URINARY TRACT INFECTIONS
TO TREAT OR NOT TO TREAT

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Objectives

1. Differentiate ASB from UTI

2. List risk factors associated with UTI

3. Determine appropriate treatment for ASB, CA-UTI, and non-CA UTI

4. Determine the appropriate course of action for fungal UTI
Asymptomatic Bacteriuria
Non-Catheter associated UTI
Catheter associated UTI
Fungal UTI
ASYMMPTOMATIC BACTERIURIA IN ADULTS
Definition

- Asymptomatic
  - Women
    - 2 consecutive voided urine specimens
    - Isolation of same bacteria from both specimens
    - $\geq 10^5$ cfu/ml
  - Men
    - Single clean-catch voided specimen
    - 1 bacterial species isolated
    - $\geq 10^5$ cfu/ml
Definition

- Asymptomatic
  - Women or Men
    - Single catherized urine specimen
    - 1 bacterial species isolated
    - $\geq 10^2$ cfu/ml
Pyuria

• Present in
  – 32% of young women
  – 30-70% of pregnant women
  – 70% of diabetic women
  – 90% of elderly institutionalized patients
  – 90% of hemodialysis patients
  – **STDs and thus not diagnostic of UTI**
<table>
<thead>
<tr>
<th>Population</th>
<th>Prevalence, %</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy, premenopausal women</td>
<td>1.0–5.0</td>
<td>[31]</td>
</tr>
<tr>
<td>Pregnant women</td>
<td>1.9–9.5</td>
<td>[31]</td>
</tr>
<tr>
<td>Postmenopausal women aged 50–70 years</td>
<td>2.8–8.6</td>
<td>[31]</td>
</tr>
<tr>
<td>Diabetic patients</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>9.0–27</td>
<td>[32]</td>
</tr>
<tr>
<td>Men</td>
<td>0.7–11</td>
<td>[32]</td>
</tr>
<tr>
<td>Elderly persons in the community(^a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>10.8–16</td>
<td>[31]</td>
</tr>
<tr>
<td>Men</td>
<td>3.6–19</td>
<td>[31]</td>
</tr>
<tr>
<td>Elderly persons in a long-term care facility</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>25–50</td>
<td>[27]</td>
</tr>
<tr>
<td>Men</td>
<td>15–40</td>
<td>[27]</td>
</tr>
<tr>
<td>Patients with spinal cord injuries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermittent catheter use</td>
<td>23–89</td>
<td>[33]</td>
</tr>
<tr>
<td>Sphincterotomy and condom catheter in place</td>
<td>57</td>
<td>[34]</td>
</tr>
<tr>
<td>Patients undergoing hemodialysis</td>
<td>28</td>
<td>[28]</td>
</tr>
<tr>
<td>Patients with indwelling catheter use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-term</td>
<td>9–23</td>
<td>[35]</td>
</tr>
<tr>
<td>Long-term</td>
<td>100</td>
<td>[22]</td>
</tr>
</tbody>
</table>

\(^a\) Age, \(\geqslant\) 70 years.
Organisms

• Women
  – E. coli is the most common organism
  – Enterobacteriaceae, CoNS, Enterococcus spp, GBS, and Gardnerella vaginalis

• Men
  – CoNS
  – GNB
  – Enterococcus
Organisms

- Institutionalized
  - Female: E. Coli
  - Men: Proteus mirabilis

- Long-term urological devices
  - Polymicrobial
  - Pseudomonas aeruginosa
  - Urease-producing organisms (P. mirabilis, Providencia stuartii, and Morganella morganii)
Treatment of ASB

• Screening and treatment for ABU are NOT recommended in:
  – Premenopausal non-pregnant women
  – Diabetic women
  – Elderly patients including residents of LTCF
  – Patients with indwelling urethral catheters
Evidence for Not Treating ABU

Asymptomatic bacteriuria is not associated with:

• hypertension,
• chronic kidney disease
• genitourinary cancer
• or decreased duration of survival
Treatment of ABU

• Treatment of asymptomatic bacteriuria neither decreases:
  – the frequency of symptomatic infection
  – nor prevents further episodes of asymptomatic bacteriuria
Treatment of ASB

• Screening and treatment for ABU are recommended in:
  – Pregnant women
    • Early in pregnancy
    • If positive treat for 7-10 days
    • Periodic screening should be undertaken
  – Before transurethral resection of the prostate
    • Treatment prior to the procedure but not after
    • Continue treatment s/p surgery if indwelling catheter remains
Treatment Options for ABU

• Treatment in Pregnant women:
  – Amoxacillin
  – Cefpodoxime or cefixime
  – Nitrofurantoin
  – Sulfamethoxazole/trimethoprim
    • Avoid in third trimester
• Duration of therapy 7-10 days
UNCOMPLICATED UTI
Decision to Initiate antibiotics
McGeer Criteria

• Absence of a catheter and three of the following characteristics:
  – Fever (≥ 38 C) or chills
  – New or increased burning pain on urination
  – New flank or suprapubric pain or tenderness
  – Change in character of the urine
  – Worsening of mental or functional status
Decision to Initiate antibiotics
Loeb Criteria

