

Urinary Tract Infections (UTI)

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National Association of
Pediatric Nurse Practitioners™



PIDS

PEDIATRIC
INFECTIOUS
DISEASES
SOCIETY

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Disclosure Statement

No disclosures to report.

No active or potential conflict of interest in relation to this presentation.

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Learning Objectives

Learner will be able to:

- Identify symptoms of UTI
- Identify abnormal labs supportive of UTI diagnosis
- State the first-line antibiotic treatment for urinary tract infections
- Define failure of outpatient antibiotic and next steps

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Clinical Practice Guidelines

American Academy
of Pediatrics



DEDICATED TO THE HEALTH OF ALL CHILDREN™

[Urinary Tract Infection: Clinical Practice Guideline for the Diagnosis and Management of the Initial UTI in Febrile Infants and Children 2 to 24 Months | Pediatrics](#)

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UTI: Frequently Used Terms Signs and symptoms

Febrile UTI - UTI associated with fever and/or urinary symptoms

Asymptomatic bacteriuria (ABU) - Significant bacteriuria in a child with no symptoms of UTI

Sterile pyuria - Increased white cells in urine in the absence of bacteria on urine culture

Bladder-bowel dysfunction (BBD) - Spectrum of signs and symptoms, including incontinence, constipation and/or encopresis associated with functional and behavioral abnormalities of the bowel, lower urinary tract, and pelvic floor

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UTI: Frequently Used Terms Site of infection

Upper-tract UTI - UTI involving kidneys and ureters

Lower-tract UTI - UTI involving bladder and urethra but not upper tract

Pyelonephritis - Kidney infection (febrile UTI may or may not be due to pyelonephritis)

Cystitis - Bladder infection

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Common things being common...

- Bladder infection (Cystitis)
most common
- Kidney infection (Pyelonephritis)
less common but more serious than bladder infection

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UTI: Frequently Used Terms

Severity of infection

Complicated UTI

UTI in newborns

Abdominal and/or bladder mass; kidney and urinary tract anomalies

Urosepsis

Organism other than *E coli*

Atypical clinical course, including absence of clinical response to antibiotic within 72 h


Renal abscess

Complicated cystitis

Children with comorbid medical conditions, underlying bladder pathology

Indwelling bladder catheter

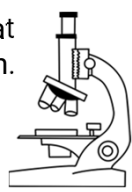
Atypical clinical course



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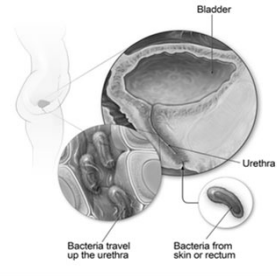
UTI's are one of the most common bacterial infections in children.

Most are ascending infections that start with periurethral colonization.



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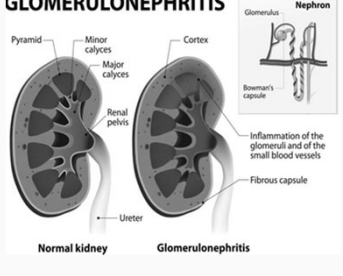
UTI and Anatomy



Bacteria travel up the urethra

Bacteria from skin or rectum

GLOMERULONEPHRITIS



Normal kidney

Glomerulonephritis

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Signs and symptoms of UTI in Infants and Young Children

UTI typically presents with nonspecific symptoms

- fever and irritability
- foul smelling urine
- gastrointestinal symptoms - vomiting, diarrhea, poor feeding

Fever

- May be sole clinical manifestation of UTI in infants and children less than 2 years of age
- More common if fever >/- 39 degrees Celcius than if lower fever present
- Fever > 24 hours associated with increased risk of UTI
- Having another source of fever (i.e. URI, AOM, acute GI) decreases risk but does not eliminate it

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Symptoms of UTI in Infants and Young Children

Bladder Infection (Cystitis) may include:

- Dysuria, pain or burning with urination
- Urinary frequency
- Urgency or need to urinate despite empty bladder
- Blood in Urine
- Pressure, cramping in groin or abdomen (suprapubic)

Kidney Infection (Pyelonephritis) may also include:

- Fever
- Chills
- Lower back pain, lateral back pain (flank pain)
- Nausea or vomiting
- Malaise



