For severe clinical presentations, a retrospective study of children with febrile UTI included those with initial tachycardia, hypotension and/or vomiting.[118] It showed that 6–9 days was as effective as ≥10 days of total antibiotics, although it did not report numbers with severe features. Once features of sepsis resolve (usually by day 3),[119] total antibiotic duration is dependent on bacteremia. A multicenter study of children under 6 months with UTI found bacteremia was more likely to be treated with ≥4 than ≤3 days IV (total 7–14 days).[120] A case-control study comparing bacteremic versus nonbacteremic UTI found a difference in IV (5–7 vs. 3–4 days) but not total (11–12 days) antibiotic duration, and no differences in outcomes.[116] For acute lobar nephronia, a review including overlapping RCTs compared 14 versus 21 days' total duration, with initial IV then switching to oral 2–3 days after defervescence.[61,121] There was higher treatment failure with 14 days, but failure was associated with longer pre-presentation fever, suggesting longer treatment is necessary for more established abscesses.

For nonurologic underlying conditions affecting the kidneys, RCTs that did not exclude renal impairment showed no difference comparing ≤3 versus ≥4 days IV of a total of 8–15 days, although renal impairment was not analyzed separately.[117,122] Postrenal transplant, expert opinion recommends 14 days total for febrile UTI/pyelonephritis, switching from IV with clinical improvement.[62]

Although immunocompromised children were unusually included in a study of febrile UTI, numbers were too small to extrapolate findings of shorter antibiotic durations.[118] A small study found children with cancer often have few classic UTI symptoms,[123] so diagnosis and definitive treatment may be delayed. Immunocompromised children usually have multiple admissions and antibiotic courses, so they are more likely to have unusual bacteria or resistance. Once definitive treatment starts, there is no reason for prolonged courses in this or other chronic conditions (eg, diabetes and liver disease).

For children with significant urologic abnormalities, the only study comparing total antibiotic duration included 23% with urological abnormalities and found no difference between 6–9 and ≥10 days in treatment failure/recurrence, although it did not analyze them separately.[118] Two RCTs investigating IV duration for febrile UTI included 34% and 37% children with VUR, respectively, and found no difference between 3 and ≥7 days IV of a total 8–15 days.[117,122,124] A retrospective study including 1930 children with urological abnormalities found they were more likely to be treated with ≥4 days than ≤3 days IV (total 7–14 days), but this was not associated with outcomes.[120] A retrospective study including urological abnormality compared 1 day versus 2–3 days' IV (median total 10 days) and found no difference in readmission, although outcomes were not analyzed by urological abnormality.[32] Recruitment is currently underway for an RCT of cUTI comparing 1 versus 3 days of IV of a total of 7 days of antibiotics.[125]

For children with multiple recurrent UTIs, antibiotic duration should be tailored to each individual acute UTI presentation. Multiple antibiotic courses for recurrent UTIs increase the likelihood of resistance.[84] Longer admissions (although not antibiotic durations) have been shown for ESBL-E UTIs than for non-ESBL-E UTI.[84,126,127] IV treatment via hospital-in-the-home programs could shorten hospital length of stay.[3] For resistant UTIs, a comparison of IV durations of ≥3 days with 0–2 days showed no difference in recurrence, although total duration was not reported.[128] Definitive antibiotic treatment should not usually need a longer duration simply due to resistance.

Supportive Management

- Additional management depends on the cUTI subgroup and complicating features. This may involve antiemetics, fluid resuscitation and management and occasionally intensive care support. There is no clear role for steroids currently (GRADE D).
- Surgically, temporary diversion may be needed for urinary obstruction, and percutaneous drainage is considered for renal abscesses (GRADE D).

Modes of supportive care for cUTI are dependent on subgroup and presenting features. Severely ill patients may need fluid resuscitation and intensive care support. Patients with vomiting should have antiemetics, as this may avoid use of IV antibiotics. With obstructive uropathy, temporary urinary diversion may be needed if antibiotics alone fails.[5] For renal abscesses >3 cm, percutaneous drainage should be considered.[17,61,98,99] A recent meta-analysis concluded that steroids reduced renal scarring associate with UTI.[129] However, the included studies either did not show this at all,[130] or did not reach statistical significance. Given the variations between included studies in inclusion criteria, intervention and timing and the uncertain clinical impact of scar reduction, there is no clear role for steroids in UTI currently. No other medications have been identified as beneficial.

How Should We Follow Up Children With cUTI?

Follow-up of children with cUTI involves consideration of antimicrobial prophylaxis, imaging and referral to nephrology/urology.

Antimicrobial prophylaxis

- The benefit of continuous antibiotic prophylaxis is controversial and reserved for particular cUTI subgroups: (1) in neonates and infants <2 m, this includes those with high-grade VUR (3–4), antenatal hydronephrosis (HN), ureteral dilatation and HN in uncircumcised infants; and (2) in older children, this includes those with multiple recurrent UTI, high-grade VUR (3–4), spina bifida accompanied with high-grade VUR and/or intermittent catheterization, bladder/bowel dysfunction and severe obstructive uropathy until surgical correction (GRADES B–D).
- In neonates, amoxicillin is the drug of choice, while older children are recommended to use trimethoprim-sulfamethoxazole or nitrofurantoin (GRADES C and D).
- Consider use of cranberry products in older children to alleviate antibiotic pressure (GRADE B).
- Duration of CAP should not exceed 3–6 months followed by critical reevaluation (GRADE D).

Effectiveness for cUTI Subgroups

Antimicrobial prophylaxis aims to prevent UTI recurrence. Several RCTs have shown that after 1 UTI, even with VUR grades 1 and 2, there is no benefit to continuous antimicrobial prophylaxis (CAP), so it is not routinely recommended.[27,29,60,131–133] However, studies have shown benefits for some subgroups[134] with cUTI (Table 4).

For children with known significant urologic abnormalities, the most well-studied has been VUR. Several multicenter RCTs have shown significant reduction in UTI recurrence in children with VUR grades 3–5, although without reducing scarring.[88,135,136] In 1 RCT, the impact was particularly high in children with bladder-bowel dysfunction.[136] In a prospective study of myelomeningocele, infants with VUR grades 3 and 4 or clean intermittent catheterization had increased UTI risk, so the authors suggested CAP for these 2 situations.[137] CAP may be beneficial in children with posterior urethral valve obstruction until surgical correction, but