Urinary Tract Infection (UTI) In-Patient Clinical Pathway

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Pathway Flow Diagram/Algorithm

UTI Clinical Pathway Flowchart

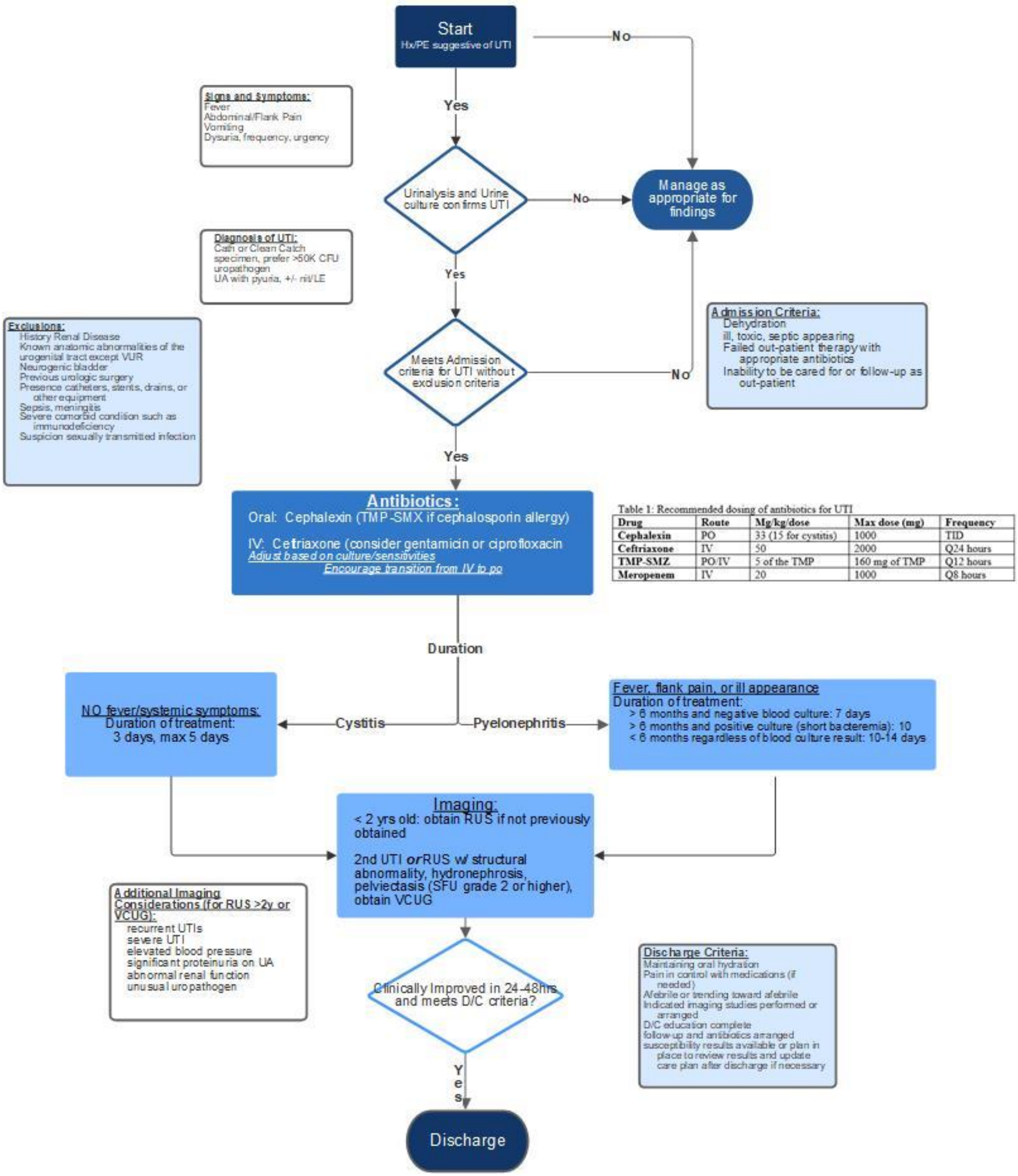

Table 1: Recommended dosing of antibiotics for UTI

Drug	Route	Mg/kg/dose	Max dose (mg)	Frequency
Cephalexin	PO	33 (15 for cystitis)	1000	TID
Ceftriaxone	IV	50	2000	Q24 hours
TMP-SMZ	PO/IV	5 of the TMP	160 mg of TMP	Q12 hours
Meropenem	IV	20	1000	Q8 hours

