
Urinary Tract Infection Inpatient Clinical Practice Guidelines

Inpatient 9/2020

Developed by: Dr. Angelica Parra, Dr. Karezhe Mersha, Dr. Pilar Gutierrez, and Dr. Robert Reid.

This clinical guideline is intended as an evidence-based guide for clinical care and not as a replacement for clinical decision making.

Estimated revision schedule every 3 years

Inclusion Criteria:

- Birth (with postmenstrual age of at least 40 weeks) to 18 years of age
- Suspected or confirmed UTI

Exclusion Criteria:

- Chronic kidney disease
- Known or suspected genitourinary conditions
 - Vesicoureteral reflux
 - Neurogenic bladder
 - Obstructive uropathy
 - Prior genitourinary surgeries
- Septic shock
- Meningitis
- High suspicion of meningitis (inconclusive cerebral spinal fluid (CSF) cell count or only CSF culture pending)
- Immunocompromised host
- Neonatal Intensive Care, Pediatric Intensive Care, or Intermediate Care admission

Goal:

- Decrease the amount of renal ultrasounds done during hospitalization in order to decrease unnecessary false positives which could decrease need of voiding cystourethrograms (VCUG)
- Decrease overuse of broad spectrum antibiotics which can lead to emergence of resistant E. Coli and other gram negatives.

Definition

- 2011 AAP Clinical practice guidelines*^{1,2}:

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- At least 50K CFU/ml of uropathogen via catheterized (cath) specimen or suprapubic catheter **AND**
 - Urinalysis (UA) suggesting infection
 - pyuria (>or = trace Leukocyte esterase (LE) or > or = 5 WBC/hpf)
or
 - bacteriuria
 - **Definitively Positive**
 - UA + (>5 wbc/hpf) and Cath Ucx + >50 K CFU/ml
 - UA + and Bag Ucx + >100K CFU/ml single organism
 - **Possibly Positive**
 - High clinical suspicion and
 - UA positive and >10K organism or
 - UA neg and >50K single organism
 - **Can have urinary inflammation without bacteria**
 - **Sterile Pyuria**
 - Kawasaki disease, viral infection, pelvic inflammatory disease, appendicitis
 - **Can have colonization which is bacteria can be present in urinary tract without causing inflammation or infection**
 - asymptomatic bacteriuria occurs in ~1% of infants and children
 - a common risk factor for colonization are children who require regular catheterization

Diagnosis

- Evaluate for UTI in all febrile infants 0-56 days old
- Consider UTI in all infants <24 months with fever without source
 - AAP CPG 2011^{*1,2}
 - Factors to change risk
 - Age
 - Gender
 - Race
 - Circumcision status
 - Duration of fever
 - Lack of other source
 - Can use UTIcalc tool to help with probability of UTI <https://uticalc.pitt.edu/>
- Fully Toilet Trained
 - Consider diagnosis based on symptoms, history, and physical exam

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- Symptoms may vary with age
 - Vomiting
 - Fever
 - Diarrhea
 - Strong smelling urine (could be misleading symptom)
 - Abdominal pain /flank pain/back pain
 - Dysuria, urgency, frequency, incontinence
 - Exam
 - Suprapubic tenderness
 - Costovertebral angle tenderness
 - History
 - of bowel or bladder dysfunction
 - Prior UTI and fever >2 or = 2 days
 - Prolonged fever > or = 5 days

If high suspicion of UTI

- Obtain Urinalysis and Urine culture
 - Infants and No-toilet Trained Children:
 - Catheterization or suprapubic aspiration
 - Toilet Trained Children
 - Midstream Clean Catch
 - Adolescents
 - Midstream Clean catch
 - Consider GC/Chlamydia testing
 - If GC/Chlamydia positive
 - Consider HIV testing, Syphilis Screen, hepatitis B and C screens.
 - Consider pregnancy testing in girls

Admission Criteria

- Infants 0-56 days
- All Ages
 - Dehydration requiring IV fluids
 - Failed outpatient therapy
 - Persistent clinical symptoms beyond 48 hours on appropriate therapy
 - Concern of medical non-compliance
 - Not tolerating home treatment
 - Unreliable caregiver

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- At risk for loss to follow up

