

Urinary Tract Infection in Childhood

Notes Review

NWN/800/024113

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Introduction and aims of project

The management of urinary tract infection (UTI) in childhood is only a small part of the General Practitioners' work but, if managed inappropriately, can have far reaching consequences. The following introduction includes the background to the disease, the reasons for my choice of project and my aims.

UTI is a common bacterial infection in childhood occurring in between 1 % and 5% depending on the population sampled^{1, 2, 3}. Gram-negative bacteria, usually of bowel origin, are the main cause of UTI, obtaining access from the bowel via the urethra⁴. Clinical evidence has established several risk factors contributing to the disease and it is essential to identify children with UTI who are at risk of renal complications so that action can be taken to minimise these.

In 1994, Smellie et al found that up to 20% of children with previously healthy kidneys will, following a UTI, develop renal scarring². Renal scarring is even more likely in children with vesico-ureteric reflux (retrograde flow of urine from the bladder to the kidney via the ureter) or any other abnormality of the urinary tract^{3, 4}. A long-term Swedish study of children that were followed up over 25-35 years showed that of the children with renal scarring, 13% went on to develop hypertension and 10% developed chronic renal failure⁵. Prompt diagnosis and effective management can limit scarring and its consequences^{6, 7, 8, 9, 10}.

Differing management plans within our practice were highlighted at a practice formulary meeting and studies over the last twenty years have echoed this across the country. For example one study showed that there could be a ten-fold difference between practices in the number of urine samples tested and therefore on the rate of UTI detected.⁹ My study was undertaken as I feel that it is an area that needs improvement both locally and nationally and any reduction in the rate of sequelae has important consequences. The aims of my project were to conduct a review of the current literature, to perform a notes review to see if my training practice was following local guidelines and to discuss means of improvement.

Summary of aims

- Review the current literature on the Management of Urinary Tract Infection in Childhood
- Perform a notes review to decide if, according to local guidelines, the practice was
detecting UTIs using urine dipsticks and urine microscopy prior to treatment
J treating patients appropriately with immediate antibiotics and prophylaxis if
indicated
J performing a test of cure
I initiating appropriate investigation and follow-up
- Discuss ways of improving present practice

Literature review

A review of the current literature was performed to find the evidence base behind local and national guidelines. This was performed by accessing the MEDLINE, EMBASE and COCHRANE databases using the keywords 'urinary tract infection' and 'childhood'. From the abstracts, papers from the last 20 years were identified and the full text reviewed.

Diagnosis and detection

The South Bedfordshire General Practitioners Group in 1990 showed that there was often a significant delay in diagnosis " ° and this has been confirmed by other studies', ". There are several aspects contributing to this delay two of which are that the symptoms can be very non-specific and therefore UTI not suspected and that urine samples can be difficult to collect.

The Royal College of Physicians drew together a Working Group in 1991. The group included paediatricians, radiologists, microbiologists, parents and general practitioners, and was created to produce guidelines for the management of UTI in childhood. Incorporated in its paper is a list of possible symptoms indicating a UTI ". Children displaying these symptoms should therefore have a urine sample collected and examined (see Appendix 1).

Obtaining and interpreting the results of urinary samples can be difficult particularly prior to toilet training '2. False positive results may lead to unnecessary investigations and

treatment; a false negative result risks renal damage². In a toilet-trained child a mid-stream urine can be obtained; in a non-trained child a clean catch specimen or suprapubic aspiration is indicated¹⁰. If there is going to be a delay in examining the specimen it should be chilled to 4°C (eg. in a domestic refrigerator) to minimise contamination¹¹. Storage with boric acid crystals may be used instead of refrigeration but this can easily lead to false negatives if not performed correctly¹².

