Urinary tract infections in children: Long-term management and prevention

Authors
Nader Shaikh, MD
Alejandro Hoberman, MD

Section Editors
Tej K Mattoo, MD, DCH, FRCP
Sheldon L Kaplan, MD

Deputy Editor
Mary M Torchia, MD

All topics are updated as new evidence becomes available and our peer review process is complete.
Literature review current through: Apr 2015. | **This topic last updated:** Mar 18, 2014.

INTRODUCTION — Urinary tract infection (UTI) is a frequently occurring clinical problem in childhood. Upper urinary tract infections (ie, acute pyelonephritis) may lead to renal scarring, hypertension, and end-stage renal dysfunction. Although children with pyelonephritis tend to present with fever, it is often difficult on clinical grounds to distinguish cystitis from pyelonephritis, particularly in young children (aged <2 years) [1]. Thus, we have defined UTI broadly here without attempting to distinguish cystitis from pyelonephritis. Acute cystitis in older children is discussed separately. (See "Acute cystitis: Clinical features and diagnosis in children older than two years and adolescents".)

The long-term management and prevention of UTI in children will be reviewed here. The epidemiology, risk factors, clinical features, diagnosis, acute management, and prognosis of UTI in children and UTI in newborns are discussed separately. (See "Urinary tract infections in children: Epidemiology and risk factors" and "Urinary tract infections in infants and children older than one month: Clinical features and diagnosis" and "Urinary tract infections in infants and children older than one month: Acute management, imaging, and prognosis" and "Urinary tract infections in neonates".)

LONG-TERM MANAGEMENT

Recurrent symptoms — Approximately 8 to 30 percent of children with urinary tract infection (UTI) experience one or more symptomatic reinfections [2-5]. Breakthrough UTI are most common in girls [6].

Progression of renal scarring is associated with recurrent episodes of pyelonephritis [7-10]. Accordingly, prompt diagnosis and treatment of these infections is critically important in reducing renal scarring [2,11,12].

Families of young children with UTI should receive instruction about the risk of recurrent UTI and be advised to seek medical attention promptly for fever and/or urinary symptoms. The evaluation of these episodes should include urinalysis, urine culture, or both [1,13]. (See "Urinary tract infections in infants and children older than one month: Clinical features and diagnosis", section on 'Laboratory evaluation'.)

Children with VUR — The long-term management and follow-up of children with vesicoureteral reflux (VUR) are discussed separately. (See "Management of vesicoureteral reflux".)

Children with bowel and bladder dysfunction — An important task in the management of children with UTI, especially those with recurrent UTI, is to identify underlying bowel and bladder dysfunction, which is an important risk factor. (See "Urinary tract infections in children: Epidemiology and risk factors", section on 'Bowel and bladder dysfunction' and "Etiology and clinical features of bladder dysfunction in children".)

Treatment of bowel and bladder dysfunction reduces the likelihood of UTI recurrences and is associated with faster resolution of VUR [14-16]. Treatment of bowel and bladder dysfunction should be initiated by the primary care provider. The first steps in the treatment of bowel and bladder dysfunction include timed voiding (scheduled voids every two to three hours), "double" voiding (asking children to sit and urinate again right after they voided), avoidance of C's (carbonated drinks, caffeine, citrus, chocolate, and food colorants), and/or the use of laxatives for children with constipation [17]. In chronically constipated children, treatment with laxatives has been shown to significantly reduce recurrences of UTI [18]. (See "Management of bladder dysfunction in children", section on

'Conservative management'.)

Referral to a nephrologist/urologist for further management (pelvic floor muscle training with biofeedback, anticholinergics) is recommended if the patient's symptoms do not respond to the initial management.

PREVENTION OF RECURRENT UTI IN CHILDREN WITHOUT VUR — To prevent renal scarring, risk factors for subsequent infection must be addressed. The discussion below focuses on prevention of recurrent urinary tract infection (UTI) in children who do not have vesicoureteral reflux (VUR), urinary obstruction, or bowel and bladder dysfunction. The management of VUR and bowel and bladder dysfunction are discussed elsewhere. (See "Management of vesicoureteral reflux" and "Management of bladder dysfunction in children".)

Surveillance cultures — Routine surveillance cultures for asymptomatic children after their first UTI should not be performed [19]. In a study comparing oral and intravenous antibiotics for UTI in children, routine surveillance of asymptomatic children did not enhance identification of true UTI episodes [2]. Further, treatment of patients who have bacteriuria without symptoms is unproven and may be harmful [20]. (See "Urinary tract infections in infants and children older than one month: Clinical features and diagnosis", section on 'Asymptomatic bacteriuria'.)