Inpatient Management

- Infants 0-28 days
 - Start IV ampicillin and gentamicin
 - If E. coli
 - Minimum of 2 days of IV antibiotics *3,4
 - Consider switch to PO after 2 days if afebrile and back to baseline > or + 24 hours, identification and sensitivities returned
 - MDR
 - Consult ID
 - If non E.coli
 - S.aureus or Pseudomonas:
 - Consult ID
 - Higher chance of abnormal urinary tract
 - Other non E.coli pathogens
 - Consider ID consult to discuss length of IV therapy
 - Total Duration IV + PO 10-14 days
 - If positive blood Culture
 - If E. coli
 - Repeat Blood Culture if not improved within 48 hours of starting antibiotics
 - Consider switching to PO after 2-3 days if meets above criteria*5,6,7
 - If a follow up blood culture was obtained, consider switching to po after repeat blood culture is negative for 36 hours.
 - If non E.coli
 - Repeat Blood Culture
 - Consult ID to discuss IV antibiotic duration
- Infants 29-56 days
 - Start IV **Cefazolin** or ampicillin + gentamicin if enterococcus is suspected
 - Minimum of 36 hrs IV antibiotics
 - Switch to PO after 36 hours, if afebrile and back to baseline > or equal 24 hours, identification and sensitivities returned
 - Total IV + PO duration 10-14 days
 - Positive blood culture
 - If E. coli
 - Repeat Blood Culture if not improved within 48 hours of starting antibiotics
 - Consider switching to PO after 2 days if meets above criteria
 - If a follow up blood culture was obtained, consider switching to po after repeat blood culture is negative for 36 hours.

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- If non E.coli
 - Repeat Blood Culture
 - Consult ID to discuss IV antibiotic duration
 - Older infants, children and adolescents
 - Give IV **Cefazolin**
 - Switch to PO if clinical response
 - Total antibiotic duration 7-10 days
 - Adolescents with cystitis can treat 3 day total
 - Identify children with Bladder and Bowel Dysfunction
 - Inquire about constipation symptoms, daytime wetting, and withholding behaviors
 - Bladder dysfunction can be treated
 - Recommend scheduled voiding every 3-4 hours
 - Treat constipation
 - For all ages
 - Children who worsen or fail to improve in 48 hours consider imaging
 - Start with RUS
 - to evaluate for renal abscess or
 - other surgically correctable anatomic abnormalities or
 - Obstruction
 - If RUS is negative and continued concern for abscess, consider CT scan
 - If there is abnormal anatomy or reflux, consider longer treatment course (this is more relevant in older children where sometimes they only get treated for 3-7 days for a typical cystitis).

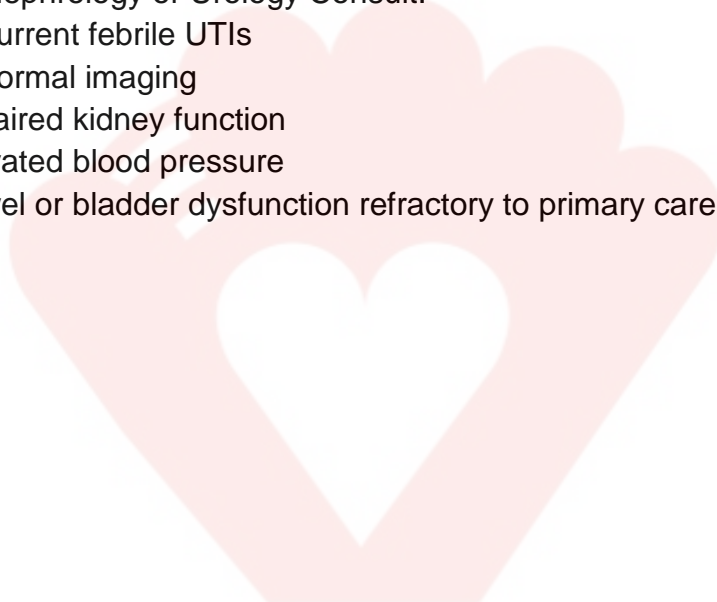
Discharge Criteria

- Clinical response to therapy
- Family and patient education completed
- **If Renal ultrasound (RUS) not completed, notify PCP it needs to be scheduled**
- **If VCUG indicated, notify PCP it needs to be scheduled**
- Social risk factors assessed and addressed
- If other studies were done to evaluate for meningitis or bacteremia, these are negative
- If bacteremia, appropriate treatment completed

