Urinary Tract Infection

Inpatient

Nationwide Children's — When your child needs a hospital, everything matters.

Center for Clinical Excellence

Inclusion & Exclusion Criteria

New suspicion for UTI in an inpatient?

- See **ED UTI Pathway** for diagnosis and initial management.
- Utilize the **UTI Calculator** for children 2-24 months old

Admission for Febrile UTI / Pyelonephritis

- Chem 7 (if not already performed)
- IV fluids and/or anti-emetics as required
- Ceftriaxone 50 mg/kg (max 2000 mg/dose) q24 hours or targeted to prior urine culture results
- **Urgent renal/bladder ultrasound, if indicated**

Check prior urine cultures for resistant organisms (prior 12 months)

Urgent renal/bladder ultrasound (if performed) concerning for abscess or obstruction?

- Yes → Off Pathway → Consult Urology
- No

Electrolyte abnormality or AKI (**definition**)?

- Yes → Replace electrolytes as indicated. Repeat Chem 7 in ~24 hours (or sooner if clinically indicated).
- No

Follow up urine culture result & susceptibilities

Urine culture positive?

- No → Off Pathway **Consider alternate diagnosis**
- Yes

Tailor antibiotic to most narrow appropriate option

Consult ID for multidrug resistant pathogens

Bacteremia present? (if already obtained for other indication; not routinely recommended)

- Yes → Repeat blood culture daily until no growth for 24 hours; If >1 positive blood culture after appropriate therapy initiated → Off Pathway
- No

Obtain/arrange recommended imaging

Obtain recommended consults

Transition to **enteral antibiotic** once tolerating PO/feeds

Total treatment (IV + enteral) duration: 7 days
If Dx Cystitis rather than Febrile UTI /Pyelonephritis refer to ED pathway for antibiotic options & dosing.

Discuss UTI prevention

Discharge from inpatient when meeting criteria:

- Fever improving (resolution NOT required)
- Abdominal/flank pain improving (resolution NOT required)
- Able to maintain hydration with PO/feeds, and able to tolerate enteral antibiotic
- Recommended inpatient imaging & consults completed
- Appropriate follow-up appointments arranged

Inclusion & Exclusion Criteria

Inclusion Criteria:

- Age > 60 days (2 months) and suspicion of UTI

Exclusion Criteria:

- Need for ICU care
- Suspected infection other than UTI
- History of renal disease
- Anatomic or functional abnormalities of the urogenital tract
- Immunodeficiency

Special Patient Populations:

The pathway can be used in the following populations with special consideration in terms of diagnosis, microbiology, imaging, antimicrobials and treatment duration:

- Previous urologic surgery
- Presence of urinary catheters, stents, drains or other equipment

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Differential Diagnoses

Many conditions can mimic symptoms of UTI and cause abnormal urinalysis results. The following list is not exhaustive:

- Bladder & bowel dysfunction (including constipation)
- Irritant urethritis
- Vulvovaginitis
- Sexually transmitted infections
- Local trauma
- Viral cystitis
- Polyuria (e.g. diabetes)
- Nephrolithiasis
- Appendicitis (fever, pain, pyuria)
- Kawasaki Disease (fever, pyuria)

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Follow-up of Urine Culture Results

Negative (any of)

- No growth
- Growth <10K CFU/mL
- Distal urethral/perineal flora only

Off Pathway

In most cases, discontinue antibiotic & consider alternate diagnosis

Equivocal (any of)

- Atypical pathogen ≥50K CFU/mL
- Pure growth 10K-49K CFU/mL
- Mixed growth >10K CFU/mL

Clinician's Discretion

Consider repeat urinalysis, urine Gram stain, and urine culture (may be impacted by pre-treatment)

If low suspicion for true UTI, discontinue antibiotic and consider alternate diagnosis

If high suspicion for true UTI, continue on pathway

Positive

Pure growth of ≥50K CFU/mL typical uropathogen

Continue on Pathway

Typical Uropathogens	Comments
E. coli	~80% UTIs overall
Other enteric Gram-negative bacilli	Klebsiella, Proteus, Enterobacter, etc.
Enterococcus	more common among males with UTI
Staphylococcus saprophyticus	especially adolescents/adults
Pseudomonas	usually in complicated UTIs

Atypical Pathogens	Comments
Group B streptococcus	usually a contaminant, but uncommonly a uropathogen in young infants
Coagulase-negative staphylococcus	usually a contaminant, but uncommonly a uropathogen in young infants
Staphylococcus aureus	may be a contaminant, but consider bacteremic seeding of kidney (especially if flank pain)

Other bacteria may be true UTI pathogens occasionally, particularly in a symptomatic patient with pyuria whose urine culture yields pure growth ≥50,000 CFU/mL

