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November 19, 2011

Questions to be Answered

- What distinguishes UTI from asymptomatic bacteriuria?
- When is treatment for asymptomatic bacteriuria or candiduria indicated?
- What are my antibiotic choices in treating UTI?
- How long should I treat?
- How can I prevent further UTIs in the catherized patient?

Asymptomatic Bacteriuria

- Isolation of a specified quantitative count of bacteria in an appropriately collected urine specimen obtained from a person without symptoms or signs referable to urinary infection
- Appropriate collection minimizes contamination
- Sample should be delivered to the laboratory in a timely fashion to limit bacterial growth

Collection of the Urine Specimen: General Guidelines

- Clean catch: Have patient start voiding, then insert collection cup into stream
- Short-term catheterization:
  - Sampling of catheter port using aseptic technique
  - If port is not present, puncture catheter tube with needle and syringe
- Long-term catheterization
  - Replace catheter, then collect specimen from freshly-placed catheter (or from clean-catch urine if patient can void spontaneously)
  - Obtain specimen prior to starting antimicrobial therapy whenever possible
  - Never obtain specimen from drainage bag
**Uncomplicated vs. Complicated UTI**

- Acute uncomplicated urinary tract infection: a *symptomatic* bladder infection characterized by frequency, urgency, dysuria, or suprapubic pain in a woman with a normal genitourinary tract
- Complicated urinary tract infection: a *symptomatic* urinary infection in individuals with functional or structural abnormalities of the genitourinary tract
  - Urinary tract infections in men are typically considered to be complicated

**Bacteriuria Incidence in Catheterized Patients**

- Estimated at 3-8% per day
- Correlated with duration of catheterization
  - By 1 month, nearly all patients with an indwelling catheter will be bacteriuric!
- More frequent in:
  - Females
  - Diabetics
  - Older patients
  - Patients with renal insufficiency at the time of catheterization

**How much bacterial growth constitutes bacteriuria?**

- Somewhat controversial, will use definitions culled from IDSA guidelines:
  - Asymptomatic women: 2 consecutive voided urine specimens with isolation of the same strain in counts \( \geq 10^5 \text{ cfu/mL} \)
  - Uncatheterized men: 1 clean-catch voided specimen with one species isolated in count \( \geq 10^6 \text{ cfu/mL} \)
  - Catheterized patients: 1 specimen with one species isolated in count \( \geq 10^5 \text{ cfu/mL} \)

**How Often Does Bacteriuria Become Symptomatic?**

- Multiple studies indicate < 25% of hospitalized patients with catheter-associated bacteriuria become symptomatic
- Rate of eventual occurrence of signs and symptoms c/w UTI in catheterized patients no different according whether bacteriuria is present at baseline
- Bacteremia complicates catheter-associated bacteriuria in <1 to 4% of cases

**Symptoms or Signs Consistent with Urinary Tract Infection**

*New onset or worsening of one or more of the following in the absence of another likely cause:*

- Dysuria
- Urgency
- Suprapubic pain or pelvic discomfort
- Flank pain
- Costovertebral angle tenderness
- Acute hematuria
- Fevers
- Rigors
- Altered mental status
- Malaise or lethargy
*Spinal cord injury:*
  - Increased spasticity, autonomic dysreflexia
  - “Sense of unease”

**Pyuria: Not On the Last Slide!**

- In the catheterized patient, pyuria is **NOT** diagnostic of bacteriuria or urinary tract infection
- The presence, absence, or degree of pyuria should **NOT** be used to differentiate asymptomatic bacteriuria from urinary tract infection
- Pyuria accompanying asymptomatic bacteriuria should **NOT** be interpreted as an indication for antimicrobial treatment
- The absence of pyuria in a symptomatic patient suggests a diagnosis other than catheter-associated UTI
Presence of Pyuria in Asymptomatic Bacteriuria
- ~32% of young women
- 30-70% of pregnant women
- 70% of diabetic women
- 90% of elderly institutionalized patients
- 90% of hemodialysis patients
- 30-75% of bacteriuric patients with short-term catheters in place
- 50-100% of patients with long-term indwelling catheters in place