Scope

Inclusion Criteria:

- Diagnosis of UTI in a patient with suggestive signs and symptoms of UTI as well as supporting urinalysis and positive culture
- Hospitalized children, including admission and observation status, ages 2 months through 18 years.
- Consider also for infants less than 2 months of age who meet no other exclusion criteria. For those infants, also refer to the Febrile Infant Clinical Pathway

Exclusion Criteria:

- History of renal disease
- Known anatomic abnormalities of the urogenital tract other than vesicoureteral reflux
- Neurogenic bladder including the need for catheterization
- Previous urologic surgery
- Presence of catheters, stents, drains or other equipment
- Presence of sepsis or meningitis
- Severe co-morbid condition such as immunodeficiency
- Suspicion of Sexually Transmitted Infection

Key Clinical Recommendations with Evidence Based Supporting Material

- **Diagnosis**
  1. In the appropriate clinical context, urine should be checked using catheterization, or clean catch if the patient is toilet-trained.[iii]

  2. To establish the diagnosis of UTI in the appropriate clinical setting, clinicians should require both a urinalysis suggesting infection (i.e. presence of pyuria and/or bacteriuria, +/- leukocyte esterase, nitrite) as well as a positive urine culture with ≥50,000 CFUs of a uropathogen via catheterized specimen.[iiiiv] Positive urine cultures with less than 50,000 CFUs of a uropathogen should be interpreted in the proper clinical context. The diagnosis of UTI may be considered in these cases, particularly with positive urinalysis, clear clinical symptoms, or in other specific clinical circumstances.

  3. Diagnostic Definitions:
     - Asymptomatic Bacteriuria in older children: No symptoms of a UTI even with pyuria and positive urine culture

     - Cystitis: Dysuria, urgency, frequency, or suprapubic pain in the absence of fever or other systemic symptoms AND pyuria AND positive urine culture

     - Pyelonephritis: Fever, flank pain, or ill appearance AND pyuria (>10 WBC/hpf) AND positive culture

- **General treatment principles**

  1. Always review previous urine culture results to assist with selection of empiric therapy

  2. Always narrow antibiotics (if possible) or stop therapy (if urine cultures reveal no organisms) once culture results are finalized

  3. In the case of catheter-associated UTIs, treatment does not need to continue for the duration of the indwelling catheter

  4. Do not send repeat urine cultures to evaluate for “test of cure”

5. A short duration of bacteremia from a urinary source should not preclude conversion to enteral therapy when patient is showing clinical improvement

6. If S. aureus recovered in urine cultures, obtain blood culture to evaluate for bacteremia

7. Oral and parenteral antibiotic treatment is equally efficacious. Thus practical considerations (i.e. whether patient is tolerating PO, etc) should be used to decide whether to use parenteral vs. oral antibiotic therapy. However, if signs of severe illness/sepsis are present, IV antibiotics are recommended.[v] <u>If started on IV therapy, change antibiotics to enteral therapy once able to tolerate enteral therapy and demonstrating clinical improvement (regardless of age)</u>

- **Empiric Treatment and Duration**

1. Asymptomatic Bacteriuria in older children: No treatment indicated unless patient is to undergo a urologic procedure, has a renal transplant, or is pregnant. Those patients are excluded from this clinical pathway.