How the specimen should be tested has been a topic of much debate and study results differ considerably. A meta-analysis was performed in 1999 assessing the performance of urine dipstick tests, Gram stain and microscopic analysis in children¹³. They concluded that both Gram stain and dipsticks for nitrite and leucocyte esterase perform similarly in detecting UTI, with a high sensitivity and a low false positive rate. It should be remembered that urine must be in the bladder for at least one hour for the bacterial conversion of nitrate into nitrite^{14, 15}. This therefore will limit the tests usefulness in children with urinary frequency or for those still in nappies. Looking at leucocytes esterase alone is also not recommended, as a Newcastle study showed that pyuria is common in feverish children without a UTI¹⁶. If either of these indices is positive, UTI should be suspected but if both are negative the diagnosis is very unlikely. They are therefore only an indicator and should not be used in place of laboratory examination¹⁷. If used carefully they are an accurate and cheap way of identifying those children requiring antibiotics without waiting for microbiological results.

Treatment and test of cure

Antibiotics should be commenced immediately after the specimen is obtained as delay increases risk of scarring. Subsequently, the culture results can allow the antibiotic to be changed according to sensitivity, or stopped. After the course of treatment, the urine should be examined to ensure that the infection has been eradicated³. Low dose prophylactic antibiotics should then be started in all children under the age of five until further investigations have been carried out⁴. This will prevent recurrent infection in those at increased risk of scarring, for example those with vesico-ureteric reflux⁶.

Investigations and referral

The Royal College Working Group decided that all children should have some form of imaging after the first proven infection⁵. This is to detect children with renal tract abnormalities that may require intervention to limit further infection and therefore minimise damage to the kidneys. The choice of modality is complex as each looks at a different part of the renal tract. It may include ultrasound, plain abdominal X-ray, micturating cystogram, intravenous pyelogram or DMSA scan.

Several studies have shown that only a minority of children are being imaged and that the pattern varies with age and sex^{3, a, g}. A longstanding myth that contributes to this is that scarring was thought not to occur in older children but Smellie et al in 1985 showed that scarring was only less likely after 7 years of age^b.

A local protocol for treatment and imaging was produced in 1994 | by the lead consultant paediatrician at our local hospital based on the Working Group Guidelines ". A flow chart based on this was used as the guidelines to which our notes were compared (Appendix 2).

Method of notes review

The review was undertaken in a practice of 9852 patients with a population of 2049 under 16 years of age.

Cases were identified using the computer recorded patient notes. The initial search identified all patients within the practice population (past and present) with the following criteria

aged 0-16

diagnosis of urinary tract infection

diagnosis during 1994-1999

Cross-searches were then performed to identify "missed cases" using the keywords 'urinary frequency', 'dysuria', 'enuresis' and 'past or present treatment with Trimethoprim'.

From the lists produced, cases were identified, hand written notes were pulled and the investigation, treatment and follow-up were recorded. The management plans were then individually assessed and compared to the local guidelines flow chart (Appendix 2). The search was performed with the help of the partners, practice manager and reception staff.

Evidence presentation

During the period studied 62 children were identified, 56 girls and 6 boys with an age range of 18 days to 16 years. The mean age was 5 years and 6 months.