Non-UTI causes of pyuria
- Renal tuberculosis
- Gonorrhea
- Chlamydia
- Tubular, interstitial, or glomerular disease
- Urinary tract obstruction
- Contamination with vaginal leukocytes
- Nephrolithiasis
- Uroepithelial malignancy

Nitrite and Leukocyte Esterase
- Nitrite: reflects presence of bacteria that produce nitrate reductase enzyme (typically Gram-negative rods)
- Leukocyte esterase: reflects presence of WBCs in urine (still present if WBCs are damaged or lysed)
- Neither add much to diagnostic accuracy and are likely less specific than pyuria in diagnosing catheter-associated UTI

When to Screen for and Treat Asymptomatic Bacteriuria
- Pregnancy: **RECOMMENDED**
  - 20-30x risk of developing pyelonephritis when bacteriuria is present
  - Risk is reduced from 20-35% to 1-4% when asymptomatic bacteriuria is treated
  - Premature delivery and low birth weight also associated with bacteriuria
  - Optimal duration of treatment is unclear; 3-7 days is suggested

- Diabetes: **NOT RECOMMENDED**
  - RCT data suggests that antimicrobial therapy for diabetic women with asymptomatic bacteriuria does NOT:
    - delay or decrease the frequency of symptomatic urinary tract infection
    - decrease the number of hospitalizations for urinary tract infection or other causes
    - affect progression of diabetic nephropathy
  - Diabetic women who received antimicrobial therapy had 5 times as many days of antimicrobial use and significantly more adverse antimicrobial events

- Patients about to undergo urologic procedures: **RECOMMENDED** (with caveats)
  - Bacteremia occurs in up to 60% of bacteriuric patients who undergo transurethral prostatic resection, with clinical evidence of sepsis in 6-10%; treatment of bacteriuria pre-TURP is effective in preventing complications
  - Little data to support use in other procedures but any intervention with a high probability of mucosal bleeding likely deserves consideration
  - Appropriate timing of screening and treatment is unclear: aim for as close to the procedure as possible
  - Antibiotics should typically not be continued post-procedure, though some have suggested that antimicrobial therapy be continued for post-TURP patients until the Foley catheter is removed

Patients with short- or long-term urinary catheters—NOT RECOMMENDED, except…
- Consideration for treating catheter-acquired bacteriuria in women in whom asymptomatic bacteriuria persists 48h after catheter removal
  - A small RCT did show reduction in eventual development of symptomatic UTI in relatively young women (median age 50) experiencing a short period of catheterization (median duration 3 days)
  - No consistent benefit seen for screening and treating asymptomatic bacteriuria in catheterized patients otherwise, with the downside of increased resistance and side effects associated with antimicrobial therapy


Cloudy or malodorous urine is NOT an indication for treatment

Bacterial colonization/infection (due to production of ammonia from bacterial ureases)
- Not all infecting bacteria have urease
- Not all bacteria that make urease cause symptomatic infection
- Dehydration (urinary concentration)
- Fecal contamination
- Ketosis
- Asparagus intake

Escherichia coli most common (overall < 1/3 of all isolates)
- Other GNRs: Klebsiella, Serratia, Citrobacter, Enterobacter, Pseudomonas, Proteus, Morganella
- Gram-positive cocci: Enterococcus, coagulase-negative staphylococci
- (Candida species: typically represent colonization, rarely true infection)

Short term catheterization typically associated with isolation of one organism, while long-term catheterization associated with polymicrobial cultures
### Antibiotic Treatment for UTI: General Guidelines
- Breadth of coverage will depend on setting and degree of illness
  - Patient presenting from non-healthcare setting who does not appear systemically ill likely does not require broad-spectrum Gram-negative coverage pending culture results
  - Consider IV therapy for more severe disease and when patient cannot tolerate oral therapy
  - Follow up culture results to ensure your therapy is appropriate and to narrow it when able

