Urinary Tract Infections: Update on Current Treatment Strategies

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Introduction

UTI is the 15th most common condition seen by family physicians

UTIs are more common in women, because:

- Shorter urethra
- Presence of antibacterial substances in male prostatic fluid


Annual Incidence

- Annual prevalence in women of 11%
- Young healthy **adult men** is less than 1%.

*Krieger JN, Ross SO, Simonsen JM. J Urol 1993*
*Fihn SD. N Engl J Med 2003*
Urinary tract infections (UTIs) are often differentiated into upper and lower:

Lower UTIs (Acute cystitis)
Infection of the bladder

Upper UTIs (Pyelonephritis)
Infection of the kidney.

Clinical presentation helps differentiate between upper and lower UTIs.
Lower and Upper UTIs

• Lower UTIs (cystitis) make up most UTIs.

• **Upper UTIs** are significantly less common, with an **annual incidence of 12 to 13 cases per 10,000 women**

Complicated Vs Uncomplicated

UTIs are also classified as either:

**Complicated**

or

**Uncomplicated**
Complicated Vs Uncomplicated

- Most UTIs are uncomplicated

- A complicated UTI, whether localized to the lower or upper tract, is associated with an underlying condition that increases the risk of recurrent infection or treatment failure.
Case of Patient Ann

Ann is a 30 y.o. diabetic female presents with urinary frequency for the last 8 days. Her last UTI was about 10 months ago when she was treated as an outpatient for a “kidney infection.” She and her husband have been trying to conceive for the last few months.

What factors about her presentation place her at risk for a complicated UTI?
1. Hx of Diabetes

*Conditions that make a UTI complicated: Diabetes Mellitus, Renal Failure or hx renal transplantation, Functional abnormality or obstruction of urinary tract, Immunosuppression*

2. Urinary frequency for the last 8 days

*Symptoms for 7 or more days before seeking care*

3. Last UTI was about 10 months ago when she was treated as an outpatient for a “kidney infection”

*History of acute pyelonephritis in the past year*

4. Her has been trying to conceive

*If she is pregnant*
Conditions that make a UTI Complicated

- Diabetes
- Pregnancy
- History of acute pyelonephritis in the past year
- Symptoms for 7 or more days before seeking care
- Multidrug-resistant pathogen
- Hospital-acquired infection
- Renal failure
Conditions that make a UTI Complicated

- Urinary tract obstruction (benign prostatic hypertrophy, stenosis, stone)
- Presence of an indwelling urethral catheter, stent, nephrostomy tube, or urinary diversion
- Recent urinary tract instrumentation
- Functional or anatomic abnormality of the urinary tract
- Renal transplantation
- Immunosuppression
Risk Factors for UTI
RISK FACTORS FOR UTI

Indwelling catheter and hospitalization:

Hospitalized patients have a risk of **5% per day** while an indwelling catheter is in place

female gender

Recent/frequent sexual intercourse

Spermicide use (*Staphylococcus Saprophyticus*)

Pelvic examinations and Pap smear

Immunodeficiency


RISK FACTORS FOR UTI

Lack of circumcision in men

Urinary tract structural abnormality, stent, obstruction, or instrumentation

History of previous UTI

Renal Disease

Tiemstra JD, Chico PD, Pela E. J Am Board Fam Med 2011
Workup
Urinalysis

Urinalysis by dipstick or microscopy in the absence of urine culture is often sufficient for diagnosis of uncomplicated cystitis.

Most commonly dipstick in an outpatient setting.
Urinalysis/Culture: Method of Urine Collection

Midstream clean catch – for most pts

Catheterization - Urinary retention or inability to give urine

Suprapubic Aspiration
- Neonates or children younger than 2 years
- Phimosis - inability to retract the distal foreskin over the glans
- Chronic infection of the urethra or periurethral glands
- Urethral stricture
- Urethral trauma
Dipstick Testing
Only **nitrite, leukocyte esterase and blood** predict UTI.

In one study, dipstick for diagnosis of UTI was:

77% sensitive and 79% specific if positive for:
Nitrite
OR
Both leukocyte esterase and blood

A negative Dipstick test cannot rule out UTI with high clinical probability

Bent S, Nallamothu BK, Simel DL, et al. Does this woman have an acute uncomplicated urinary tract infection? JAMA 2002
Dipstick Testing: Leukocyste Esterase for Pyuria

- Leukocyte esterase (LE) is not quite as good as Microscopy for WBC but is a rapid screen

Compared to microscopy

sensitivity of 75%-96%
specificity of 94%-98%

Leukocyte Esterase Side-Note

- Particularly in premenopausal pts, compare the LE to the total amount of blood.
- If LE higher than the blood on dipstick, likely NOT just a contaminant.
Nitrite reflects the presence of Enterobacteriaceae (gram-negative bacteria), which convert urinary nitrate to nitrite.

