Attribution Key

Use + Share + Adapt

Public Domain – Government: Works that are produced by the U.S. Government. (17 USC § 105)

Public Domain – Expired: Works that are no longer protected due to an expired copyright term.

Public Domain – Self Dedicated: Works that a copyright holder has dedicated to the public domain.

Creative Commons – Zero Waiver

Creative Commons – Attribution License

Creative Commons – Attribution Share Alike License

Creative Commons – Attribution Noncommercial License

Creative Commons – Attribution Noncommercial Share Alike License

GNU – Free Documentation License

Public Domain – Ineligible: Works that are ineligible for copyright protection in the U.S. (17 USC § 102(b)) *laws in your jurisdiction may differ

Public Domain – Government: Works that are produced by the U.S. Government. (17 USC § 105)

Public Domain – Expired: Works that are no longer protected due to an expired copyright term.

Public Domain – Self Dedicated: Works that a copyright holder has dedicated to the public domain.

Creative Commons – Zero Waiver

Creative Commons – Attribution License

Creative Commons – Attribution Share Alike License

Creative Commons – Attribution Noncommercial License

Creative Commons – Attribution Noncommercial Share Alike License

GNU – Free Documentation License

Fair Use: Use of works that is determined to be Fair consistent with the U.S. Copyright Act. (17 USC § 107) *laws in your jurisdiction may differ

Our determination DOES NOT mean that all uses of this 3rd-party content are Fair Uses and we DO NOT guarantee that your use of the content is Fair.

To use this content you should do your own independent analysis to determine whether or not your use will be Fair.
Urinary Tract Infection (UTI)

Incidence:

Adult women: 6 → 10% per year
Pregnancy: 4 → 10%
Single catheterization: 1 → 3% for normal pt.
                      10 → 15% for debilitated pt.
Female: male ratio overall 10 : 1
(↑ male incidence age < 1 and > 50 years)
UTI

Predisposing Factors

1. Obstruction: calculi, tumors, BPH, extrinsic
2. Vesicoureteral reflux
3. Incomplete bladder emptying (neurogenic, voluntary)
4. Diabetes / sickle cell / immune compromise
5. Bladder instrumentation / foreign bodies
6. Congenital structural abnormalities
7. Marriage, sexual activity, pregnancy
Acute trigonitis occurs here

U.S. NCI SEER, Wikimedia Commons
90 % of first episodes : E. coli
10 % : Proteus, Klebsiella, Strep. fecalis, Enterobacter
Debilitated pt. : Pseudomonas, Serratia, Providencia
Venereal : chlamydia, gonorrhea, trichomonas
1. Adult: dysuria
   - frequency
   - urgency
   - nocturia
   - suprapubic pain
   - ± back pain
   - ± hematuria
   - ± cloudy urine
   - ± enuresis
2. Babies: lethargy
   poor feeding
   fever or hypothermia
   vomiting
   diarrhea
   strong smelling urine
3. Elderly: Malaise
   weakness
   vomiting
   fever or hypothermia
   confusion
   hypotension
   urine retention
UTI

Symptoms and signs do not reliably differentiate upper from lower tract infection
UTI
Collection Methods

1. Clean voided specimen (CVS)
2. “Minicath” : for menstruating female
3. Perineal bag or suprapubic tap for babies
4. Straight cath male (8 to 10 French catheter) only if unable to void
“Minicath” urine collection tube
UTI Diagnosis

1. Dipstick (Chemstrip 9)
   Leucocyte esterase: fairly accurate if 2+

2. Gram stain unspun urine (if 1 bacteria per hpf: indicates UTI)

3. U/A with microscopic (√ for squamous cells)

4. Urine Culture and Sensitivity (C & S)
UTI
Indications to Obtain Urine C & S

1. Children
2. Most males
3. Immunosuppressed
4. Pregnancy
5. Toxic appearance
6. Underlying medical / urologic disorder
7. Recently hospitalized
8. Recently instrumented
9. Recently on antibiotics
10. Recent treatment failure
UTI
Indications to Check
Electrolytes / BUN / Creatinine

1. Frequent vomiting
2. Toxic appearance
3. Urinary retention
4. Post-catheter diuresis
5. Hypertensive
6. Known non-end-stage renal failure
7. Marked edema
UTI
Standard 7 day Treatment Choices

