1978; **14**: 1-35.
- Smellie JM, Ransley PG, Normand ICS, *et al.* Development of new renal scars: a collaborative study. *BMJ* 1985; **290**: 1957-1960.

Acknowledgements

This study was funded by grants from the audit fund of the Northern and Yorkshire Regional Health Authority and the Royal Victoria Infirmary Children's Kidney Fund.

Address for correspondence

Dr MG Coulthard, Department of Paediatric Nephrology, Royal Victoria Infirmary, Newcastle Upon Tyne NE1 4LP.