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Risk Factors for UTI

- Less than 12 months of age
- Female Child
- No apparent source of fever
- Fever \geq 39 degree Celcius (102.2F)
- Fever \geq 2 days
- Non-black
- Bowel Bladder Dysfunction (BBD)
- Congenital Anomalies of the Kidneys and Urinary Tract (CAKUT)
- Vesicoureteral Reflux (VUR) included in CAKUT
- Circumcision status in male child (Uncircumcised)


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Common organisms causing UTI

85-90% of UTIs are caused by *Escherichia coli*

Other common organisms include:

- Klebsiella
- Proteus
- Enterococcus
- Enterobacter




Pathogens causing UTI are becoming increasingly resistant to commonly used antibiotics

**** Indiscriminate use in doubtful cases of UTI is discouraged ****

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Approaching UTI at Dell Children's Medical Center

First Febrile Urinary Tract Infection Clinical Pathway





Guideline Inclusion Criteria
2 months to 18 years of age
Symptomatic: fussiness, foul smelling urine, blood in urine, new incontinence, dysuria, urethral discharge

Guideline Exclusion Criteria
Known genitourinary anatomical abnormality
Known immunodeficiency and/or on immunosuppressants
Known uncorrected, hemodynamically unstable heart disease
Prior febrile UTI with pathogen other than E. Coli
Prior febrile UTI with E. Coli known to be resistant to empiric abx
Clinically unstable/septic shock

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DCMC Screening Recommendations: First Febrile UTI

Greater than 2 months old and NOT Toilet Trained

<p>Probability of UTI >1% - FEMALE 2 or more risk factors</p> <ul style="list-style-type: none"> Non-black T\geq 39 degrees Celsius Fever \geq 2 days No apparent source of fever Age < 12 months 		<p>Probability of UTI >1% -MALE Uncircumcised OR Circumcised 3 or more risk factors</p> <ul style="list-style-type: none"> Non-Black T\geq 39 degrees Celsius Fever \geq 2 days No apparent source of fever Age < 6 months 	
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Laboratory values supporting UTI Diagnosis

Urinalysis and Urine Culture:

Urine Dipstick alone unable to report WBC count and presence of bacteria

Urine Bag specimen - option for use within guideline for clinician convenience
If Bag UA +, strongly advise obtaining catheterized specimen for urine culture to avoid contamination



Interpretation of UA/Culture Results:
Presence of Leukocyte Esterase OR Nitrites OR Micro + for leukocytes or bacteria = ACTIVE UTI

Pyuria: \geq 5 WBCs/hpf (centrifuged) or \geq 10 WBCs/hpf (counting chamber)
Urine Culture is + if \geq 50,000 cfu/mL in specimen obtained by catheter or suprapubic aspiration
Urine Culture is + if \geq 100,000 cfu/mL in specimen obtained by clean catch

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Antibiotic Management ED/Outpatient - DCMC First Febrile UTI Guideline

Empiric First Line

Cephalexin 50-100 mg/kg/day divided TID-QID
Maximum 1000 mg/dose

Empiric Alternative

Amoxicillin/Clavulanate 20-40 mg/kg/day divided BID
Maximum 875 mg/dose

If IgE Mediated Allergy to Penicillins AND Cephalosporins

Ciprofloxacin 20 mg/kg/day divided BID
Maximum 750 mg/dose


Duration of Antibiotics: IV + PO = 7 Days (>6 months old) or 10 Days (< 6 months old)

**** Trimethoprim/sulfamethoxazole (Bactrim) should be used with caution as empiric therapy due to**

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Criteria for Hospital Admission - UTI Management

- Ill-appearing (SIRS/SEPSIS)
- Dehydration requiring IV or NG fluids
- Persistent vomiting or inability to tolerate PO antibiotics
- Social indicators concerning for treatment compliance or PCP follow-up
- Failure of outpatient treatment with need for IV therapy



Inpatient Criteria from: DCMC EBOC First Febrile UTI Clinical Guidelines, Last updated 5/31/2017

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DCMC Imaging Recommendations for UTI Diagnosis

Renal Bladder Ultrasound Criteria

Age 2 to 24 months: First Febrile UTI or no prior RB U/S
 -Advised in ALL young children with first febrile UTI
 -Advised in older children with recurrent UTI

Age > 24 months with any of the following:
 - Pathogen other than *E. Coli*
 - Family history renal/urologic disease
 - HTN
 - Poor growth (per PCP recs)
 - No clinical improvement on empiric therapy for > 48 hours

Source: DCMC EBOC Imaging Recommendations First Febrile UTI (2017) and Mattou, Shaikh and Nelson (2021)

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DCMC Imaging Recommendations for UTI Diagnosis

Voiding Cystourethrogram (VCUG) Criteria

- Abnormal findings: Hydronephrosis, Scarring, Dilated Pelvis, Dilated Ureter
- Recommended by reviewing Peds Radiologist
- Chronic HTN +/- poor growth
- Urinary pathogen other than *E. Coli*
- ESBL producing *E. Coli*

Source: DCMC EBOC Imaging Recommendations First Febrile UTI (2017) and Mattou, Shaikh and Nelson (2021)

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Simple one page handout made for our local pediatricians!