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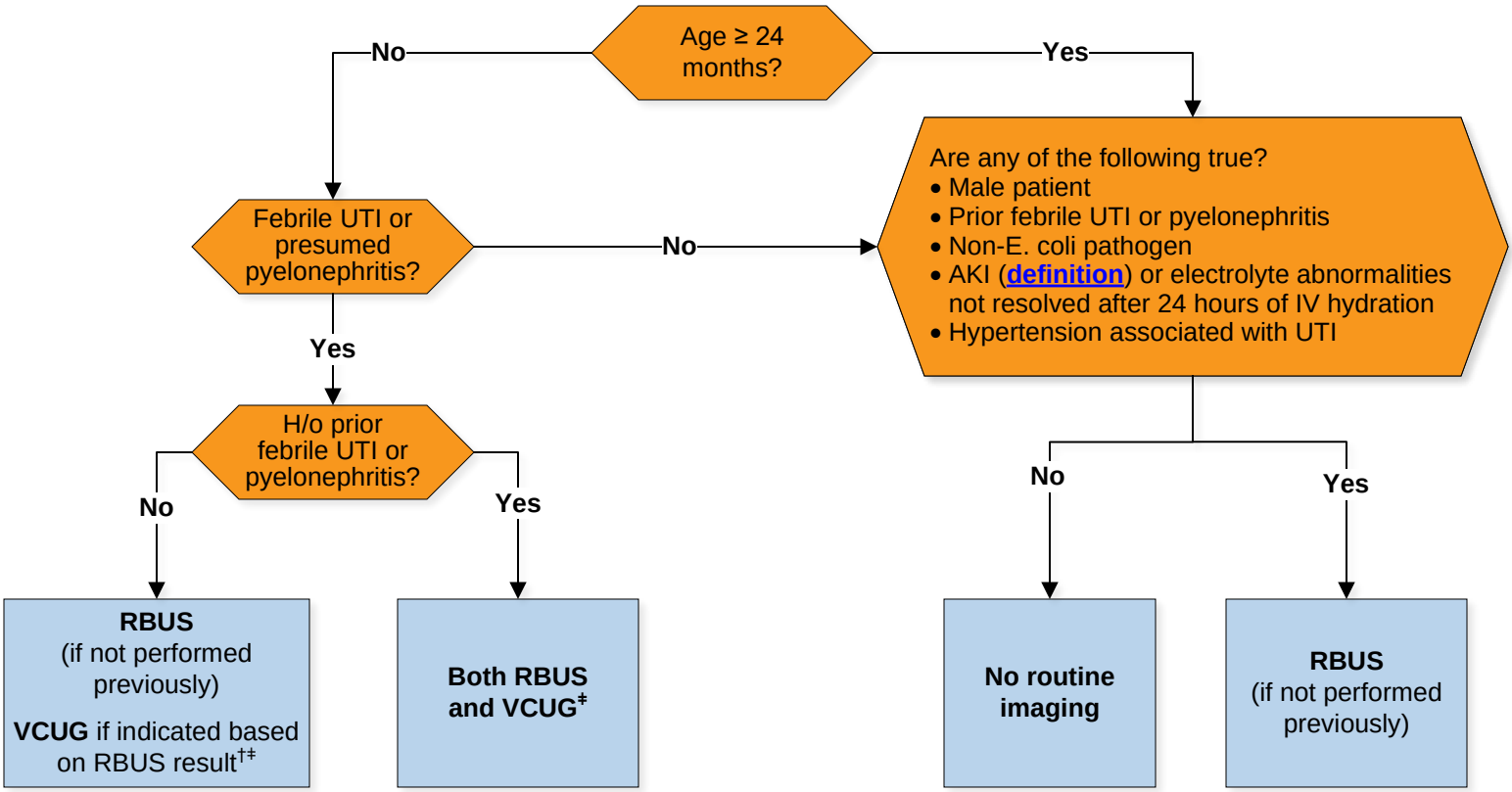
Imaging Recommendations

URGENT renal/bladder ultrasound (RBUS):

- *Complete same day the indication becomes apparent*
- *Goal: evaluate for abscess or obstruction*
- Indications for urgent imaging:
  - Failure to improve after 48 hours of effective antibiotic therapy
  - History of kidney stones
  - Unusually severe presentation: hemodynamic instability or severe flank pain

Non-urgent imaging:

- *Complete once patient afebrile & symptoms improving. May be done outpatient if no social concerns for follow up.*
- *Goal: identify evidence of structural or functional urinary tract anomaly*
- See flowchart and footnotes regarding indications for and timing of renal/bladder ultrasound (**RBUS**) and voiding cystourethrogram (**VCUG**)



†RBUS findings that warrant performing a VCUG:

- Uroepithelial thickening
- Hydronephrosis/pelviectasis
- Hydroureter
- Concern for renal scarring
- Renal size discrepancy >1cm

‡Complete VCUG once afebrile and clinically improved, prior to completion of the antibiotic course if possible

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Consult Recommendations

Recommendations for Consult to Urology and/or Nephrology
(ask specialist if unsure which service most appropriate)

- Hospitalization for a recurrent UTI
- Hemodynamic instability
- Imaging concerning for a structural or functional urinary tract anomaly or UTI complication:
  - Vesicoureteral reflux
  - Posterior urethral valves
  - Bladder diverticulum
  - Ureterocele
  - Bladder and/or kidney stones
  - Solitary kidney
  - Duplex kidney, horseshoe kidney, or cross-fused ectopia
  - Kidney size discrepancy >1 cm
  - Renal cyst(s)
  - Renal/perinephric abscess
  - Renal scar or wedge-shaped areas of increased echogenicity
- AKI (definition below) and/or electrolyte abnormalities not resolved after 24 hours of IV hydration
- Associated hypertension
- Concern for significant **bowel and bladder dysfunction**

Definition of AKI:

- Increase in serum creatinine (SCr) by ≥ 0.5 mg/dL within 48 hrs
- Increase in SCr by ≥ 50% above baseline* (peak value must be at least 0.5 mg/dL)
  - *Baseline SCr:
    - lowest SCr in previous 6 months
    - if no prior SCr, then estimate by Schwartz: 0.413 x height (cm) / 120

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Culture-Directed Enteral Antibiotic Options for Febrile UTI / Pyelonephritis

Spectrum	Antibiotic	Dose
Most Preferred ↓ Least Preferred	Amoxicillin	20 mg/kg/dose (max 875 mg/dose) TID
	Cephalexin	25 mg/kg/dose (max 1000 mg/dose) TID
	TMP/SMX	4 mg/kg/dose (max 160 mg/dose) BID
	Cefdinir	7 mg/kg/dose (max 300 mg/dose) BID
	Amoxicillin/ Clavulanate	20 mg/kg/dose (max 875 mg/dose)* TID
	Ciprofloxacin	15 mg/kg/dose (max 750 mg/dose) BID

*Dose based on amoxicillin component. Use products with 7:1 ratio of amoxicillin to clavulanate below:
Suspension: 400 mg/57 mg/5 mL | Tablet: 875 mg/125 mg | Chewable tablet: 400 mg/57 mg

Duration of treatment is 7 days for febrile UTI / Pyelonephritis. If the diagnosis is bacterial cystitis rather than Febrile UTI / Pyelonephritis, refer to ED pathway for antibiotic options, dosing, and duration.

Nitrofurantoin should not be used for febrile UTI / pyelonephritis because it does not achieve adequate concentrations in kidney tissue.

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Treatments Not Recommended

- Continuous antibiotic prophylaxis is not recommended after a 1st febrile UTI with a normal renal/bladder ultrasound
- Decisions regarding continuous antibiotic prophylaxis in patients with recurrent febrile UTIs or abnormal imaging should be made in consultation with Urology and/or Nephrology

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Patient Handout on UTI Prevention

References

1. SUBCOMMITTEE ON URINARY TRACT INFECTION. Reaffirmation of AAP Clinical Practice Guideline: The Diagnosis and Management of the Initial Urinary Tract Infection in Febrile Infants and Young Children 2-24 Months of Age. *Pediatrics*. 2016;138(6):e20163026. doi:10.1542/peds.2016-3026

2. Afshar K, Mirbagheri A, Scott H, MacNeily AE. Development of a symptom score for dysfunctional elimination syndrome. *J Urol*. 2009;182(4 Suppl):1939-1943. doi:10.1016/j.juro.2009.03.009

3. Brady PW, Conway PH, Goudie A. Length of intravenous antibiotic therapy and treatment failure in infants with urinary tract infections. *Pediatrics*. 2010;126(2):196-203. doi:10.1542/peds.2009-2948

4. Fox MT, Amoah J, Hsu AJ, Herzke CA, Gerber JS, Tamma PD. Comparative Effectiveness of Antibiotic Treatment Duration in Children With Pyelonephritis. *JAMA Netw Open*. 2020;3(5):e203951. Published 2020 May 1. doi:10.1001/jamanetworkopen.2020.3951

5. Hoberman A, Wald ER, Hickey RW, et al. Oral versus initial intravenous therapy for urinary tract infections in young febrile children. *Pediatrics*. 1999;104(1 Pt 1):79-86. doi:10.1542/peds.104.1.79

6. Mattoo TK, Shaikh N, Nelson CP. Contemporary Management of Urinary Tract Infection in Children [published correction appears in Pediatrics. 2022 Oct 1;150(4):e2022059259. doi: 10.1542/peds.2022-059259]. *Pediatrics*. 2021;147(2):e2020012138. doi:10.1542/peds.2020-012138