### Antibiotic Treatment for UTI: Oral Options
- Consider IV therapy for more severe disease and when patient cannot tolerate oral therapy
- Nitrofurantoin 100mg bid
  - Avoid if early pyelonephritis or complicated disease is suspected (typically should not be used in men)
  - Rare but serious side effect: interstitial pneumonitis
- Trimethoprim-sulfamethoxazole (TMP-SMX), typically 1 DS tab bid (normal renal function)
  - Monitor potassium and creatinine if renal insufficiency is present, especially if on ACE-inhibitor or ARB
  - Avoid if resistance prevalence is known to exceed 20% or if used for UTI in the previous 3 months

### Antibiotic Treatment for UTI: Other Oral Options
- Ciprofloxacin 250-500mg po bid
  - Avoid co-administration with tri- and divalent cations (aluminum, magnesium, calcium, iron, zinc) that lower absorption (e.g. tube feeds)
  - Know your local resistance patterns
  - β-Lactams/cephalosporins
    - Amoxicillin-clavulanate, cefdinir, cefaclor, cefpodoxime
    - Cephalexin 250-500mg po qid
      - Better Gram-negative coverage than you think
      - Misses enterococci, most coag-negative staph
    - Avoid in acute pyelonephritis unless IV agent given first, as they are less effective than other agents

### Antibiotic Treatment for Complicated UTI or Pyelonephritis: IV Options (non-MDR organisms suspected)
- Ertapenem 1g IV q24h
  - Very broad coverage (though misses *Pseudomonas*)
- Ceftriaxone 1g IV q24h
  - Somewhat less-broad GNR coverage than ertapenem
  - Also misses *Pseudomonas*
- Ciprofloxacin 400mg IV q12h
  - Good activity against most outpatient Gram-negative isolates at VA GLA but much more spotty against nosocomial isolates (~50% resistance in *E. coli*, *Klebsiella*, *Proteus*, *Pseudomonas*)

### Antibiotic Treatment for Complicated UTI or Pyelonephritis: IV Options (MDR organisms suspected)
- Aminoglycoside
- Piperacillin-tazobactam
- Cefepime
- Imipenem
- Meropenem
- Gram-positive coverage (vancomycin, linezolid) is often considered empirically, though enterococci and coag neg staph tend to be of lower virulence
- MRSA is an uncommon cause of UTI (and when found in the urine should prompt investigation of occult bacteremia)

### Antibiotics to Avoid in Complicated UTI
- Nitrofurantoin, fosfomycin as above
- Moxifloxacin: likely does not achieve effective levels in the urine
- Ampicillin and amoxicillin: very high prevalence of resistance and relatively poor efficacy
Cystitis
- Single-dose: fosfomycin
- 3 days: TMP-SMX, fluoroquinolones
- 5 days: nitrofurantoin
- 3-7 days: β-lactams/cephalosporins

Pyelonephritis
- Typically 7 days
  - 5 days: levofloxacin 750mg qd
  - 14 days: oral TMP-SMX

Duration of Treatment: Uncomplicated UTI

Duration of Treatment: Complicated and Catheter-Associated UTI
- 7 days reasonable for patients who have prompt resolution of symptoms with treatment
- Extend treatment to 10-14 days if response is delayed
- Can consider 3 day course for women age ≤ 65 who develop UTI without upper tract symptoms after a catheter has been removed

Antibiotic Prophylaxis for Recurrent Catheter-Associated UTI?
- A few studies do show some reduction in symptomatic UTI with a short course (≤ 72h) of antibiotics starting immediately prior to catheter placement for surgical procedures
- For long-term catheterization, antibiotic prophylaxis likely reduces bacteriuria in the first ~4 days of catheterization, an effect that wanes over time