2. Cystitis: Duration of treatment: 3 days, max 5 days.

3. Pyelonephritis Duration of treatment:
    a. > 6 months and negative blood culture: 7 days
    b. >6 months and positive blood culture (short bacteremia): 10 days
    c. <6 months regardless of blood culture result: 10-14 days

First-line empiric antibiotic choices include:
1. Oral: Cephalexin.
    - For cephalosporin allergic patients, Trimethoprim-Sulfamethoxazole (TMP-SMZ) should be considered
    - If allergic to both cephalosporins and Sulfa drugs, consult ID for recommendations
2. IV: Ceftriaxone
    - Can be given IM if no IV access
    - For cephalosporin allergic patients, gentamicin or ciprofloxacin could be considered
    - Meropenem should be considered if concerned for sepsis and patient has a history of infection with extended spectrum beta-lactamase (ESBL)-producing *Enterobacteriaceae*

3. Adjust regimen when culture susceptibilities are available[vi]. If patient is on Ceftriaxone and otherwise meeting discharge criteria but final culture not available, provider may consider narrowing to cephalexin vs. using cefdinir while awaiting final culture results.

- **Imaging/Ongoing Management**:
    1. Patients less than 2 years of age with their first febrile UTI should undergo renal and bladder ultrasonography (RUS), ideally prior to discharge.[vii,viii] Consider RUS, as well, in older children depending on clinical circumstances to include:
        - Recurrent febrile UTIs
        - Severe UTI
        - Presence of family history of VUR
        - Presence of elevated blood pressure unrelated to pain or discomfort
        - Significant proteinuria on urinalysis
        - Abnormal renal function
        - Unusual uropathogen identified (i.e. Pseudomonas species)
        - Persistent fevers/symptoms despite appropriate antibiotic therapy

2. Voiding cystourethrogram (VCUG) is not indicated *__routinely__* after first febrile UTI. VCUG is indicated if renal ultrasound reveals hydronephrosis or other findings that would suggest high-grade (VUR) or obstructive uropathy such as RUS with pelviectasis SFU Grade 2 or higher. VCUG is also indicated for a recurrence of febrile UTI. Consider also in other complex clinical circumstances to include:
    - Severe UTI
    - Presence of family history of VUR
    - Presence of elevated blood pressure unrelated to pain or discomfort
    - Significant proteinuria on urinalysis
    - Abnormal renal function
    - Unusual uropathogen identified (i.e. Pseudomonas species)

__Evidence and Supporting Material__

__Background:__

Urinary tract infections are the most common serious bacterial infections in infants and young children affecting 2-5% of all children[ix]. Although common, certain aspects of UTI management have remained controversial. In September of 2011, the American Academy of Pediatrics (AAP) developed a Clinical Practice Guideline to aid in the accurate diagnosis and appropriate treatment of UTI.[x] This CPG was reaffirmed in December, 2016. The AAP suggests appropriate screening measures to diagnose underlying risk factors that may lead to recurrent UTI and possible long-term sequelae. Other evidence has further clarified best practice regarding imaging and antimicrobial prophylaxis, such as the RIVUR study.[xxvii] This guideline is intended to aid physicians in properly incorporating the best available evidence in the management of UTI.

__Risk factors__ for UTI include girls (relative risk 2.27), uncircumcised boys, and absence of another source of infection.[xixii]

Diagnosis: A specimen should preferably be collected via clean catch or catheterized specimen. The AAP CPG supports the option of ruling out UTI with a negative UA from a bag specimen but this is generally not practical in the context of in-patient management.

__Organisms__:

1. Escherichia *coli* is the most common organism and the causative agent in >80% of first UTIs
2. Klebsiella species is the second most common organism in UTIs
3. Uncommon causes of UTI include: Enterococcus, Group B Streptococcus, and Staphylococcus *aureus*, Proteus, Enterobacter, Pseudomonas, and coagulase-negative Staphylococcus

__Antibiotic Therapy__

When initiating empiric treatment the clinician should consider the likely uropathogens and their resistance patterns according to the PCH antibiogram. In 2020, E. *coli* isolates at PCH showed a sensitivity pattern of 92% to Cefazolin and 94% to Ceftriaxone. An individual patient's characteristics should be taken into account such as history of allergies or co-morbid conditions.