7. NICE. Overview | Pyelonephritis (acute): antimicrobial prescribing | Guidance | NICE. Nice.org.uk. Published October 31, 2018. https://www.nice.org.uk/guidance/ng111

8. 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. *American Academy of Pediatrics*. 2011;128(3):595-610. doi:https://doi.org/10.1542/peds.2011-1330

9. Shaikh N, Hoberman A, Hum SW, et al. Development and Validation of a Calculator for Estimating the Probability of Urinary Tract Infection in Young Febrile Children. *JAMA Pediatr*. 2018;172(6):550-556. doi:10.1001/jamapediatrics.2018.0217

10. Shaikh N, Lee MC, Stokes LR, et al. Reassessment of the Role of Race in Calculating the Risk for Urinary Tract Infection: A Systematic Review and Meta-analysis [published correction appears in JAMA Pediatr. 2022 Aug 1;176(8):829. doi: 10.1001/jamapediatrics.2022.2261]. *JAMA Pediatr*. 2022;176(6):569-575. doi:10.1001/jamapediatrics.2022.0700

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Quality Measures

- Use of most narrow appropriate option for definitive treatment of inpatients
- Duration of treatment for febrile UTI / pyelonephritis
- Completion of recommended imaging studies
- Inpatient order set utilization
- Inpatient UTI pathway visualization

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Team & Process

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Clinical Pathway Development

This clinical pathway was developed using the process described in the NCH Clinical Pathway Development Manual Version 6, 2022. Clinical Pathways at Nationwide Children's Hospital (NCH) are standards which provide general guidance to clinicians. Patient choice, clinician judgment, and other relevant factors in diagnosing and treating patients remain central to the selection of diagnostic tests and therapy. The ordering provider assumes all risks associates with care decisions. NCH assumes no responsibility for any adverse consequences, errors, or omissions that may arise from the use or reliance on these guidelines. NCH's clinical pathways are reviewed periodically for consistency with new evidence; however, new developments may not be represented, and NCH makes no guarantees, representations, or warranties with respect to the information provided in this clinical pathway.

For more information about our pathways and program please contact:
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Helping Hands

Urinary Tract Infection (UTI): Prevention

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Vancouver Symptom Score

Tool to Assess for Bowel and Bladder Dysfunction

1. I pee in my underwear during the day:	*Response:*	Never	1 day a week	2-3 days a week	4-5 days a week	Everyday
	Score:	0	1	2	3	4
2. When I pee in my underwear, they are:	*Response:*	I don't pee in my underwear	Almost dry	Damp	Wet	Soaked
	Score:	0	1	2	3	4
3. In a normal day I go to the bathroom to pee:	*Response:*	1-2 times	3-4 times	5-6 times	7-8 times	More than 8 times
	Score:	4	2	0	2	4
4. I feel that I have to rush to the bathroom to pee:	*Response:*	Never	Less than half of the time	Half of the time	More than half of the time	Everyday
	Score:	0	1	2	3	4
5. I hold my pee by crossing my legs or sitting down:	*Response:*	Never	Less than half of the time	Half of the time	More than half of the time	Everyday
	Score:	0	1	2	3	4
6. It hurts when I pee:	*Response:*	Never	Less than half of the time	Half of the time	More than half of the time	Everyday
	Score:	0	1	2	3	4
7. I wet my bed at night:	*Response:*	Never	3-4 nights per month	1-2 nights per week	4-5 nights per week	Every night
	Score:	0	1	2	3	4
8. I wake up to pee at night:	*Response:*	Never	3-4 nights per month	1-2 nights per week	4-5 nights per week	Every night
	Score:	0	1	2	3	4
9. When I pee, it stops and starts:	*Response:*	Never	Less than half of the time	Half of the time	More than half of the time	Everyday
	Score:	0	1	2	3	4
10. I have to push or wait for my pee to start:	*Response:*	Never	Less than half of the time	Half of the time	More than half of the time	Everyday
	Score:	0	1	2	3	4
11. I have bowel movements (poop):	*Response:*	More than once per day	Everyday	Every other day	Every 3 days	More than every 3 days
	Score:	0	1	2	3	4
12. My stool (poop) is hard:	*Response:*	Never	Less than half of the time	Half of the time	More than half of the time	Everyday
	Score:	0	1	2	3	4
13. I have bowel (poop) accidents in my underwear:	*Response:*	Never	1-2 times per week	3 times per week	4-5 times per week	Everyday
	Score:	0	1	2	3	4

A total score of ≥ 11 indicates the presence of bowel and bladder dysfunction

Adapted from Afshar et al. *J Urol* 2009