BUT...
- Potential for benefit for prophylaxis in the vast majority of both short- and long-term catheterization is outweighed by:
  - Increased risk for subsequent infection with resistant organisms
  - Adverse effects of antibiotic therapy
    - Antibiotic-associated diarrhea, including C. difficile-associated colitis
    - Allergic reaction
    - Idiosyncratic effects (tendon rupture with fluoroquinolones, interstitial pneumonitis with nitrofurantoin)
- Rarely indicated

Other Prophylaxis Options That Probably Don’t Work in Catheterized Patients
- Methenamine salts: hydrolyzed to ammonia and formaldehyde in bladder
  - Requires long dwell time to be effective and is thus typically not of benefit in most situations involving indwelling catheters
  - Requires low urinary pH
- Cranberry products
  - Conflicting data on benefit in reducing symptomatic UTIs in uncatheterized young women with recurrent UTIs
  - Effectiveness in catheterized patients is doubtful

Other Strategies That Probably Don’t Work
- Daily meatal cleansing with povidone-iodine, silver sulfadiazine, or polyantibiotic ointment or cream for patients with indwelling catheters
- Catheter/bladder irrigation with antimicrobials or saline
- Addition of antimicrobials or antiseptics to the drainage bag of catheterized patients
- Routine catheter changes without any other indication to do so
**CDC Recommendations To Reduce Catheter-Associated UTI**

- Hand hygiene (particularly in catheter placement and handling)
- Aseptic technique and sterile equipment
- Securing catheter properly: keep catheter below bladder and drainage bag below catheter
- Maintaining closed, sterile drainage
- Catheterize only when necessary
- Remove unneeded catheters

**When Is Urinary Catheterization Needed?**

- Urinary obstruction
- Urinary retention
- Urologic or contiguous surgery
- Measuring urine output in critically ill patients
- Convenience should not be the only reason!

*Avoid the one-point restraint...*

**When Is Urinary Incontinence an Indication for Catheterization?**

- At patient request when other measures to treat incontinence have failed
- Comfort care in terminal illness
- To avoid contamination of wounds (i.e. sacral decubiti)—theoretical; no data to actually support this indication

**Alternatives to Indwelling Catheterization**

- Condom catheterization
  - Generally preferred for management of incontinence with low postvoid residual in patients who are not cognitively impaired
  - More comfortable/less painful than indwelling catheterization
  - Likely lower risk for bacteriuria
  - Less urethral trauma, but watch for external trauma/ulceration
- Intermittent catheterization
  - Neurogenic bladder retention

**The Epidemic of Inappropriate Urinary Catheterization: Case 1-The Large Academic Hospital**

- Prospective study of 202 patients admitted to a medical intensive care unit (n=135) or medical floor (n=67) of a tertiary academic medical center who received an indwelling urinary catheter
- Initial indication for placement unjustifiable in 21% of episodes

**The Epidemic of Inappropriate Urinary Catheterization: Case 1-The Large Academic Hospital**

- Continued catheterization unjustified in 47% of overall patient days
- 64% of unjustified catheter use in ICU from excessively prolonged monitoring of urine output
- 56% of unjustified catheter use on floor for urinary incontinence

Are Physicians Aware Of Which of Their Patients Have Indwelling Urinary Catheters?

Sanjey Saini, MD, MPH, Jeff W. Viera, MD, John K. Amorey, MD, Michael L. Bernstein, MD, Utpal D. Patel, MD, Judith K. Zemencuk, MA, Steven J. Bernstein, MD, MPH, Benjamin A. Lipsky, MD, Timothy P. Hofer, MD, MS

- 288 providers on 56 medical teams in 4 teaching hospitals given a list of their current patients and asked which ones had an indwelling urinary catheter
- Of all the patients with an indwelling urinary catheter:
  - 21% of students unaware
  - 22% of interns unaware
  - 27% of residents unaware
  - 38% of attendings unaware

The Epidemic of Inappropriate Urinary Catheterization: Case 2-The Community Hospital