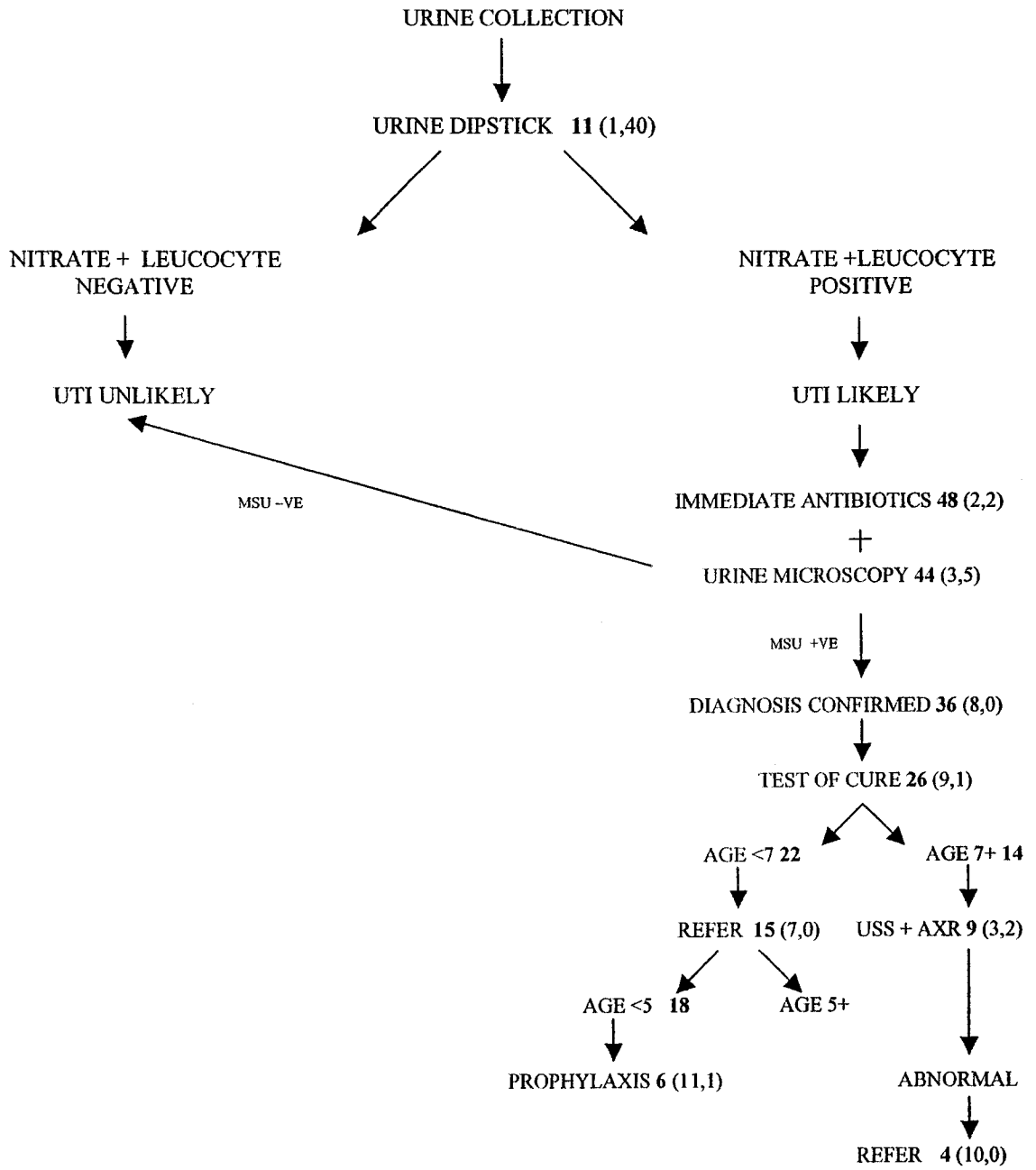
Of these, 10 cases were diagnosed during hospital admissions and in a further 17 cases there was no definite diagnosis of UTI as no sample was sent, there was no bacterial growth or there was insufficient data recorded to enable confirmation of the diagnosis. These cases account for "missing data" in the flow chart below.

Guidance to interpreting flow- chart

All the numbers given relate to numbers of children. All numbers in bold indicate a positive result eg. the number of children on whom a dipstick analysis was performed. The next figures given are in brackets - the first of these indicates the number for whom the test was not performed and the second indicates data not recorded.

For example, with respect to dipstick analysis, 11 (1,40) is equivalent to 11 children having the test performed, 1 child not having the test performed and 40 children with data not recorded.

Please note that only 52 children are included in the flow-chart as the cases diagnosed in hospital were not included.