Prophylaxis — Several randomized trials have evaluated the benefit of prophylactic antibiotics in preventing recurrent UTI in children, but most studies included only children with VUR [21]. Three trials included children with and without VUR, but none was powered to detect differences in efficacy in the subgroup of children without VUR [22-24]. A meta-analysis of individual data restricted to young children 2 to 24 months of age without VUR did not detect a benefit for prophylaxis in preventing recurrence [13]. Importantly, very few children in the three trials had history of recurrent UTIs; two trials restricted enrollment to children with a first UTI and one trial included <30 percent of children with recurrent UTI. Thus, although available data suggest that routine prophylactic antibiotics are not beneficial after a first UTI in children without VUR, there are few data to guide care of children with frequent recurrent UTIs.

We suggest antimicrobial prophylaxis in children without vesicoureteral reflux (VUR) who have frequent recurrent UTIs (three febrile UTIs in six months or four total UTIs in one year). When prescribing antimicrobial prophylaxis, we generally suggest trimethoprim-sulfamethoxazole (TMP-SMX) 2 mg TMP/kg as a single daily dose or nitrofurantoin 1 to 2 mg/kg as a single daily dose for six months. Antimicrobial prophylaxis can be discontinued if no infection occurs during the period of prophylaxis; if infection recurs, resumption of prophylaxis may be warranted. The management of children with VUR is discussed separately. (See "Management of vesicoureteral reflux".)

Cranberry juice — We do not routinely suggest cranberry juice for the prevention of recurrent UTI in children. In a meta-analysis of 13 studies including children and adults (n = 2462), cranberry products did not reduce the occurrence of symptomatic UTI compared with placebo, water, or no treatment [25]. Meta-analysis of two studies limited to children with recurrent UTI [26,27] also found no benefit. Although cranberry juice in moderation is unlikely to be harmful, excessive intake may contribute to dental caries, diarrhea, and obesity.

INFORMATION FOR PATIENTS — UpToDate offers two types of patient education materials, “The Basics” and “Beyond the Basics.” The Basics patient education pieces are written in plain language, at the 5th to 6th grade reading level, and they answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials. Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are written at the 10th to 12th grade reading level and are best for patients who want in-depth information and are comfortable with some medical jargon.

Here are the patient education articles that are relevant to this topic. We encourage you to print or e-mail these topics to your patients. (You can also locate patient education articles on a variety of subjects by searching on “patient info” and the keyword(s) of interest.)

- Basics topic (see "Patient information: Urinary tract infections in children (The Basics)")
- Beyond the Basics topic (see "Patient information: Urinary tract infections in children (Beyond the Basics)")

SUMMARY AND RECOMMENDATIONS

- Families of young children with urinary tract infection (UTI) should receive instruction about the risk of recurrent UTI and be advised to seek medical attention promptly for fever and/or urinary symptoms. (See 'Recurrent symptoms' above and "Urinary tract infections in children: Epidemiology and risk factors", section on 'Risk factors for renal scarring'.)
- The evaluation for episodes of fever and/or urinary symptoms should include a properly collected urine specimen (using bladder catheterization in children who are not toilet trained) which is then sent for urinalysis, urine culture, or both. (See "Urinary tract infections in infants and children older than one month: Clinical features and diagnosis", section on 'Laboratory evaluation'.)
- The treatment of bowel and bladder dysfunction may include timed voiding, "double voiding," the use of laxatives, and/or referral to a urologist. (See 'Children with bowel and bladder dysfunction' above.)
- Routine surveillance cultures in asymptomatic children after their first UTI are unnecessary. (See 'Surveillance cultures' above.)
- We suggest antimicrobial prophylaxis in children without vesicoureteral reflux (VUR) who have frequent recurrent UTIs (three febrile UTIs in six months or four total UTIs in one year) (**Grade 2B**). Trimethoprim-sulfamethoxazole or nitrofurantoin may be used for prophylaxis. (See 'Prophylaxis' above.)
- Prophylactic antibiotics are usually continued for six months. They can be discontinued if no infection occurs during the period of prophylaxis. Resumption of prophylaxis may be warranted if infection recurs. (See 'Prophylaxis' above.)
- We do not routinely suggest cranberry juice for the prevention of recurrent UTI in children (**Grade 2B**). (See 'Cranberry juice' above.)
- The long-term management and follow-up of children with vesicoureteral reflux are discussed separately. (See "Management of vesicoureteral reflux".)

REFERENCES

1. Hoberman A, Charron M, Hickey RW, et al. Imaging studies after a first febrile urinary tract infection in young children. N Engl J Med 2003; 348:195.
2. Hoberman A, Wald ER, Hickey RW, et al. Oral versus initial intravenous therapy for urinary tract infections in young febrile children. Pediatrics 1999; 104:79.
3. Conway PH, Cnaan A, Zaoutis T, et al. Recurrent urinary tract infections in children: risk factors and association with prophylactic antimicrobials. JAMA 2007; 298:179.
4. Peters CA, Skoog SJ, Arant BS Jr, et al. Summary of the AUA Guideline on Management of Primary Vesicoureteral Reflux in Children. J Urol 2010; 184:1134.
5. Shaikh N, Ewing AL, Bhatnagar S, Hoberman A. Risk of renal scarring in children with a first urinary tract infection: a systematic review. Pediatrics 2010; 126:1084.
6. Goldraich NP, Goldraich IH. Followup of conservatively treated children with high and low grade vesicoureteral reflux: a prospective study. J Urol 1992; 148:1688.
7. Panaretto K, Craig J, Knight J, et al. Risk factors for recurrent urinary tract infection in preschool children. J Paediatr Child Health 1999; 35:454.
8. Martinell J, Hansson S, Claesson I, et al. Detection of urographic scars in girls with pyelonephritis followed for 13-38 years. Pediatr Nephrol 2000; 14:1006.
9. Wennerström M, Hansson S, Jodal U, Stokland E. Primary and acquired renal scarring in boys and girls with