Imaging

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- Infant 0-56 days
 - RUS
 - **Timing**8,9,10**
 - **Ask PCP to schedule** 2 weeks after diagnosis
 - During hospitalization if
 - severe illness
 - not improving by 48hrs
 - Concern of noncompliance
 - Concern for abnormal anatomy such as male with history of weak urinary stream
 - VCUG
 - **Timing**
 - **Ask PCP to schedule** after diagnosis
 - During hospitalization
 - Concern of noncompliance
 - if done during acute infection, radiology requests
 - Negative urine culture
 - Afebrile >24 hrs
 - Children 2-24 months
 - RUS
 - First febrile UTI or recurrent UTI
 - **Timing**8,9,10**
 - **Ask PCP to schedule** 2 weeks after diagnosis
 - During hospitalization if
 - severe illness
 - not improving by 48hrs
 - Concern of non-compliance
 - Concern for abnormal anatomy such as male with history of weak urinary stream
 - VCUG
 - Febrile UTI **and** an abnormal renal and bladder ultrasonographic finding
 - **Timing**
 - 2-4 weeks after diagnosis
 - In the hospital,
 - Concern of non-compliance
 - if done during acute infection, radiology requests
 - Negative Urine Culture
 - Afebrile >24 hours
 - **Ask PCP to schedule** if less than 24 months with recurrent febrile UTI
 - Had abnormal RUS
 - Children > 24 months

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- RUS
 - Recurrent febrile UTI
 - Atypical Clinical course
 - Non E. coli UTI
 - **Ask PCP to schedule** 2 weeks after diagnosis**8,9,10
 - During hospitalization if
 - Severe illness
 - Not improving by 48hrs
 - Concern of non-compliance
 - VCUG
 - Discuss with nephrology for imaging recommendations
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- Consider Nephrology or Urology Consult:
 - Recurrent febrile UTIs
 - Abnormal imaging
 - Impaired kidney function
 - Elevated blood pressure
 - Bowel or bladder dysfunction refractory to primary care measures



Bibliography

1. American Academy of Pediatrics, Subcommittee on Urinary Tract Infection, Steering Committee on Quality Improvement and Management. Urinary tract infection: clinical practice guideline for the diagnosis and management of the initial UTI in febrile infants and children aged 2 to 24 months. *Pediatrics*. 2011;128(3):595–610
2. 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
3. William W. Lewis-de los Angeles, Cary Thurm, Adam L. Hersh, Samir S. Shah, Michael J. Smith, Jeffrey S. Gerber, Sarah K. Parker, Jason G. Newland, Matthew P. Kronman, Brian R. Lee, Thomas V. Brogan, Joshua D. Courter, Alicen Spaulding and Sameer J. Patel. *Pediatrics* December 2017, 140 (6) e20171021.
4. [Length of Intravenous Antibiotic Therapy and Treatment Failure in Infants With Urinary Tract Infections](#). Patrick W. Brady, Patrick H. Conway, Anthony Goudie. *Pediatrics*, Aug 2010, 126 (2) 196-203
5. [Parenteral Antibiotic Therapy Duration in Young Infants With Bacteremic Urinary Tract Infections](#). Desai S, Aronson PL, Shabanova V, Neuman MI, Balamuth F, Pruitt CM, DePorre AG, Nigrovic LE, Rooholamini SN, Wang ME, Marble RD, Williams DJ, Sartori L, Leazer RC, Mitchell C, Shah SS; FEBRILE YOUNG INFANT RESEARCH COLLABORATIVE. *Pediatrics*. 2019 Sep;144(3)
6. [Diagnosis and management of bacteremic urinary tract infection in infants](#). Roman HK, Chang PW, Schroeder AR. *Hosp Pediatr*. 2015 Jan;5(1):1-8
7. [Bacteraemic urinary tract infection: management and outcomes in young infants](#). Schroeder AR, Shen MW, Biondi EA, Bendel-Stenzel M, Chen CN, French J, Lee V, Evans RC, Jerardi KE, Mischler M, Wood KE, Chang PW, Roman HK, Greenhow TL. *Arch Dis Child*. 2016 Feb;101(2):125-30
8. Seattle Children's Hospital, Chang, P., Kaplan, R., Ahn, J., Brothers, A., Fenstermacher, S., McMahon, E., Tang, E., Migita, D., 2020 February. Urinary Tract Infection Pathway.
9. [Urinary Tract Infections in Children](#). Eric Balighian, Michael Burke. *Pediatrics in Review*, Jan 2018, 39 (1) 3-12
10. [the-hospitalist.org/hospitalist/article/171218/infectious-diseases/skip-ultrasound-acute-uti-small-children](https://www.the-hospitalist.org/hospitalist/article/171218/infectious-diseases/skip-ultrasound-acute-uti-small-children)

Urinary Tract Infection Inpatient CPG (Abbreviated Version)

Inclusion Criteria, hospitalized patients:

- Birth (with postmenstrual age of at least 40 wks) to 18 years of age
- Suspected or confirmed UTI