Lacks adequate sensitivity for detection of other organisms

Sensitivity 22% and specificity of 94-99%

False-positive nitrite tests can occur with substances that turn the urine red, such as phenazopyridine or ingestion of beets.

Microscopy
Urinalysis: Microscopy

Pyuria

The finding of greater than or equal to 10 leukocytes/mL

Pyuria is typically present in most women with UTIs, and its absence suggests consideration of another diagnosis or an obstructing lesion.

Pyuria and bacteriuria may be absent if the collecting system is obstructed.

Bacteriuria:

**Determination of bacteriuria by direct microscopy is inaccurate, particularly at lower levels of bacteriuria**

(Culture or **gram stain** better)

*Pappas PG. Med Clin North Am 1991*
Urinalysis: Hematuria

- **Hematuria:** Confirmed only by microscopy
- Helpful because it is common in the setting of UTI but not in urethritis or vaginitis
## Positive Test and Probability of UTI

<table>
<thead>
<tr>
<th>Test</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrite</td>
<td>75%</td>
</tr>
<tr>
<td>Bacteria (microscopy)</td>
<td>35%</td>
</tr>
<tr>
<td>Leukocytes (microscopy)</td>
<td>30%</td>
</tr>
<tr>
<td>Leukocyte esterase:</td>
<td>25-30%</td>
</tr>
<tr>
<td>Blood</td>
<td>9%</td>
</tr>
</tbody>
</table>

*White B. Diagnosis and treatment of urinary tract infection in children. Am Fam Physician 2011*
Case of Patient Jane

Jane is a 24 year old female with no significant PMH who presents with dysuria and urinary frequency for the last 3 days. Denies f/s/c. Vitals nml. No CVA tenderness. Similar symptoms 2 months ago and was treated with Bactrim X 3 days with resolution of symptoms. Her urinalysis shows +1 leukocyte esterase and trace blood.

Does Jane need any further blood or urine tests?
Urine Culture
Urine culture remains the standard for the diagnosis of UTI.

The need for routine urine cultures in non-pregnant women with acute dysuria is controversial, although there is little evidence for routine urine cultures on all patients with dysuria.

Indications for a Urine Culture

- Symptoms are atypical
- Risk factor(s) for a complicated UTI are present
- Pregnancy
- Patient treated for a UTI within 3 months with recurrence or persistence of symptoms
- Suspected or diagnosed pyelonephritis

McIsaac WJ. Arch Intern Med 2002;162(5):600.
Urine Culture

Historically, the definition of UTI was based on the finding at culture of 100,000 CFU/mL of a single organism. **THIS HAS NOW CHANGED.**

Gupta K, Clin Infect Dis 2011;52(5):e103

This definition missed up to 50% of symptomatic infections, and therefore, the lower colony rate of greater than **1000 CFU/mL** is now accepted.


The 2010 Infectious Disease Society of America consensus limits for clean catch midstream urine specimens:

- **Cystitis > 1000 CFU/mL**
- **Pyelonephritis > 10,000 CFU/mL**

**Suprapubic aspirate**: Any pathogen considered evidence of a UTI
Follow-up urine cultures are not needed in patients with *uncomplicated* acute cystitis OR pyelonephritis whose symptoms resolve on antibiotics

**Exception:** Pregnancy
Other Urine Lab Testing

In Hospitalized patients:

- **Urine Gram stain** may be helpful in guiding the choice of empirical therapy

In Women of Childbearing age:

- **Pregnancy testing** should be obtained in all women of childbearing age
**Pyelonephritis Workup:**

- **Urine culture:** should be obtained in all patients with suspected pyelonephritis.

- **Blood Culture:** should be obtained in all patients with suspected pyelonephritis or renal abscess.

