Question #1

A 35 year-old woman comes to your clinic with a 5-day history of burning on urination. She denies fevers, chills and flank pain. What is your clinical diagnosis?

Definition of UTI

1. Lower UTI
   • Cystitis, urethritis, prostatitis
   • Infection of the lower genitourinary tract characterized by:
     – Dysuria
     – Increased frequency of urination
     – Urinary urgency
     – Suprapubic pain
     – Hematuria (occasionally)
Definitions of UTI

2. Upper UTI
   • Infection of the kidney (pyelonephritis)
   • Characterized by:
     – Fever
     – +/- Chills
     – Flank pain/tenderness
     – May or may not be associated with signs and symptoms of lower UTI

Question #2

• On further history-taking, she reports being sexually active with her husband.
• She uses a diaphragm and occasionally a spermicide.
• She admits to being stressed with work lately. She works for a very busy company that she rarely takes a break.
• What are her risk factors for developing UTI?

Protective Mechanisms

• Anti-microbial properties of intact bladder mucosa
  – IgA and IgG
  – Tamm-Horsfall proteins
    • decrease attachment of bacteria to urothelium
  – pH
• Flushing mechanisms associated with periodic voiding of urine
Pathogenesis of UTI

Route of Infection
1. Ascending Infection
   • GUT flora reach bladder via urethra
   • Perineal/periurethral colonization in females
   • Massaging action of intercourse
   • Catheterization or other instrumentation

2. Hematogenous Seeding
   • Staphylococcus aureus

Host Factors
- Behavior
  - Frequency of sexual intercourse
  - Use of diaphragm/vaginal spermicide
  - Hygiene: direction of wiping

- Susceptibility to local colonization
  - Receptors: women who are of P1 blood group have epithelial receptors that mediate attachment of bacteria
  - pH of urine
Question #3
What organism do you suspect is the cause of her UTI?
1. Klebsiella
2. Proteus
3. E.coli
4. S. saprophyticus

Epidemiology of UTI
Organisms
- E.coli - 80%
- S. saprophyticus
- Klebsiella
- Proteus
- Others

Question #4
• She is afebrile and hemodynamically stable. On review of her chart, you note a sulfa allergy. What is your next step in management?
1. Advise cranberry juice
2. Obtain a urine dipstick in your office
3. Send to the lab for urine culture
4. Start a course of antibiotics
Diagnosis of Acute Uncomplicated Cystitis

- Women with symptoms of lower UTI, no vaginal discharge, had >90% probability of acute cystitis
- Do not need to do a UA
- Do not need a urine culture


Questions #5

What antibiotic therapy would you prescribe?

A. Ciprofloxacin
B. Metronidazole
C. Nitrofurantoin
D. Piperacillin-Tazobactam
E. Vancomycin
F. Trimethoprim-sulfamethoxazole

Management

- Uncomplicated Cystitis (IDSA guidelines)
- First line regimens:
  - Nitrofurantoin 100 mg PO BID x 5 days
  - Trimethoprim-sulfamethoxazole (T-S)160/800 mg BID x 3 days (avoid if resistance prevalence is >20% or if used in previous 3 months)
  - Fosfomycin 3 gm x single dose
- Alternative regimens:
  - Fluoroquinolones x 3 days
  - Cautions, black box warning, increasing resistance
Question #6

- You send her home on a 5-day Rx of nitrofurantoin. At the completion of her therapy, she calls your office and asks you if there is anything else she needs to do. Her symptoms have resolved.

1. Send her to the lab for repeat UA.
2. Send her to the lab for repeat UA and urine culture.
3. No follow-up needed.
4. Cranberry juice to prevent recurrent UTI

Question #7

- 1 year later, she comes to your office for a wellness check-up. She reports noticing foul-smelling urine yesterday when she woke up. She denies other symptoms. She requests for a UA and urine culture. What will you do?

1. Obtain UA only to prove she has no UTI.
2. Obtain UA AND urine culture due to her history of UTI in the past.
3. Start her on nitrofurantoin.
4. Explain "gently" that there is no indication for any further testing at this time.

Asymptomatic Bacteriuria

- Positive urine culture without any signs and symptoms of UTI
- Screening only recommended for:
  - Pregnant women
  - Patients undergoing transurethral resection of the prostate
  - Patients undergoing urologic procedures for which mucosal bleeding is anticipated
Question #8

A 67-year old man presents with 3-days of dysuria. He has a history of diabetes mellitus type 2 with peripheral neuropathy and benign prostatic hyperplasia. He occasionally requires self-catheterization due to urinary retention. On exam he is febrile up to 101 deg F. There is some suprapubic tenderness and right flank tenderness on examination.