Exclusion Criteria:

- Chronic kidney disease
- Known or suspected genitourinary conditions
 - Vesicoureteral reflux
 - Neurogenic bladder
 - Obstructive uropathy
 - Prior genitourinary surgeries
- Septic shock
- Meningitis
- High suspicion of meningitis (inconclusive cerebral spinal fluid (CSF) cell count or only CSF culture pending)
- Immunocompromised host
- Neonatal Intensive Care, Pediatric Intensive care or intermediate care admission

Goal:

- Decrease the amount of renal ultrasounds done during hospitalization in order to decrease unnecessary false positives which could decrease need of voiding cystourethrograms (VCUG)
- Decrease overuse of broad spectrum antibiotics which can lead to emergence of resistant E. Coli and other gram negatives.

Definition of UTI

- Clinical signs and symptoms
- UA with pyuria and or bacteriuria
- Uropathogen identified in Urine

Specimen	Possible	Definitive
Cath	≥10,000 cfu/ml	≥50,000 cfu/ml
Clean Catch	≥50,000 cfu/ml	≥100,000 cfu/ml

Diagnosis:

- Evaluate for UTI in all febrile infants 0-56 days of age
- Consider UTI in all infants <24 months with fever without source
 - Can use UTIcalc tool to help with probability of UTI <https://uticalc.pitt.edu/>
- In fully toilet trained
 - Consider diagnosis based on symptoms, history, and physical exam

Meets diagnostic criteria:

- Obtain Urinalysis and Urine culture
 - Infants and Non-toilet Trained Children:
 - Catheterization or suprapubic aspiration
 - Toilet Trained Children and Adolescents

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- Midstream Clean Catch
 - Adolescents
 - Consider GC/Chlamydia testing
 - Consider pregnancy testing in girls

Admission Criteria:

- Dehydration requiring IV fluids
- Failed outpatient therapy
- Concern of medical non-compliance
- Febrile neonate less than 56 days



Urinary Tract Infection-Inpatient Management

Infants 0-28 days	Infants 29-56 days	Older Infants, Children, & Adolescents
<p>Start IV ampicillin and gentamicin If E. coli</p> <ul style="list-style-type: none"> Minimum of 2 days of IV antibiotics Consider switch to PO after 2 days if afebrile and back to baseline ≥ 24 hrs, identification and sensitivities available MDR: Consult ID <p>If non E.coli</p> <ul style="list-style-type: none"> S.aureus or Pseudomonas <ul style="list-style-type: none"> Consult ID Higher chance of abnormal urinary tract Other non E.coli pathogens: consider ID consult to discuss length of IV therapy <p>Total Duration IV + PO 10-14 days</p> <p>*Consider imaging if no Improvement in 48 hrs</p> <p>**See Criteria for Nephro/Uro consults</p>	<ul style="list-style-type: none"> Start IV Cefazolin only or ampicillin + gentamicin if enterococcus is suspected Minimum of 36 hrs IV antibiotics Switch to PO after 36 hours, if afebrile and back to baseline ≥ 24 hours, identification and sensitivities returned Total IV + PO duration 10-14 days <p>*Consider imaging if no improvement in 48 hrs</p> <p>*Start with RUS, if negative and continued concern for abscess, consider CT scan</p> <p>**See Criteria for Nephro/Uro Consults</p>	<ul style="list-style-type: none"> Give IV Cefazolin Switch to PO if clinical response, consider waiting for identification and sensitivities Total antibiotic duration 7-10 days (consider longer if atypical course) Adolescents with cystitis can treat 3 day total Identify children with Bladder and Bowel dysfunction <p>*Consider imaging if no improvement in 48 hrs</p> <p>**Consider Nephrology or Urology Consult if:</p> <ul style="list-style-type: none"> Recurrent febrile UTIs Abnormal imaging Impaired kidney function Elevated blood pressure Bowel or bladder dysfunction refractory to primary care measures



<p>Positive Blood Culture If E. coli</p> <ul style="list-style-type: none"> Repeat Blood Culture if not improved within 48 hours of starting antibiotics Consider switching to PO after 2-3 days if meets above criteria If a follow up blood culture was obtained, consider switching to po after repeat blood culture is negative for 36 hours. <p>If non E.coli</p> <ul style="list-style-type: none"> Repeat Blood Culture Consult ID to discuss IV antibiotic duration 	<p>Positive blood culture If E. coli</p> <ul style="list-style-type: none"> Repeat Blood Culture if not improved within 48 hours of starting antibiotics Consider switching to PO after 2 days if meets above criteria If a follow up blood culture was obtained, consider switching to po after repeat blood culture is negative for 36 hours. <p>If non E.coli</p> <ul style="list-style-type: none"> Repeat Blood Culture Consult ID to discuss IV antibiotic duration
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Discharge Criteria:

- Clinical response to therapy
- Family and patient education completed
- If Renal ultrasound (RUS) not completed, notify PCP it needs to be scheduled
- If VCUG indicated, notify PCP it needs to be scheduled
- Social risk factors assessed and addressed
- If other studies were done to evaluate for meningitis or bacteremia, these are negative
- If bacteremia, appropriate treatment completed

Imaging:

<p>Infant 0-56 days</p>	<p>Children 2-24 months</p>	<p>Children >24 months</p>
<p>RUS</p> <ul style="list-style-type: none"> • Ask PCP to schedule 2 weeks after diagnosis • During hospitalization if <ul style="list-style-type: none"> ○ severe illness ○ not improving by 48hrs ○ Concern of noncompliance ○ Concern for abnormal anatomy such as male with history of weak urinary stream <p>VCUG Timing</p> <ul style="list-style-type: none"> • Ask PCP to schedule 2 wks after dx • During hospitalization <ul style="list-style-type: none"> ○ Concern of noncompliance <p>-If done during acute infection, radiology requests</p> <ul style="list-style-type: none"> • Negative urine cx • Afebrile X 24 hrs 	<p>RUS if:</p> <ul style="list-style-type: none"> • First febrile UTI or recurrent UTI • Ask PCP to schedule 2 weeks after diagnosis • During hospitalization if <ul style="list-style-type: none"> ○ severe illness ○ not improving by 48hrs ○ Concern of noncompliance ○ Concern for abnormal anatomy such as male with history of weak urinary stream <p>VCUG If</p> <ul style="list-style-type: none"> • Febrile UTI and an abnormal RUS finding • Ask PCP to schedule <ul style="list-style-type: none"> ○ 2-4 weeks after dx • During hospitalization <ul style="list-style-type: none"> ○ Concern of noncompliance <p>-If done during acute infection, radiology requests</p> <ul style="list-style-type: none"> • Negative urine cx • Afebrile X 24 hrs 	<p>RUS if:</p> <ul style="list-style-type: none"> • Recurrent febrile UTI • Atypical Clinical course • Non E. coli UTI • Ask PCP to schedule 2 weeks after diagnosis <ul style="list-style-type: none"> • During hospitalization if <ul style="list-style-type: none"> ○ severe illness ○ not improving by 48hrs ○ Concern of noncompliance ○ <p>VCUG</p> <ul style="list-style-type: none"> • Discuss with nephrology for imaging recommendations

New Pediatric Clinical Guideline Setup Checklist

Guideline Name:

Goal of Clinical Guideline:

Y

Does the proposed guideline meet the below four criteria?

- The intervention is a structured **multidisciplinary** plan of care
- The intervention is used to translate guidelines or evidence into local structures
- The intervention details the steps in a course of treatment or care in a plan, pathway, algorithm, guideline, protocol or other 'inventory of actions' (i.e. the intervention had time-frames or criteria-based progression)
- The intervention aims to standardize care for a specific population

(Lawal et al. What is a clinical pathway? Refinement of an operational definition to identify clinical pathway studies for a Cochrane systematic Review. BMC Medicine (2016) 14:35)

CHECKLIST

- Physician (or an alternate author) submitting the clinical guideline must be able (directly or through virtual meeting) to attend Clinical Guidelines Meeting
- All participants in the clinical guideline development should be listed and primary author identified
- Participants who are submitting clinical guideline should sign off and include the division chief(s) from all involved specialties (for purposes of disseminating to entire division)
- All clinical guidelines should include a disclaimer ...*"this clinical guideline is intended as an evidence-based guide for clinical care and not as a replacement for clinical decision making"*
- Clinical guideline authors should submit an estimated revision schedule, i.e. every 3 years.
- References must be included in the submission.
- Authors of the guideline must identify 1-2 quality metrics that can be measured to gauge impact on care

Signature of Contributing Pathway Developers:

Dept. Name	MD Developer Name	Signature
Infectious Disease	Dr. Pilar Gutierrez	<i>[Signature]</i>
Infectious Disease	Dr. Robert Reid	<i>[Signature]</i>
Nephrology	Dr. Karezhe Mersha	<i>[Signature]</i>
Hospital Medicine	Dr. Angelica Parr	<i>[Signature]</i>
Date _____	Dr. Angélique Martiny	<i>[Signature]</i>