- **Complete blood count:** may be useful in determining the severity of infection, but is rarely helpful in determining the diagnosis or the need for admission.
Imaging
Imaging studies are not routinely required
Indications for Imaging

- Patients with **persistent hematuria** or **persistent growth of bacteria aside from E coli** (with appropriate treatment) should undergo **cystoscopy and imaging of the upper urinary tract**.
Indications for Imaging

Imaging should be obtained or considered if the patient:

Has pyelonephritis and:
- Persistent clinical symptoms after 48 to 72 hours of appropriate antibiotic therapy
- Symptoms consistent with renal stones
- Diabetes
- Highly virulent pathogen
- History of urologic surgery
- Immunosuppression
- Recurrent pyelonephritis

Imaging Studies

Computed tomography (CT) is generally the study of choice to evaluate for an underlying anatomic abnormality or abscess

Kawashima A, LeRoy AJ. 2003
Imaging Studies

- Renal ultrasonography is appropriate in patients for whom exposure to contrast or radiation is undesirable.

- Magnetic resonance imaging is not advantageous over CT except when avoidance of contrast dye or ionizing radiation is necessary.

Pathogens
The most common pathogen is *Escherichia coli*, accounting for 70% to 95% cases of acute uncomplicated cystitis.


Uncomplicated UTI Pathogens

The second most common pathogen is *Staphylococcus saprophyticus*, accounting for 5% to 15% of UTIs, and occurs mainly in young women. (spermicide)

Less common pathogens include *Klebsiella pneumoniae* and *Proteus mirabilis*

The microbial spectrum of complicated UTIs is broader

Also includes *Pseudomonas, Enterococcus, Staphylococcus, Serratia, Providencia, and fungi.*


Contaminants

Among otherwise healthy nonpregnant women, the isolation of the following organisms **tend to represent contamination:**

- Lactobacilli
- Enterococci
- Group B streptococci
- Coagulase-negative staphylococci (other than *Staphylococcus saprophyticus*)


Antibiotic Resistance

- In general, a resistance rate greater than 20% is considered unacceptable for 1st line therapy of UTIs
ANTIMICROBIAL RESISTANCE

Significant regional variability

In general, resistance rates greater than 20%:

In **all regions for AMPICILLIN**

**Many regions for trimethoprim-sulfamethoxazole**

Quinolone Resistance

• Fluoroquinolone resistance rates show a consistent trend for *increasing resistance* over time.

• In a US study of outpatient *E coli* urinary isolates, resistance rates to ciprofloxacin increased from 3% to 17% between 2000 and 2010.

Treatment
Asymptomatic Bacteriuria

- Prospective, randomized trials consistently conclude that *antimicrobial therapy* for asymptomatic bacteriuria is *not beneficial in most populations*.


- The *main exception is in pregnant women*
Non-Antibiotic Treatments

Phenazopyridine (Azo, Pyridium)

To relieve discomfort with urination

2-day course is usually sufficient
Treatment: Are Antibiotics necessary for all UTIs?

Without treatment, 25% to 42% of uncomplicated acute cystitis cases in women resolve spontaneously.


Even without effective treatment, progression to pyelonephritis is only around 2%.


However, the standard therapy for all UTIs is antibiotic treatment.
Oral Vs IV Antibiotics for “Severe” UTIs

Cochrane Review: Fifteen RCTs

Included upper and lower UTIS

Studies compared oral, IM, parenteral treatment regimens

No significant outcome differences

Concluded oral therapy appears equally effective for treating UTI and preventing complications

Pohl A. Cochrane Database of Systematic Reviews 2007
Case of Patient Sarah

Sarah is a 25 y.o. female presents with dysuria for the last 2 days. She has no history of urinary structural abnormality, no hx of recurrent/recent UTIs or chronic medical conditions. She denies f/s/c or back pain. No n/v. U/A shows +bld, LE, and nitrites. Based on the current guidelines and medical literature which of the following would be recommended empiric therapy?

A. Keflex
B. Fosfomycin
C. Doxycycline
D. Augmentin
E. Ciprofloxacin
1st Line Tx: Acute Uncomplicated Cystitis

- Nitrofurantoin monohydrate/macrocrystals
- Fosfomycin
- TMP-SMX **

** TMP-SMX resistance has recently increased to levels greater than 20% in many regions, so local resistance levels should be considered before using TMP-SMX
TMP-SMX

TMP-SMX (1 double-strength tablet [160/800 mg] twice daily for 3 days)

Trimethoprim only considered equivalent (sulfa allergic pts)

Recent studies show resistance rates now greater than 20% in many regions

Per IDSA:

Although there is some debate on the use of empirical TMP-SMX for acute cystitis, it should be avoided as empirical treatment if:

The prevalence of resistance is known to be high in the area (>20%)