Discussion of evidence

The correct treatment of urinary tract infection in childhood is extremely important as it can have far reaching consequences if not performed correctly. It would therefore be hoped that the local guidelines would be followed closely. Unfortunately the notes review showed that the guidelines were not always being followed in the practice although this has been echoed in several areas of the country previously ^{z.3.6.9}.

Detection of urinary tract infection

From this study the use of dipstick analysis was not clear, due to lack of data recorded, but the majority (84.6%) of patients did have their urine microbiology checked at the time of diagnosis. This figure is reassuringly high as it can be difficult to collect urine samples in children, particularly if young, and there are also logistical problems of storing and transporting samples. The South Bedfordshire Group found that urine was only obtained in 80% of suspected episodes of UTI', One study in the Northern Region showed that the use of urine samples depended on the time of consultation with 87.2% being collected on a weekday and 58.6% at the weekends'. The time of urine collection was not recorded in this study.

Treatment of urinary tract infection

The majority of patients received antibiotics immediately (92.3%) with an identifiable delay in only 2 patients. One of these was because of non-attendance by the patient after follow-up had been arranged.

Eight children (15.4%) received antibiotics who subsequently had negative cultures. Although harmful effects of antibiotics include increased antibiotic resistance in the community and temporary alteration of gut flora in the patient 's, this has to be weighed up against the increased renal scarring that could occur if antibiotics are delayed ^{2,4, 6,6}. The number of children treated inappropriately can however be limited with the correct use of dipsticks as they are highly sensitive and specific.

Test of cure

The test of cure was performed in only 72.2% although this was markedly higher than 22% that was quoted in a Gloucester study '. Limitations to this could include lack of samples being provided by the patients. Parent education is therefore a vital part in the treatment of the condition.

Investigation and follow up

The investigation and follow up pattern was erratic. The general trend was that children were being under-investigated and under-referred. In the age group under 7 years old, all should have been referred whereas only 68.2% were. Of the children not referred, five did have limited imaging by the GP but all these children were at risk of having renal damage or at risk of further damage that needed assessment by specialist imaging techniques. Any child with possible renal disease also warrants specialist follow-up as some would be at risk of hypertension or chronic renal failure'.

In the age group under 5 years old, all should have been started on prophylactic antibiotics to prevent recurrent infection. In the study, only 33% were immediately commenced on prophylaxis although several of the older children were given them inappropriately with implications on cost and possible side-effects.

Children over the age of 7 years old should have had GP initiated investigations and then been referred if these were abnormal. 9 children (64.3%) had the investigations performed and 4 of the 9 were referred. In only 1 of the referrals was there an indication for referral as the other 3 had normal investigation results.

Some GPs may have felt that they could accurately predict which children were at risk of further problems and therefore they self-selected children for further investigations without following guidelines. It should be noted though that even the Royal College Working Group, a group of experts, did not feel that these children were identifiable clinically "

Limitations to this study

The study was small involving only 62 children. These cases represented 3% of the practice population of that age group. This compares with an incidence of 1% - 5% that has been quoted previously^{1, 2, 3}.

All data collections are limited by the method chosen although every effort was made to try and identify "missed cases" by cross searches. Cases may have been "missed" as they were not recorded using the keywords used in the searches. A hand search of all children in the correct age group could have retrieved all cases but this would have been too time-consuming. Other ways of identifying cases could have been by consulting the local microbiology department and X-ray department records.

The figures generated depended on the interpretation of the cases by the author with comparison to local guidelines. In order to limit bias it would have been preferable to have one or more independent examiners.

Recommendations for change

It is recognised that the majority of healthcare errors occur as a result of inadequate systems and poor communication ". Most of the following measures therefore address this.

1. Adopt the flow chart as the practice protocol and have an education meeting to bring this to the attention of the primary care team. (In 1993 a study of Gloucester GPs showed that present practice may still be related to previous teaching 9)
2. Use a computer template based on the guidelines, placing emphasis on the importance of immediate treatment and fixing follow-up arrangements from the first consultation.
3. Highlight abnormal urine results from the local laboratory.
4. Design and distribute parent education leaflets covering the natural history of the disease and the importance of treatment and investigation. The leaflets should also discuss methods of urine collection and storage to minimise false positive results by contamination.
5. Perform a re-audit of the topic with related audits for example parent understanding.