Amoxicillin 500 mg (40 mg/Kg/day) tid (but fairly high incidence of E. coli resistance now in most areas of U.S.)
Bactrim DS one bid
Cefadroxil 500 mg bid or 1 gm qd
Cephalexin 250 to 500 mg bid to qid
Noroxin 400 mg bid
Ciprofoxacin 500 mg bid
<table>
<thead>
<tr>
<th>Drug</th>
<th>Regimen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxicillin</td>
<td>250 to 500 mg q 8h for 7 days</td>
</tr>
<tr>
<td>Cephalexin</td>
<td>250 to 500 mg q 6h for 7 days</td>
</tr>
<tr>
<td>Doxycycline</td>
<td>50 to 100 mg q 12h or q 24h for 7 days</td>
</tr>
<tr>
<td>Nitrofurantoin</td>
<td>50 to 100 mg q 6h for 7 days</td>
</tr>
<tr>
<td></td>
<td>or 100 mg q 6h for 3 days</td>
</tr>
<tr>
<td>Sulfamethoxazole</td>
<td>1 g q 12h for 7 days</td>
</tr>
<tr>
<td>Sulfisoxazole</td>
<td>1 g q 6h for 7 days</td>
</tr>
<tr>
<td>Tetracycline</td>
<td>250 to 500 mg q 6h for 7 days</td>
</tr>
<tr>
<td>Trimethoprim</td>
<td>100 mg q 12h for 7 days</td>
</tr>
<tr>
<td>Trimethoprim-</td>
<td>1 DS tablet q 12h for 7 days</td>
</tr>
<tr>
<td>sulfamethoxazole</td>
<td></td>
</tr>
</tbody>
</table>
UTI
Single Dose Treatment
(for uncomplicated pt.)

Amoxicillin 3 grams PO
Septra DS 3 tablets PO
Sulfisoxazole 2 grams PO
Kanamycin 500 mg IM
Cefonicid 1 gram IM
<table>
<thead>
<tr>
<th>Drug</th>
<th>Regimen</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oral</strong></td>
<td></td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>3 g (6 500 mg tablets)</td>
</tr>
<tr>
<td>Bacampicillin</td>
<td>1.6 g (4 400 mg tablets)</td>
</tr>
<tr>
<td>Sulfamethoxazole</td>
<td>2 g (4 500 mg tablets)</td>
</tr>
<tr>
<td>Sulfisoxazole</td>
<td>2 g (4 500 mg tablets)</td>
</tr>
<tr>
<td>Trimethoprim-sulfamethoxazole</td>
<td>3 DS tablets/d for 2 days</td>
</tr>
<tr>
<td><strong>Parenteral</strong></td>
<td></td>
</tr>
<tr>
<td>Cefonicid</td>
<td>1 g IM</td>
</tr>
<tr>
<td>Kanamycin</td>
<td>500 mg IM</td>
</tr>
</tbody>
</table>
If chlamydia suspected, or recent treatment failure or unremarkable U/A with typical symptoms, try doxycycline 100 mg PO bid x 7 days
UTI
Treatment Choices in Pregnancy

Amoxicillin

Cephalosporins

Erythromycin

Penicillin G or VK
## Antimicrobial Agents for UTIs in Pregnancy

<table>
<thead>
<tr>
<th>Drug</th>
<th>Regimen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxicillin</td>
<td>250 mg po tid for 7 days</td>
</tr>
<tr>
<td>Cephalexin</td>
<td>250 mg po qid for 7 days or 500 mg po bid for 7 days</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>250 mg po qid for 7 days or 333 mg po tid for 7 days</td>
</tr>
<tr>
<td>Penicillin G</td>
<td>250 mg po qid for 7 days</td>
</tr>
</tbody>
</table>
UTI
Groups with Asymptomatic Bactiuria
Who Should Receive Treatment

- Pregnancy
- Diabetics
- Young
- Severe immunocompromise
- Sickle cell disease

Do not treat only because chronic catheter present
**UTI**

**Indications for Admission**

1. Toxic appearance / possible sepsis
2. Possible urinary obstruction
3. Vomiting / unable to take PO meds
4. Kids < 1 y/o
5. Most males, especially if febrile
6. If pre-existent or suspected renal failure
UTI Treatment

If ill enough to admit:

IV ampicillin / gentamicin
IV cefoxitin
IV aminoglycoside / antipseudomonal PCN (if resistant Pseudomonas suspected)
## Urinalysis Acid-Base Status Related to Infections

<table>
<thead>
<tr>
<th>Alkaline</th>
<th>Acidic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group D-2</td>
<td>Genitourinary tuberculosis</td>
</tr>
<tr>
<td>Corynebacterium</td>
<td></td>
</tr>
<tr>
<td>Kiebsiella (rare)</td>
<td></td>
</tr>
<tr>
<td>Proteus</td>
<td></td>
</tr>
<tr>
<td>Providencia</td>
<td></td>
</tr>
<tr>
<td>Serratia (rare)</td>
<td></td>
</tr>
<tr>
<td>Staphylococcus</td>
<td></td>
</tr>
<tr>
<td>saprophyticus</td>
<td></td>
</tr>
<tr>
<td>Ureaplasma urealyticum</td>
<td></td>
</tr>
</tbody>
</table>
# Pyuria: Differential Diagnosis

<table>
<thead>
<tr>
<th>INFECTIOUS</th>
<th>NON-INFECTIONOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlamydia</td>
<td>Kawasaki Syndrome</td>
</tr>
<tr>
<td>Neisseria gonorrheae</td>
<td>Leptospirosis</td>
</tr>
<tr>
<td>Trichomonas</td>
<td>Partially treated UTI</td>
</tr>
<tr>
<td>Acute appendicitis</td>
<td>Prostatitis</td>
</tr>
<tr>
<td>Acute urethral syndrome</td>
<td>Renal or cortical abscess</td>
</tr>
<tr>
<td>Balanitis</td>
<td>Salpingitis</td>
</tr>
<tr>
<td>Brucellosis</td>
<td>Toxic shock syndrome</td>
</tr>
<tr>
<td>Candidal UTI</td>
<td>Tuberculosis</td>
</tr>
<tr>
<td>Diphtheria</td>
<td>Urethritis</td>
</tr>
<tr>
<td>Enterovirus</td>
<td></td>
</tr>
</tbody>
</table>

| Exercise (excessive)                            | Interstitial nephritis                |
|                                                 | Lupus nephritis                       |
|                                                 | Regional ileitis                      |
|                                                 | Urethral Inflammation                 |

| Bladder tumors                                  |                                       |
| Calculi                                         |                                       |
| Cystitis                                        |                                       |
| Diverticulitis                                  |                                       |

**Note:** The table summarizes common causes of pyuria, categorized into infectious and non-infectious conditions.
Failure of Fever Resolution Within 96 hours in Pyelonephritis

• Infectious Causes
  Obstruction
  Abscess
  Inappropriate antimicrobial agent
  Coexistent infection at another body site

• Noninfectious Causes
  Adverse drug reaction
  Thrombophlebitis at IV catheter site
  Diabetes mellitus
Severe pyelonephritis. A CT scan of the abdomen of a diabetic patient with severe pyelonephritis shows a massively distended right kidney. Air density collections are present within the renal parenchyma and the collecting system, which is consistent with emphysematous pyelonephritis. Nonfunction of the right kidney is indicated by the absence of contrast material in the affected area.
Conditions That Increase Risk of Severe Morbidity and/or Renal Scarring from Recurrent Urinary Tract Infection

- Renal failure
- Obstructive uropathy
- Diabetes melitus
- Renal papillary necrosis
- Infection caused by urea-spitting bacteria that cause infection stones
- Congenital abnormalities that become secondarily infected
- Pregnancy
- High-pressure neurogenic bladder
- Indwelling catheter
Correctable Urologic Abnormalities That Can Harbor Persistent Bacteria and Cause Recurrent Urinary Tract Infection With Same Organism

- Infection stone
- Unilateral, atrophic pyelonephritis
- Medullary sponge kidney
- Papillary necrosis
- Pericalyceal diverticulium
- Nonrefluxing urethral stump following nephrectomy for pyonephrosis
- Ectopic or duplicated ureter
- Urethral diverticulum
- Paravesical abscess with fistula to bladder
- Foreign bodies
UTI
Lecture Summary

- Decide if empiric Rx on basis of dipstick positive leucocyte esterase alone or if full urinalysis and/or C & S needed
- Decide on length of Rx (one week sufficient usually for lower tract or occult upper tract infection)
- Arrange definite followup if C & S sent