- Review of 285 charts of patients age 65 and older in which urinary catheterization was performed < 24h of admission
  - Patients admitted for surgery excluded
  - Appropriate indication for catheterization in only 46% of patients
  - Physician or nurse explicitly documented reason for catheterization in 13%
  - No order for catheterization in written chart for 33%

Consequences of Urinary Catheterization in Long-Term Care Facilities (LTCFs)

- Approximately half of all bacteremias in LTCFs are of urinary tract origin
- Urinary catheterization estimated to increase risk of bacteremia 39-fold
- Increased mortality among LTCF patients with long-term indwelling catheters
- Unclear if this is due to bacteriuria or other confounding factors

Feedback Works!

- When hospital nursing staff members were provided with quarterly reports of catheter-associated bacteriuria rates by unit, bacteriuria rate was cut in half
- An ICU program involving education and performance feedback regarding catheter care measures and handwashing compliance resulted in a ~40% drop in catheter-associated UTI rates

Intervention at Minneapolis VA to Reduce Inappropriate Catheter Use

- Multifaceted approach used in 3 different phases over 5 years:
  - Education: "One-Point Restraint" buttons, "Light at the End of the Catheter" and "On the John" presentations, newsletters, posters, etc.
  - Provider buy-in: Meet with leadership groups (RNIs, PAs, MDs), offer rewards for " Foley Stewards," reinforcement of rate of catheterization per nursing unit
  - CPRS tools: Order templates, alerts/flagging when catheterization orders expire
  - Patient empowerment: "It’s OK to ask why I have a catheter in"
  - Final phase was to hire a dedicated Foley nurse who made rounds and noted inappropriate use
Table 2. Extent of Study Periods and Associated Outcomes Measured During a 3-year Foley Catheter (FC) Use Improvement Project

<table>
<thead>
<tr>
<th>Observation period</th>
<th>Duration (months)</th>
<th>Surveillance days during</th>
<th>Observed patient days</th>
<th>FC days, no. (FC% of observed patient days)</th>
<th>Daily prevalence of FC use, mean ± SD, % of patients</th>
<th>Daily proportion of FC use without antiseptic/sterile dressing, mean ± SD, %</th>
<th>Daily proportion of nonrecommendations for FC use, mean ± SD, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>29.2</td>
<td>1271</td>
<td>799 (15.5)</td>
<td>182 (11.0)</td>
<td>17 ± 2 (0)</td>
<td>13.2 ± 2 (0)</td>
<td>0.0 ± 0 (0)</td>
</tr>
<tr>
<td>Phase I</td>
<td>6.0</td>
<td>65</td>
<td>1101</td>
<td>149 (13.6)</td>
<td>NA*</td>
<td>NA*</td>
<td>NA*</td>
</tr>
<tr>
<td>Phase II</td>
<td>27.3</td>
<td>122</td>
<td>25,529</td>
<td>2480 (13.9)</td>
<td>13.7 ± 2.6 (0)</td>
<td>13.2 ± 2 (0)</td>
<td>13.2 ± 2 (0)</td>
</tr>
</tbody>
</table>

*Percentage values for total FC days divided by total observed patient days differ slightly from the mean daily FC use prevalence values, which are based on the daily percentage of patients using FC.
*P < .001 for performance of patients with FCs, baseline vs phase I (all *P* values determined with 2-tailed test).
**P < .001 for percentage of patients with FCs, baseline vs phase II.
*FC not applicable. During phase I, the prevalence trend line for FC use included such steep slopes in negative during phase I, baseline during phase II, and positive during phase III, that mean prevalence values for these periods are not shown.
*Time not used: N/A
*No FC use in phase I; all FC use in phase II; all FC use in phase III.
**P < .001 for percentage of patients with FCs, baseline vs phase II.
*P < .001 for percentage of FCs without an active protocol; phase I vs phase III.

“Wait, this one’s a lawyer. We’d better wash our hands.”

Thanks!