Conclusions

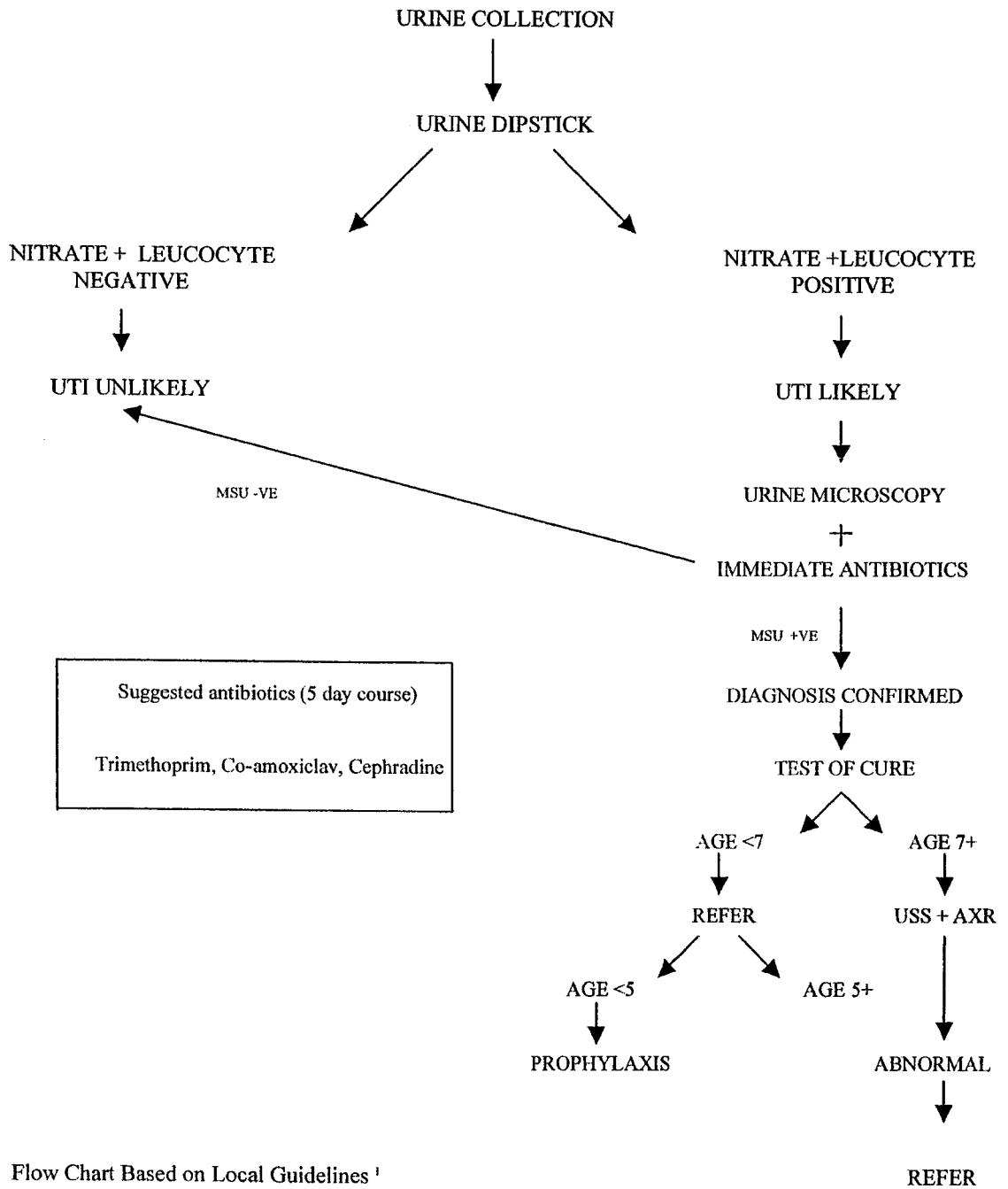
- Previous data and this notes review show that childhood UTI is a relatively uncommon but important reason for consultation in primary care. There was an incidence of 3% in our practice in the study period
- This notes review supports previous evidence that guidelines were not always being followed
 - i. detection - 84.6% had an MSU sent
 - ii. treatment- 92.3% received antibiotics immediately
 - iii. test of cure - performed in 72.2%
 - iv. prophylaxis - 33% under 5 years old received this
 - v. investigation and referral - 68.2% age<7 referred, 64.3% aged 7 or over were investigated
- Deficiencies in the notes were common leading to limitations in the study
- Most of the possible changes suggested to improve the above are based on improving communication systems and the education of health care workers and parents