We reviewed available local pediatric data to provide guidance for the treatment of uncomplicated urinary tract infection in pediatric patients.

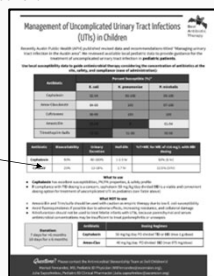
When selecting antibiotics use your local susceptibility data to guide antimicrobial therapy considering the concentration of antibiotics at the site, safety, and compliance (east of administration)

What to use

- **Cephalexin** has excellent susceptibilities, PK/PK properties, & safety profile
- If compliance with TB dosing is a concern, cephalexin 50 mg/kg/day divided BID is a viable and convenient dosing option for treatment of uncomplicated UTI in pediatrics (see Table above)

What NOT to use

- Amoxicillin and Trim/sulfa should be used with caution as empiric therapy due to low *E. coli* susceptibility
- Avoid fluoroquinolones if possible due to adverse effects, increasing resistance, and collateral damage
- Nitrofurantoin should not be used to treat febrile infants with UTIs, because parenchymal and serum antimicrobial concentrations may be insufficient to treat pyelonephritis or urosepsis.



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Local Antibigram - Gram Negative

DELL CHILDREN'S MEDICAL CENTER OF CENTRAL TEXAS
2020 - 2021 ANTI BIOGRAM

GRAM NEGATIVE	Number of isolates	Antibiotic Susceptibility											
		Amoxicillin	Ampicillin	Amoxicillin/Clavulanic Acid	Amikacin	Colistin	Colistin	Colistin	Colistin	Colistin	Colistin	Colistin	Colistin
<i>E. coli</i>	107	100	100	100	100	100	100	100	100	100	100	100	100
<i>K. pneumoniae</i>	17	88	88	88	88	88	88	88	88	88	88	88	88
<i>K. oxytoca</i>	15	73	73	73	73	73	73	73	73	73	73	73	73
<i>P. mirabilis</i>	44	100	100	100	100	100	100	100	100	100	100	100	100
<i>E. cloacae</i>	14	88	88	88	88	88	88	88	88	88	88	88	88
<i>K. aerogenes</i>	18	100	100	100	100	100	100	100	100	100	100	100	100
<i>S. marcescens</i>	11	100	100	100	100	100	100	100	100	100	100	100	100
<i>C. freundii</i>	1	100	100	100	100	100	100	100	100	100	100	100	100
<i>P. aeruginosa</i>	143	89	89	89	89	89	89	89	89	89	89	89	89
<i>S. enteritidis</i>	23	100	100	100	100	100	100	100	100	100	100	100	100
<i>Salmonella spp.</i>	18	100	100	100	100	100	100	100	100	100	100	100	100
<i>S. maritima</i>	1	100	100	100	100	100	100	100	100	100	100	100	100
<i>A. baumannii</i>	8	100	100	100	100	100	100	100	100	100	100	100	100

DELL CHILDREN'S MEDICAL CENTER OF CENTRAL TEXAS
2020 - 2021 ANTI BIOGRAM

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Local Antibigram - Gram Positive

DELL CHILDREN'S MEDICAL CENTER OF CENTRAL TEXAS
2020 - 2021 ANTI BIOGRAM

GRAM POSITIVE	Number of isolates	Antibiotic Susceptibility											
		Penicillin	Penicillin + M	Amoxicillin	Amoxicillin/Clavulanic Acid	Amikacin	Colistin	Colistin	Colistin	Colistin	Colistin	Colistin	Colistin
MSSA	331	100	100	100	100	100	100	100	100	100	100	100	100
MRSA	131	100	100	100	100	100	100	100	100	100	100	100	100
<i>S. epidermidis</i>	93	100	100	100	100	100	100	100	100	100	100	100	100
<i>E. faecalis</i>	117	100	100	100	100	100	100	100	100	100	100	100	100
<i>E. faecium</i>	8	100	100	100	100	100	100	100	100	100	100	100	100
<i>S. pneumoniae</i>	41	83	83	83	83	83	83	83	83	83	83	83	83