Antimicrobial prophylaxis has been shown to decrease the likelihood of recurrent febrile UTI by 12% absolute points in patients with grade 1-4 VUR (RIVUR study ref). However, no therapy has been shown to decrease the risk of scarring in patients with VUR. Antimicrobial prophylaxis also increases the rate of resistant organisms when patients do have a recurrence. Concerns have been raised regarding risk of increased antibiotic resistance in the community given that several thousand doses of antibiotic prophylaxis are required to prevent each UTI. Therefore, risks and benefits for this therapy should be carefully considered in the context of an individual patient. If antimicrobial prophylaxis is used, options include nitrofurantoin, trimethoprim-sulfamethoxazole, cephalexin and amoxicillin. .[xiiixivxvxvixviixviii]

__Imaging__

Since no link has been proven between low-grade VUR and chronic kidney disease and no specific prophylactic or definitive therapy for VUR has been proven useful, there is no proven utility of finding low-grade VUR. As very few patients have high-grade VUR, and evidence for high grade VUR will usually be seen on ultrasonography, the cost of *routine* VCUG after first UTI (i.e. radiation, cost, and discomfort) are not outweighed by this unclear benefit. In the event that high-grade VUR is not detected on ultrasound or screened for with a VCUG, presumably recurrent UTIs will ensue, a VCUG will be indicated and the high grade VUR discovered and addressed appropriately.

<u>Consultation</u> should be considered but not limited to the following clinical scenarios:

- Management is uncertain in the face of high grade (> grade 3) VUR
- Renal scarring or structural abnormality
- Presence of renal or bladder stone
- Unusual organism isolated on urine culture
- Presence of elevated blood pressure unrelated to pain or discomfort, significant proteinuria on urinalysis or abnormal renal function
- Presence of renal or perinephric abscess

Such cases may benefit from consultation with Pediatric Urology, Pediatric Nephrology and/or Pediatric Infectious Disease as deemed appropriate.

<u>Special Considerations for Patients less than 2 months of Age:</u>
Although the AAP Clinical Practice Guideline does not specifically address treatment of UTI in this age group, significant evidence exists to suggest that it is reasonable to use the same general approach. Assuming other infections (such as meningitis or bacteremia) have been ruled-out, there is data to suggest early transition to oral antibiotics is appropriate.[xix] [xx] There has been no risk proven to occur to infants of this age group when transitioned early to oral antibiotics, however, risks of complications from PICC lines and other interventions associated with prolonged IV antibiotic use have been clearly demonstrated.

Medication Recommendations

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Admission Criteria

1. Dehydration with inability to take oral fluids
2. Signs of severe illness/sepsis
3. Failed outpatient appropriate antibiotic treatment
4. Social concerns making treatment outside the hospital unsafe or unfeasible

Discharge Criteria

1. Ability to maintain adequate oral hydration
2. Pain control, if needed, with oral medications only
3. Afebrile or trending towards afebrile
4. Expect outpatient oral antibiotic therapy to be tolerated and effective with organism (antibiotic susceptibility results preferably available or plan in place to review results and update plan if needed after discharge)
5. Indicated imaging studies performed or arranged
6. Discharge education complete
7. Responsible and capable parent(s) or guardian(s) and follow-up to care for the child as an outpatient

Patient and Family Education/Discharge Planning

- Begin discharge education upon presentation to the ED and subsequent admission/observation
    - Review UTI education material with parent(s) or guardian(s) and teach signs of worsening infection and dehydration
    - Review whom to contact for questions or problems and reasons to call physician and return to ED
- Educate families that the expected length of stay is 12-48 hours and that their child will be discharged when they meet the discharge criteria
- Involve case management and social work upon admission if special needs exist that may be expected to delay discharge
- Review antibiotic administration including dosage, frequency, length of therapy, taste, pharmacy availability and cost
- Review follow-up recommendations with primary care provider and any recommendations for further testing or specialty care

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Pathway Champions

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