CLINICAL PATHWAY:
Urinary Tract Infection (UTI)

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.

Factors associated with UTI:

Males
- Uncircumcised <1 year old
- All <6 months old
- Temp >39° C
- Fever >24hrs
- Absence of another source of infection

Females
- All <12 months old
- Temp >39°C
- Fever >2 days
- Absence of another source of infection

Inclusion Criteria: ≥2 months old with 1st or 2nd urinary tract infection (UTI)
Exclusion Criteria: <2 months old, past documented >2 UTI or pyelonephritis, pre-existing GU/Nephro abnormalities, concern for sepsis (see Septic Shock Clinical Pathway)

Initial Work Up:
- *If 2mo-24mo or non-toilet trained*:
  - Obtain urinalysis (U/A) **and** culture via suprapubic aspiration (SPA) or catheterization (cath)
  - If any voided specimen is positive (LE/nitrite/bacteria/pyuria): obtain a cath specimen for U/A, culture
- *If toilet trained/non sexually active adolescent*: Obtain mid stream clean catch U/A and culture
- *If sexually active adolescent*[1]: Obtain dirty urine for GC/Chlamydia, mid stream clean catch U/A, culture, urine hCG

If suspected UTI based on clinical picture **or**
presumed UTI (U/A with positive leukocyte esterase or nitrates, and/or >5 WBC and bacteria)

Meets Admission Criteria?
Requires IV antibiotics; immunocompromised; vomiting/unable to tolerate oral medication; lack of adequate follow-up

Yes

Antibiotics:
Obtain U/A and culture before starting antibiotics.
Review past culture results for potential resistance.
- Start empiric treatment with **Ceftriaxone IV**
  - 2-24 months old: 50 mg/kg/dose q24hr (max 1 g/day)
  - >24 months old: 50 mg/kg/dose q24hr (max 2 g/day)

Work-Up and Consults:
- iStat chem 10, if not done
  - If abnormal, send chem 10 to lab
- Call Nephrology if acute kidney injury (AKI)[2]

Definite UTI?
(+U/A and +culture)
Positive urine culture =
*SPA ≥100 cfu/ml **OR***
Clean catch: ≥100,000 cfu/ml
*of a single organism **OR***
Cath: ≥10,000 cfu/ml

No → Discontinue antibiotics and consider other sources of fever. Consider discussing with Infectious Diseases.

Yes

Antibiotics:
- *If urine culture grows Enterococcus faecalis*: change to ampicillin IV 100 mg/kg/day div q6hr (max 4 g/day). If *Enterococcus faecium* – check susceptibilities before changing.
- Adjust antibiotics according to sensitivities of organism and transition to PO once clinically improving (e.g., improved fever curve, tolerating PO, pain improvement)
  - If organism is not susceptible to cefazolin, discuss with ID
- **Duration of treatment**:
  - Cystitis (e.g., dysuria, frequency, urgency, afebrile): 3 days; mild pyelonephritis (e.g., urinary s/s *and* fever and/or flank pain) with rapid response to antibiotics: 7 days; severe pyelonephritis with delayed response to antibiotics: 10 days; pyelonephritis complicated by intrarenal or perinephric abscess: at least 14 days as directed by ID
- ID consult for: UTI likely but culture >1 organism, drug resistant organisms, UTI with bacteremia, severe pyelonephritis with delayed response to antibiotics, pyelonephritis complicated by intrarenal or perinephric abscess

Order Renal Bladder Ultrasound (RBUS) for:
- All boys, girls 2-24 months, previously abnormal RBUS, girls >24 months at provider discretion (based on behavioral history such as toileting issues, constipation, and bladder dysfunction), seriously ill, poor urine flow, elevated creatinine, urine culture positive for *Candida* or *Staphylococcus aureus*
- *If RBUS is anatomically abnormal, consult Nephrology and/or Urology. Strongly consider VCUG or contrast enhanced voiding urosonography (ceVUS) per urology/radiology while on current therapeutic antibiotics toward end of antibiotic course (at discretion of Urology/Nephrology)*
- *If 2nd UTI with normal RBUS, can discuss further imaging with specialist.*

Consider:
- Treating any bowel/bladder dysfunction (i.e. constipation)

Discharge Criteria
Clinical improvement (down-trending fevers, down-trending CRP if following); adequate PO without need for IVFs; tolerating PO antibiotics; parent capable of caring for child at home; parental education complete; imaging studies completed or scheduled as outpatient; PCP and/or subspecialty follow-up scheduled

No

OUTPATIENT TREATMENT
U/A and culture should be obtained prior to starting antibiotics. Review past culture results for resistance patterns.
If history of MDRO, consult ID and treat off pathway.

Antibiotics:
- **Cephalexin** PO 50 mg/kg/day div TID (max 1 g/dose) *(If concern for pyelonephritis*: 100 mg/kg/day div) (MIC should be ≤2 for cefazolin. If MIC >2, discuss w/ID.)
- *If PCN allergy:*
  - **Bactrim PO** 8 mg TMP/kg/day divided BID (max: 160 mg TMP per dose) or
  - **Nitrofurantoin PO** *(only for use in simple cystitis)* 5-7 mg/kg/day divided QID (max 400 mg/day)
- *If sexually active female with cystitis*:
  - Nitrofurantoin 100 mg BID x5-7 days or Bactrim DS BID x3 days (for *Staph. saprophyticus*). If concern for pyelonephritis, consider cephalexin
- **Duration of treatment**:
  - Cystitis (e.g., dysuria, frequency, urgency, afebrile): 3 days (up to 5-7 if sexually active female on nitrofurantoin)
  - Mild pyelonephritis (e.g., urinary s/s *and* fever and/or flank pain): 7 days
- Discuss need for prophylaxis with urology and/or Infectious Diseases (if involved)

Imaging:
- Renal bladder ultrasound if indicated:
  - All patients ages 2-24 months 1st or 2nd UTI; All boys; previously abnormal RBUS; urine culture positive for *Candida* or *Staphylococcus aureus*
  - Girls >24 months: provider discretion based on behavioral history such as toileting issues, constipation, and bladder dysfunction
- Consider VCUG *or contrast enhanced voiding urosonography (ceVUS) per urology/radiology* if previous or current RBUS abnormal while on current therapeutic antibiotics toward end of antibiotic course *(at discretion of Urology/Nephrology)*

Follow Up:
- Urine culture for speciation and sensitivities. If *Enterococcus faecalis* grows, change to amoxicillin 50 mg/kg/day div TID. If *Enterococcus faecium* – check susceptibilities before changing.
- Schedule follow-up w/PCP
- If imaging abnormal, consider follow-up with Nephrology and/or Urology
  Follow up with ID if multidrug resistant pathogen

[1] **Additional considerations for sexually active females:**
- *If lower abdominal/pelvic pain*: consider bimanual exam to evaluate for PID.
- *If abnormal vaginal discharge*: test for yeast, BV, trichomonas

[2] **Definition of Acute Kidney Injury (AKI)**
(It should be noted that this definition does not apply to children <1 year of age)

AKI is defined by having ***either***:
- At least a 50% increase in Scr above baseline* **and** new Scr ≥0.5 mg/dL **OR**
- An increase by 0.3 mg/dL from baseline*, **and** new Scr ≥0.5 mg/dL

**If a baseline creatinine is unknown, estimate baseline Cr using the Schwartz Calculation (baseline creatinine = (0.413 * height cm)/120 GFR). For patients with Chronic Kidney Disease (CKD), use the CKiD U25 Calculator.*

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