• Absence of a catheter AND
• Acute Dysuria OR
• Fever in addition to one of the following:
  – Urinary frequency
  – New or worsening urgency
  – Suprapublic pain
  – Gross hematuria
  – Urinary incontinence
  – Costovertebral angle tenderness
Uncomplicated UTI

• Episodes of cystitis occurring in otherwise healthy individuals
  – Mostly women
  – No structural or functional abnormalities within the urinary tract
  – No underlying diseases which increases the risk of infections
Uncomplicated UTI

• Pathogens:
  - E. Coli 60-90%
  - Enterobacteriaceae 20%
  - S. saprophyticus 5-10%
  - Enterococci
Uncomplicated UTI
Cystitis

• Nitrofurantoin 100mg daily for 5-7 days
  – Equivalent to TMP/SMX x7 days
  – Equivalent to ciprofloxacin 100mg BID x3 days

• TMP/SMX DS 1 tablet BID for 3 days
  – Do not consider for empiric therapy if resistance >20% to common pathogens
  – 74% sensitive to E. coli, and 90-92% sensitive to enterobacteriaceae
  – Low level of secondary resistance
  – Equivalent to ciprofloxacin in clinical cure rate
Uncomplicated UTI

Cystitis

- Fosfomycin 3g x 1 dose
  - Alternative
  - Inferior clinical cure rate compared to nitrofurantoin

- Fluoroquinolones (Olfloxacin, ciprofloxacin, and levofloxacin) x 3 days
  - Considered alternative agents for cystitis due to collateral damage
  - Associated with MRSA development
Uncomplicated UTI
Cystitis

• Beta-lactam agents (amoxacillin-clavulanate, cefdinir, cefaclor, cefpodoxime) x 3-7 days
  – Alternatives if other agents can not be used
  – Associated with ESBL resistance
  – Cefpodoxime x3 days equivalent to TMP/SMX x3 days
Table 4. Treatment Regimens and Expected Early Efficacy Rates for Acute Uncomplicated Cystitis

<table>
<thead>
<tr>
<th>Drug (dosage)</th>
<th>Estimated clinical efficacy&lt;sup&gt;ab&lt;/sup&gt;</th>
<th>Estimated microbiological efficacy&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Common side effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrofurantoin monohydrate/macrocystals (100 mg twice daily for 5–7 days)</td>
<td>93 (84–95)</td>
<td>88 (86–92)</td>
<td>Nausea, headache</td>
</tr>
<tr>
<td>Trimethoprim-sulfamethoxazole (160/800 mg twice daily for 3 days)</td>
<td>93 (90–100)</td>
<td>94 (91–100)</td>
<td>Rash, urticaria, nausea, vomiting, hematologic</td>
</tr>
<tr>
<td>Fosfomycin trometamol (3 g single-dose sachet)</td>
<td>91</td>
<td>80 (78–83)</td>
<td>Diarrhea, nausea, headache</td>
</tr>
<tr>
<td>Pivmecillinam (400 mg twice daily for 3–7 days)</td>
<td>73 (55–82)</td>
<td>79 (74–84)</td>
<td>Nausea, vomiting, diarrhea</td>
</tr>
<tr>
<td>Fluoroquinolones (dose varies by agent; 3–day regimen)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>90 (85–98)</td>
<td>91 (81–98)</td>
<td>Nausea/vomiting, diarrhea, headache, drowsiness, insomnia</td>
</tr>
<tr>
<td>β-lactams (dose varies by agent; 3–5 day regimen)&lt;sup&gt;d&lt;/sup&gt;</td>
<td>89 (79–98)</td>
<td>82 (74–98)</td>
<td>Diarrhea, nausea, vomiting, rash, urticaria</td>
</tr>
</tbody>
</table>
Contraindications to 3-day Therapy

- Pregnancy
- Male patients
- Elderly patients
- Suspected pyelonephritis
- Relapsing infection
- Recent antibiotic use
- Presence of urinary tract abnormalities
- Children
- Symptoms for > 7 days
Complicated UTI
Pyelonephritis

• Symptoms usually include:
  – Dysuria
  – Polyuria
  – FEVER (>102)
  – Definite CVA tenderness
  – Septic appearance
Complicated UTI
Pyelonephritis

• Subclinical/occult PN:
  – More common in pregnant women
  – Patients who have had UTI prior to age of 12
  – Patients with a history of PN
  – Patients with >3 UTI in the past 12 months
  – Patients who have failed 3-day course of antibiotics for uncomplicated UTI (cystitis)
Complicated UTI
Pyelonephritis

- E. Coli (85%)
- Enterobacteriaaceae (10%)
- Enterococci and S. saprophyticus (5%)
- Pseudomonas aeruginosa (<5%)
  - Hospital acquired infection
  - Women with recurrent UTIs
  - Patient with recent antibiotic failure
Complicated UTI
Pyelonephritis

• If resistance to ciprofloxacin <10%
  – Initial ciprofloxacin 400mg IV OR
  – Initial aminoglycoside IV ODA dose OR
  – Initial ceftriaxone 1gm IV
Followed by
Ciprofloxacin 500mg PO BID x 7 days OR
Levofloxacin 750mg PO Daily x 5 days
Complicated UTI
Pyelonephritis