Word Count: 2716

Appendix 1: List of Symptoms Indicating Possible UTI as defined by Royal College of Physicians Working Group "

Unexplained vomiting or abdominal pain
Frequency of micturition, dysuria or enuresis
Failure to thrive
Prolonged jaundice in the newborn
Non-specific illness
Suspected sexual abuse
Haematuria or hypertension

Appendix 2: Flow chart for Management of UTI in Childhood



References

1. Diagnosis and Management of Urinary Tract Infections in Childhood: A Practical Guide. *Local Trust Medical Journal* 1994; 2(3): 46-49.
2. Smellie J, Poulton A, Prescod N. Retrospective study of children with renal scarring associated with reflux and urinary infection. *BAH* 1994; 308: 1193-1196.
3. South Bedfordshire Practitioners' Group. How well do general practitioners manage urinary problems in children? *Br J of General Practice* 1990; 40:146-149.
4. Twajji M. Urinary tract infection in children: a review of its pathogenesis and risk factors. *J of Royal Society for the Promotion of Health* 2000;120(4): 220-226.
5. Jacobson S et al. Development of hypertension and uraemia after pyelonephritis in childhood: 27 year follow up. *BM.I* 1989; 299: 703-706.
6. Smellie et al. Development of new renal scars: a collaborative study. *BM.I* 1985; 209: 1957-1960.
7. Vernon S, Foo C, Coulthard M. How general practitioners manage children with urinary tract infection: an audit in the former Northern Region. *Br J of General Practice* 1997; 47: 297-300.
8. Pead L, Maskell R. Study of urinary tract infection in children in one health district. *BMJ* 1994; 309: 631-634.
9. Jadresic L et al. Investigation of urinary tract infection in children. *BMJ* 1993; 307: 761-764.
10. South Bedfordshire Practitioners Group. Development of renal scars in children: missed opportunities in management. *BMJ* 1990; 301: 1082-1084.

11. Report of the Working Group, Royal College of Physicians. Guidelines for the management of acute urinary tract infection in childhood. *J Royal College Physicians* 1991; 25: 36-42.
12. Giddens J, Robinson G. How accurately do parents collect urine samples from their children? A pilot study in general practice. *Br J of General Practice* 1998; 48: 987-988.
13. Gorelick M, Shaw K. Screening tests for urinary tract infection in children: a meta-analysis. *Pediatrics* 1999; 104 (5):e54.
14. Turner G, Couthard M. Fever can cause pyuria in children. *BMJ* 1995; 311: 924.
15. Shareif N, Hameed M, Petts D. Use of rapid dipstick tests to exclude urinary tract infection in children. *Br J of Biomedical Science* 1998; 55(4): 242-246.
16. Larcombe J. Urinary tract infection in children. *BMJ* 1999; 319: 1173-1175.
17. Meenan G, Taylor D. Unexpected outcomes and ethical considerations arising out of an audit of management of paediatric urinary tract infection. *J of Clinical Governance* 2001; 9: 5-9.