What is your clinical impression?
A. Uncomplicated UTI
B. Complicated UTI

Definition of UTI

3. Complicated UTI

- Infection in men, pregnancy and children
- Hospital-acquired infection
- Infection in the presence of factors that predispose to persistent or relapsing infection:
  - Calculi or other obstruction
  - Indwelling catheters or other drainage devices
  - Renal failure
  - Immunosuppression: renal transplantation, chemotherapy, steroids, AIDS
  - Urinary retention from neurological disease

Definition of UTI

4. Uncomplicated UTI

- Simple cystitis
- Absence of:
  - Pyelonephritis
  - Pregnancy
  - Urologic abnormalities including stones
  - Indwelling foley catheter, stent, nephrostomy tube or urinary diversion
  - Immunosuppression
  - Bacteremia
Question #9

A 67-year old man presents with 3-days of dysuria. He has a history of diabetes mellitus type 2 with peripheral neuropathy and benign prostatic hyperplasia. He occasionally requires self-catheterization due to urinary retention. On exam he is febrile up to 101 deg F. There is some suprapubic tenderness and right flank tenderness on examination.

What are his risk factors for developing UTI?

Pathogenesis of UTI

Host factors

- Urinary stasis
  - Diabetes, neurological disorders, spinal cord injury, etc

- Anatomic/physiologic changes:
  - Urinary obstruction: stones, BPH, tumors
  - Reflux
  - Pregnancy

- Instrumentation/Foreign bodies
  - Presence of catheters, stents, nephrostomy tubes, etc

Question #10

- What is your next step in management?

  A. Obtain urinalysis with reflex culture
  B. Begin antibiotics, no urinalysis and/or culture needed
Question #11

- You obtain a urinalysis with findings below:
  - pH of 6
  - No proteins
  - No glucose
  - WBC >180
  - Nitrites +
  - Leukocyte esterase +
  - WBC cast +
  - RBC >10
- Which of the above parameters is highly suggestive of pyelonephritis?

Diagnosis of UTI

Chemical screening tests

- Leukocyte esterase - detects pyuria
- Nitrite - detects action of bacterial nitrate reductase on urinary nitrates
  - GNR: E.coli, Klebsiella, Proteus
- WBC cast - indicative of pyelonephritis
- Comparable to urinalysis but false negative tests occur.

Diagnosis of UTI
Diagnosis of UTI

Microbiological tests

- Quantitative urine culture - >10^5 bacteria/ml usually (80% correlation) indicates infection
- Less than 1000 (10^3) bacteria/ml usually indicates contamination
- Lower numbers, i.e., 10^2 - 10^4/ml, may be significant in young women with cystitis, males, and patients with indwelling catheters
- Blood culture - may be positive in acute pyelonephritis or acute prostatitis

Diagnosis of UTI

Pure plate

Contaminated

Question #12

What antibiotic therapy would you prescribe while awaiting culture results?

A. Ciprofloxacin
B. Metronidazole
C. Nitrofurantoin
D. Piperacillin-Tazobactam
E. Vancomycin
Epidemiology of UTI

1. Organisms

<table>
<thead>
<tr>
<th>Acute uncomplicated</th>
<th>Complicated or Recurrent</th>
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<tbody>
<tr>
<td>E.coli: 80%</td>
<td>E.coli</td>
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<tr>
<td>S. saprophyticus</td>
<td>Proteus</td>
</tr>
<tr>
<td>Klebsiella</td>
<td>Providentia</td>
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<td>Staphylococcus</td>
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<td></td>
<td>Yeast</td>
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Pathogenesis of UTI

Microbial Factors

- Adherence factors: pil or fimbriae
- Motility- ascend against urine flow
- Hemolysin- induces pores in cell membrane
- Cytotoxin- Cytotoxic necrotizing factor-1
- Aerobactin- a siderophore that scavenges iron
- Urease- elevated urinary pH by breakdown of urea (Proteus sp); associated with calculi
- Serum resistance
- Biofilm

Question #13

Culture of the urine revealed a thin film of bacterial growth over the entire blood agar plate that appears to be “swarming.” The urease test was positive.

Which one of the following is the MOST likely organism to cause this infection?

(A) *Escherichia coli*

(B) *Proteus mirabilis*

(C) *Enterococcus faecalis*

(D) *Moraxella catarrhalis*
First Aid Review

UTI BUGS

- Motility causing "swarming" on agar; produces urease; associated with struvite stones
  - *Proteus mirabilis*

- Colonies show green metallic sheen on EMB agar, leading cause of UTI
  - *Escherichia coli*

- 2nd leading cause of UTI in sexually active women
  - *Staphylococcus saprophyticus*
**First Aid Review**

**UTI BUGS**

- Large mucoid capsule and viscous colonies
  - *Klebsiella pneumoniae*

- Blue-green pigment and fruity odor, usually nosocomial and drug resistant
  - *Pseudomonas aeruginosa*

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**Catheter-Associated UTI (CAUTI)**

- Patients with indwelling urethral, suprapubic, or intermittent catheterization with signs and symptoms compatible with UTI along with $\geq 10^3$ CFU/mL of bacterial sp from urine sample

- Above in patients whose catheters have been removed within 48 hours
Best Ways to Prevent CAUTI

- Limit unnecessary catheterization
- Discontinuation of catheterization

- Methods with no data for recommendations:
  - Antimicrobial coated catheters
  - Prophylaxis with systemic abx
  - Prophylaxis with methenamine salts
  - Prophylaxis with cranberry products
  - Enhanced meatal care
  - Catheter irrigation
  - Antimicrobials in the drainage bag