The patient has taken TMP-SMX for cystitis in the preceding 3 months
Nitrofurantoin

• May be the best 1st line choice

• Nitrofurantoin (100 mg orally twice daily for 5–7 days): nitrofurantoin is a reasonable first-line therapy for uncomplicated acute cystitis based on clinical efficacy and cost. McKinnell JA, Stollenwerk NS, Jung CW, et al. Mayo Clin Proc 2011

• It is bactericidal in urine at therapeutic doses.
Nitrofurantoin

- Clinical **efficacy rate** with a 5-day to 7-day regimen is 90% to 95%


- **Safe in pregnancy**

- Nitrofurantoin should be **avoided if there is suspicion for early pyelonephritis**

- Contraindicated when creatinine clearance is less than 60 mL/min.
Fosfomycin Trometamol

Fosfomycin in a 3-g single dose; safe in pregnancy

“Like a single dose nitrofurantoin”

A bactericidal agent with a clinical efficacy rate that seems to be similar to that of nitrofurantoin.


Should be avoided for pyelonephritis.

More expensive than nitrofurantoin
2nd Line Treatment: Cystitis

Fluoroquinolones: 3-day regimens are reasonable alternative second-line agents

Multiple randomized trials show efficacy, although increased resistance is mitigating their usefulness

When possible, reserve fluoroquinolones for uses other than acute uncomplicated cystitis

2nd Line Treatment: Cystitis

Oral Beta-lactams:

• Beta-lactam antibiotics may be used when usual first-line agents are not appropriate.

• However, oral beta-lactams seem to be less effective than fluoroquinolones and TMP-SMX

Gupta K, Hooton TM, Naber KG, et al.. Clin Infect Dis 2011
Changing Antibiotics

Change to a different antibiotic regimen if:

*Persistent symptoms after 48 to 72 hours*

Recurrent symptoms within a few weeks of treatment
Darlene is a 35 y.o. female with a history renal transplantation who presents with dysuria and urinary frequency for 24hrs. No f/s/c. No CVA T. + nitrites, negative LE, trace blood on UA. Normal creatinine.

What would be the ideal empiric treatment?

A. Ciprofloxacin
B. Fosfomycin
C. Trimethoprim/Sulfa (Bactrim)
D. Macrobid
E. Augmentin (amox/clav)
Treatment of Complicated UTIs
Recap: Conditions that make a UTI Complicated

- Diabetes
- Pregnancy
- History of acute pyelonephritis in the past year
- Symptoms for 7 or more days before seeking care
- Multidrug-resistant pathogen
- Hospital-acquired infection
- Renal failure
Recap: Conditions that make a UTI Complicated

- Urinary tract obstruction
- Presence of an indwelling urethral catheter, stent, nephrostomy tube, or urinary diversion
- Recent urinary tract instrumentation
- Functional/ anatomic abnormality of urinary tract
- Renal transplantation
- Immunosuppression
If tolerate oral therapy, 1st line therapy is: oral fluoroquinolone for 5 to 14 days:

- **Ciprofloxacin**: 500 mg orally twice a day x 7–14 days
- **Levofloxacin**: 750 mg orally daily x 7–14 days
Presence of *gram-positive cocci* is suggestive of *enterococci*, typically treated empirically with *penicillins* such as:

- Amoxicillin
- Ampicillin
- Amoxicillin-clavulanate
Nitrofurantoin, TMP-SMX, fosfomycin, and Oral b-lactams are poor choices for complicated cystitis because of high prevalence of resistance among causative pathogens.

However, use of these antibiotics is acceptable if the isolate is known to be susceptible.
Duration of Treatment: Complicated Cystitis

Most clinical trials have evaluated 7 to 14 days of therapy, but as short as 5 days has been shown to be efficacious.

A minimum 5-7-days is suggested with complicated cystitis.

A longer 10-14 day course is recommended for patients with more severe presentations manifested by fever, bacteremia, or hypotension.

Using a 3-day regimen is not recommended or proven to be effective.

IV Treatment of Complicated Cystitis Treatment

Parenteral regimens include:

- Levofloxacin
- Ciprofloxacin
- Ceftriaxone
- Carbapenem
- Aminoglycoside

Dose and duration often vary based on the severity of the infection

Pyelonephritis Treatment
Outpatient management is acceptable for patients with mild to moderate illness who tolerate PO.

In an emergency department study, a 12-hour observation period with IV antibiotics followed by completion of outpatient oral antibiotics was effective for 97% of patients.