urinary tract infection. J Pediatr 2000; 136:30.

10. Merrick MV, Notghi A, Chalmers N, et al. Long-term follow up to determine the prognostic value of imaging after urinary tract infections. Part 2: Scarring. Arch Dis Child 1995; 72:393.
11. Hiraoka M, Hashimoto G, Tsuchida S, et al. Early treatment of urinary infection prevents renal damage on cortical scintigraphy. Pediatr Nephrol 2003; 18:115.
12. Smellie JM, Poulton A, Prescod NP. Retrospective study of children with renal scarring associated with reflux and urinary infection. BMJ 1994; 308:1193.
13. Subcommittee on Urinary Tract Infection, Steering Committee on Quality Improvement and Management, Roberts KB. Urinary tract infection: clinical practice guideline for the diagnosis and management of the initial UTI in febrile infants and children 2 to 24 months. Pediatrics 2011; 128:595.
14. Koff SA, Lapides J, Piazza DH. Association of urinary tract infection and reflux with uninhibited bladder contractions and voluntary sphincteric obstruction. J Urol 1979; 122:373.
15. Koff SA, Murtagh DS. The uninhibited bladder in children: effect of treatment on recurrence of urinary infection and on vesicoureteral reflux resolution. J Urol 1983; 130:1138.
16. Seruca H. Vesicoureteral reflux and voiding dysfunction: a prospective study. J Urol 1989; 142:494.
17. Feldman AS, Bauer SB. Diagnosis and management of dysfunctional voiding. Curr Opin Pediatr 2006; 18:139.
18. Loening-Baucke V. Urinary incontinence and urinary tract infection and their resolution with treatment of chronic constipation of childhood. Pediatrics 1997; 100:228.
19. American Academy of Pediatrics. Ten things physicians and patients should question. http://www.choosingwisely.org/doctor-patient-lists/american-academy-of-pediatrics/ (Accessed on March 18, 2014).
20. Hansson S, Jodal U, Norén L, Bjure J. Untreated bacteriuria in asymptomatic girls with renal scarring. Pediatrics 1989; 84:964.
21. Williams G, Craig JC. Long-term antibiotics for preventing recurrent urinary tract infection in children. Cochrane Database Syst Rev 2011; :CD001534.
22. Craig JC, Simpson JM, Williams GJ, et al. Antibiotic prophylaxis and recurrent urinary tract infection in children. N Engl J Med 2009; 361:1748.
23. Garin EH, Olavarria F, Garcia Nieto V, et al. Clinical significance of primary vesicoureteral reflux and urinary antibiotic prophylaxis after acute pyelonephritis: a multicenter, randomized, controlled study. Pediatrics 2006; 117:626.
24. Montini G, Rigon L, Zucchetta P, et al. Prophylaxis after first febrile urinary tract infection in children? A multicenter, randomized, controlled, noninferiority trial. Pediatrics 2008; 122:1064.
25. Jepson RG, Williams G, Craig JC. Cranberries for preventing urinary tract infections. Cochrane Database Syst Rev 2012; 10:CD001321.
26. Salo J, Uhari M, Helminen M, et al. Cranberry juice for the prevention of recurrences of urinary tract infections in children: a randomized placebo-controlled trial. Clin Infect Dis 2012; 54:340.
27. Ferrara P, Romaniello L, Vitelli O, et al. Cranberry juice for the prevention of recurrent urinary tract infections: a randomized controlled trial in children. Scand J Urol Nephrol 2009; 43:369.

Topic 6066 Version 13.0

Disclosures

Disclosures: **Nader Shaikh, MD** Nothing to disclose. **Alejandro Hoberman, MD** Nothing to disclose. **Tej K Mattoo, MD, DCH, FRCP** Nothi [antibiotic (Ceftaroline)]; Optimer [antibiotic (fidaxomicin)]. Consultant/Advisory Boards: Pfizer [vaccine (PCV13)]. **Mary M Torchia, MD** Nothing to disclose.

Contributor disclosures are reviewed for conflicts of interest by the editorial group. When found, these are addressed by vetting through a m Appropriately referenced content is required of all authors and must conform to UpToDate standards of evidence.

Conflict of interest policy