- If resistance to ciprofloxacin >10%
  - Initial aminoglycoside IV ODA dose OR
  - Initial ceftriaxone 1gm IV x 1 dose

Followed by
TMP/SMX DS 1 tablet PO BID x 14 days OR
Beta-lactam (inferior to TMP/SMX)
Complicated UTI
Pyelonephritis

• If Pseudomonas suspected:
  – Aminoglycoside (drug of choice)
  – Aztreonam (alternative)
  – Ceftazidime or cefepime (alternative)
  – Imipenem/cilastin (alternative)
  – Pipercillin/Tazobactam (alternative)

• If GPC suspected:
  – Ampicillin
  – Vancomycin (in PCN allergic patients)

• TREATMENT DURATION 14 DAYS
CATHETER-ASSOCIATED URINARY TRACT INFECTION
CA-UTI
McGeer Criteria

- Treatment is indicated in patient with an indwelling catheter and two of the following symptoms:
  - Fever (≥ 38 C) or chills
  - New flank or suprapubic pain or tenderness
  - Change in character of urine
  - Worsening of mental or functional status
CA-UTI

• Most common nosocomial infection
  – 40% of all nosocomial infections
• Secondary to GU manipulation
  – 80% due to catheterization
• Most commonly seen in nursing home patients and residents of LTCF
CA-UTI
Risk Factors

• Single (straight) catheterization
  – 1-5% develop bacteriuria

• Short-term catheterization
  – 3-6% per day develop bacteriuria
  – 50% within 7-10 days of catheterization

• Intermittent catheterization
  – 35-50% develop bacteriuria

• Chronic catheterization
  – 5% per day
  – ~100% with at least one bacterial species within 30 days
CA-UTI
Risk Factors

• Non-modifiable:
  – Female gender
  – Older/debilitated patients
  – Colonization

• Semi-modifiable:
  – Duration of catheterization
  – Catheter insertion technique
  – Type of catheter used
  – Administration of systemic antibiotics
CA-UTI

- **Planktonic growth:**
  - Bacteria that grow in the urine itself
  - E. coli most common planktonic organism

- **Biofilm growth:**
  - Bacteria which grow on the surface of the catheter
  - Proteus and pseudomonas
CA-UTI

Treatment

• Treatment not indicated in asymptomatic CA-UTI
• Treatment similar to non-CA UTI if PN is suspected
• Bacteremic CA-UTI should be treated for 14 days
• Non-bacteremic CA-UTI should be treated for 5-7 days
• Catheter should ALWAYS be changed prior to initiation of antibiotic therapy
FUNGAL URINARY TRACT INFECTION
Fungal UTI

• If one urine sample is positive for fungi, another sample should be obtained to rule out possible contamination

• If the patient has an indwelling catheter, replacement of the catheter is recommended prior to obtaining the urine sample

• If the second specimen yields no fungi, no further workup or treatment is indicated
Fungal UTI

• > 50% are due to non-candida albicans species
Fungal UTI

- In ICU patients, candiduria (regardless of presence of symptoms) is a potential marker for invasive candidiasis
- 80% of candidemia present with candiduria
Candiduria

- Urine Analysis:
  - Leukocyte esterase presence provides no diagnostic benefit for diagnosing candida
  - Presence of pyuria is non-specific to candiduria unless patient is not catheterized and only candida is present in specimen
  - Protein and blood in specimen support the presence of candiduria
Candiduria

Treatment

• A search for the cause of the candiduria should be sought:
  – DM
  – Renal transplant
  – Extremes of age
  – Instrumentation of the urinary tract
  – Female sex
  – Congenital abnormalities of the urinary tract
  – Prolonged hospitalization
  – ICU admission
  – Use of broad spectrum antibiotics
  – Indwelling urinary catheters
  – Nephrolothiasis
  – Bladder dysfunction
Treatment of Asymptomatic Candiduria

Figure 1. Algorithm for the management of asymptomatic candiduria.

1. fluconazole 400-800mg iv/d
2. caspofungin 70 mg iv loading → 50 mg/d
3. anidulafungin 200mg iv loading → 100mg/d
4. voriconazole 6mg/kg iv q 12; then 4 mg/kg q 12h
5. amphotericin B 0.6-0.7 mg/kg/d +/- flucytosine
Treatment of Symptomatic Candiduria

- **Cystitis, pyelonephritis:**
  1. Fluconazole 400mg po x 2-4 wks
  2. Flucytosine 25mg/kg po qid x 2-4 wks
  3. AmB 0.3-1mg/kg iv 1 or more doses

- **Prostatitis, epididymo-orchitis:**
  1. Fluconazole 400mg po x 4 wks
  2. Surgical drainage

- **Fungus ball:**
  1. Fluconazole 400mg po x 4 wks
  2. Flucytosine 25mg/kg po qid x 2-4 wks
  3. AmB 0.3-1mg/kg iv 1 or more doses
  4. Surgical drainage

**Figure 2.** Algorithm for the management of symptomatic candiduria.