Outpatient Antibiotic Treatment

- Fluoroquinolones are the only oral antimicrobials recommended by the IDSA for outpatient empirical treatment of acute uncomplicated pyelonephritis.

Outpatient Antibiotic Treatment: Pyelonephritis

- Fluoroquinolones: highly effective for treatment of pyelonephritis when the infecting pathogen is susceptible

- However, there is increasing resistance to Quinolones

Outpatient Treatment of Acute Pyelonephritis: IDSA

**Oral Ciprofloxacin** 500mg BID for 7 days, when community resistance to quinolones does not exceed 10%.

If fluoroquinolone resistance is likely >10%:

**ADD** an initial IV (or IM) dose of ceftriaxone or aminoglycoside

Outpatient Treatment of Acute Pyelonephritis: Per IDSA

Oral β-lactam agents are less effective than most other agents available.

The use of nitrofurantoin and fosfomycin should be avoided in pyelonephritis, because they do not achieve suitable renal tissue levels.

Outpatient Pyelonephritis
Antibiotic Treatment

With fluoroquinolone allergy/resistance:

**TMP-SMX or an oral b-lactam** could be used, but **only in combination** with an initial IM/IV dose of long-acting cephalosporin or aminoglycoside.

Case of Patient Berta

Berta is a 47 female on chronic immunosupression for rheumatoid arthritis. She now presents to the ED with new n/v and R sided back pain X 1 week. She has CVA T on R side and UA has +2 LE and + nitrites. Her CBC reveals a mild leukocytosis consistent with previous CBC a few weeks ago. She notes sweats and chills but is afebrile with normal vitals. She is able to tolerate a small amount of PO fluid.

Does this patient need to be admitted?
Should IV or oral antibiotics be used?
Pyelonephritis: Indications for Inpatient Admission

- Complicated pyelonephritis
- Severe illness with high fever, pain, and marked debility
- Inability to maintain oral hydration or take oral medications
- Pregnancy
- Concerns about patient compliance
Uncomplicated Pyelonephritis
Inpatient Antibiotic Regimen

Parenteral Antibiotics:

Fluoroquinolone
Aminoglycoside
3rd or 4th generation cephalosporin
Carbapenem

Treatment of Complicated Pyelonephritis

Mild to Moderate Complicated Pyelonephritis

- Cefepime or ceftriaxone 1 g daily
- Ciprofloxacin 400 mg q 12 h
- Levofloxacin 750 mg daily
- Aztreonam 1 g q 8 h

Complicated Severe Pyelonephritis

- Meropenem 500 mg q 8 h
- Imipenem 500 mg q 6 h
Treatment of Pyelonephritis With Bacteremia

There is no evidence that bacteremia (without sepsis) has a worse prognosis.

The duration of antibiotic therapy does not need to be extended in the absence of other complicating factors.

Complicated Pyelonephritis

Treatment

All patients with complicated pyelonephritis should initially be managed in the hospital setting.
Empiric Treatment Summary:

**Cystitis:**

- **Uncomplicated:** Nitrofurantoin, Fosfomycin (Bactrim)
- **Complicated:** PO Quinolone or IV (multiple Abx)

**Pyelonephritis:**

- **Outpt Uncomplicated:** PO Quinolone (+-IM/IV dose rocephin or aminoglycoside)
- **Inpt Uncomplicated:** IV then PO (multiple Abx)
- **Complicated:** Hospitalized with IV Antibiotics (Antibiotic – depends on severity)
Chronic and Recurrent UTIs
Recurrent UTI

Definition:

Recurrent UTIs are symptomatic UTIs that follow resolution of an earlier episode

Recurrent UTI can be defined as 3 or more uncomplicated UTIs in 12 months

Recurrent UTIs

Want to culture prove

Is this persistent/chronic or a recurrence?

**Note:** persistent (other than E coli) UTI requires imaging, but unless recurrent Upper UTI, recurrent UTIs do not (by themselves) warrant imaging
Recurrent pyelonephritis in healthy women is uncommon

**Reurrence of cystitis is common** within 1 year *(particularly for E Coli)*

For **uncomplicated adult UTIs**, there is no evidence that recurrent UTI leads to chronic health problems such as hypertension or renal disease.

Recurrent UTIs

Urine culture and sensitivity should be performed to establish the correct diagnosis of recurrent UTI

Recurrent UTI Prevention

Cranberry products: Older studies show are effective in reducing recurrent UTIs, but a recent Cochrane review concluded it’s likely not effective.