DELL CHILDREN'S MEDICAL CENTER OF CENTRAL TEXAS
2020 - 2021 ANTI BIOGRAM

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Urine collection protocol

Step by step:

1. Wash hands with soap and water
 2. Do not remove the cap from the urine cup until time of collection
 3. Refrain from touching the inside of cup or cap at any time
 4. Clean with towelette
 - Male: Clean the penis using circular strokes, if your child is uncircumcised pull back the foreskin and clean thoroughly
 - Female: First wipe the ride side of the urinary opening from front to back, with new towelette wipe the left side from front to back, with new towelette wipe the center area
1. Collect at least 30 mL of urine
 - Have the child start urinating, then hold the container under the stream of urine and collect 30 mL (mid stream catch)
 1. Recap the urine cup
 2. After collection label with full name and date of birth
 3. Bring specimen to lab within 30 minutes or refrigerate sample and keep cold when transferring to lab

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Can UTIs Be Prevented

Change diapers often to help prevent the spread of bacteria that cause UTIs

Girls should know to wipe from front to back

School-age girls

Avoid irritating agents like bubble baths, spray, powders in the genital area

Wear cotton underpants and avoid tight fitting jeans or pants

After swimming change into dry clothing

Dysfunctional voiding

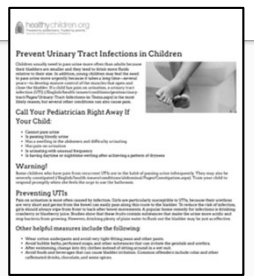
Stay well hydrated

All kids should be taught not to "hold it" when they have to go. Pee that stays in the bladder gives bacteria a good place to grow.

Avoid constipation

Encourage children should have a bowel movement once daily

Common foods that can cause irritation to bladder include caffeinated drinks,



Family resource at healthychildren.org

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Additional Parent Education



Call Your Pediatrician Right Away If Your Child:

- Cannot pass urine
- Is passing bloody urine
- Has a swelling in the abdomen and difficulty urinating
- Has pain on urination
- Is urinating with unusual frequency
- Is having daytime or nighttime wetting after achieving a pattern of dryness

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AAP Red Book - Role of the Medical Provider

1. Confirm the diagnosis of urinary tract infection by documenting that the patient is symptomatic and has a properly obtained urinalysis and positive quantitative culture. When the infection is confirmed and susceptibility tests are completed, choose an appropriate agent with the narrowest spectrum of activity to target the isolated organism.

3. Standardize processes to ensure that appropriate cultures and other diagnostic tests are obtained before antimicrobial agents are administered.

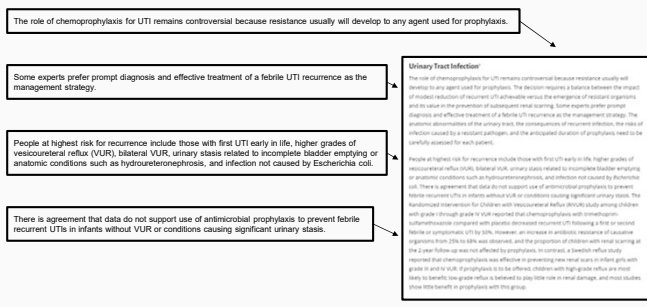
4. Know how to access local antibiograms and be aware of antimicrobial resistance patterns.

7. Collaborate with the local antimicrobial stewardship team and request formal infectious diseases consultation for cases in which the patient has comorbidities, a severe illness, difficult to treat organism, or if the diagnosis is uncertain.



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AAP Red Book - Infection-Prone Sites



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Case Study

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Case Study

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Case Study

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References

American Academy of Pediatrics. Urinary tract infection: Clinical practice guideline for the diagnosis and management of the initial uti in febrile infants and children 2-24 months

Dell Children's Medical Center of Central Texas (Updated 31 May 2017). EBOC uti pathway: First febrile urinary tract infection. Retrieved from link: [First Febrile Urinary Tract Infection Risk Factors and Screening Recommendations](#).

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<https://www.healthychildren.org/English/health-issues/conditions/genitourinary-tract/Pages/Prevent-Urinary-Tract-Infections-in-Children.aspx>

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