Probiotics: Conflicting results in recent meta-analyses

Recurrent UTI Prophylaxis:

Continuous antibiotic prophylaxis reduces the rate of UTI during prophylaxis

Postcoital may be as effective as continuous prophylaxis

Albert X, Huertas I, Pereiro I, et al. Cochrane Database of Systematic Reviews 2004
Recurrent UTI Prophylaxis

Prophylaxis usually anywhere from 6 months to 5 years

Regimines:
Keflex 250mg daily
Cipro 125 mg daily
Nitrofurantoin 100mg daily
TMP/Sulfamethoxazole, Bactrim SS (40/200mg)

Pediatric UTIs
8% of girls and 2% of boys have a UTI by age 2.

Pathogens are similar in children, with E. coli predominating.

Childhood UTIs can be associated with long-term negative outcomes, including hypertension, preeclampsia/eclampsia in pregnancy, renal scarring, and chronic renal failure.

Pediatric UTIs

Difficult distinguish cystitis from pyelonephritis, particularly in young children (those younger than two years)

A 12 month old female presents with a fever of 101°F with positive LE and blood on urinalysis. Pt was treated with cephalexin. Based on the most recent American Academy of Pediatrics Guidelines, which of the following imaging tests would be recommended?

A. Renal/Bladder Ultrasound  
B. VCUG  
C. CT scan abdomen/pelvis  
D. All of the above  
E. None of the above
Evidence to support the utility of routine imaging in reducing long-term sequelae (renal scarring, hypertension, renal failure) is limited

Pediatric scarring

The risk of renal scarring increases with recurrent episodes of pyelonephritis

5 percent after the first episode
10 percent after the second
20 percent after the third
40 percent after the fourth
60 percent after the fifth

Pediatric Imaging

- There is a lack of consensus about the optimal imaging strategy for pediatric UTIs

- 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. Subcommittee on Urinary Tract Infection, Steering Committee on Quality Improvement and Management, Pediatrics. 2011;128(3):595


2011 Guidelines: American Academy of Pediatrics (AAP) 2-24 months

Renal/bladder ultrasound examination after a first febrile UTI to rule out anatomic abnormalities (particularly obstruction) that warrant further evaluation.

**VCUG** should **NOT** be routinely performed after a first febrile UTI, but is recommended for recurrent UTIs

VCUG is indicated if Renal/Bladder Ultrasound reveals abnormalities or in other atypical or complex clinical circumstances

Imaging: Pediatric UTI

Radiologic evaluation is not routinely necessary in children >2 y.o. and adolescents with uncomplicated cystitis
Pediatric UTI Treatment: Uncomplicated
Antimicrobial agents include:

- **B-lactams amoxicillin/clavulanate**
- **Cephalexin**
- **TMP-SMX**

*White B. Am Fam Physician 2011*
Pediatric Pyelonephritis Tx

Acute pyelonephritis can be treated with 10 to 14 days of oral therapy or 2 to 4 days of IV therapy followed by oral antibiotics to complete 10 to 14 days.

Hospitalization is indicated for toxic-appearing children or those unable to succeed on oral therapy.

An aminoglycoside is recommended if IV therapy is initiated.

Pediatric Pyelonephritis Tx

**Cipro** is FDA approved for use in pts 1-17 y.o., but the American Academy of Pediatrics recommends reserving fluoroquinolones for use with multidrug-resistant or Pseudomonas infections.

Therefore, Aminoglycosides are typically used for hospitalized pediatric patients with acute pyelonephritis.

Cochrane Review: Antibiotics for Recurrent Infections in Children

Long-term antibiotics appear to reduce the risk of repeat symptomatic UTI in susceptible children but the benefit is small.

Williams G, Craig JC. Long-term antibiotics for preventing recurrent urinary tract infection in children. Cochrane Database of Systematic Reviews 2011
Pediatric Prevention

- Cranberry juice has not been shown to be effective in children.
  White B. Diagnosis and treatment of urinary tract infection in children. Am Fam Physician 2011

- Circumcision decreases the risk of UTI, but benefits do not outweigh risks of surgical complications
**Summary: Pediatric UTI**

_**First febrile UTI**_ should obtain _at the minimum:_ Renal and Bladder _Ultrasound_

_**Recurrent infections:**_ add VCUG (consult)

**Treatment:**

* **Cystitis:** Amoxicillin/clavulanate, cephalosporins, TMP-SMX

* **Pyelonephritis:** Aminoglycoside or Cipro
Questions?