Infection Control: Urinary Tract Infections

Infectious Disease Epidemiology Section
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Your taxes at work
Source of Infection
Normal Bladder

• Bladder content sterile
• Micturition empties bladder completely
• Exfoliation of urethral cells pushes microbes out
• Any interference will increase risk of infection
Urinary Catheter Risks

- Catheter
  - Breaches barrier
  - Balloon prevents complete emptying
  - Distends bladder
  - Pool of urine

- Condom catheter
  - Warm moist conditions inside ⇒ high inoculum
  - Travel upwards

- Closed systems
  - Never completely closed
  - Bag may have high counts
  - Travel upwards
Microbe Migration

- Microbes migrate
  - Up lumen: even non-motile bacteria
  - Up external surface of catheter

- Biofilm = matrix of polysaccharides
  - with encased bacteria, up to 4 species (usually 1 in urine)
  - Microcolonies
  - Water channels

- Bacteria in biofilms express different genes
  - Increase production of extracell polymeric substance (EPS)
  - 50-90% of biofilm mass

- Biofilms
  - Poor antibiotic diffusion
  - Slow bacterial multiplication
  - Less effectiveness of antibiotics
Definitions
Asymptomatic Bacteriuria

- Very common among hospitalized patients
- Endogenous organisms:
  - Fecal flora colonizes perineum
- Exogenous organisms:
  - From HCW hands / collection containers
  - Colonize perineum
- Colonization progresses to meatal/urethral surface
  - Kass EH 1957, NEJM 256:55: Serratia marcescens applied to perineum, in 3 days Sm appeared in urine
  - Meatal colonization more important than length of urethra
    Female at higher risk of meatal colonization
- Pyuria
  - Often absent
  - Suppression of immune response by catheter
Asymptomatic Bacteriuria -1-

- Patient with indwelling urinary catheter within 7 days before first culture
  
  and

- Positive urine culture $\geq 10^5$ microorganisms per mL with no more than two species of microorganisms
  
  and

- Patient has no fever ($\leq 38^\circ C$), urgency, frequency, dysuria, or suprapubic tenderness
Asymptomatic Bacteriuria -2-

- Patient with NO indwelling urinary catheter within 7 days before first culture

  and

- Patient with at least 2 positive urine cultures $\geq 10^5$ microorganisms / mL of urine with repeated isolation of same microorganism and

- no more than two species of microorganisms

  and

- patient has no fever ($\leq 38^\circ$ C), urgency, frequency, dysuria, or suprapubic tenderness
Symptomatic UTI -1-

- Patient has at least one of the following signs or symptoms with no other recognized cause:
  - Fever (≥ 38°C), urgency, frequency, dysuria, suprapubic tenderness

  and at least one of the following:

- Positive urine culture ≥ 10⁵ microorganisms per mL
- or urine with no more than two species of microorganisms
Symptomatic UTI -2-

- Patient has at least one of the following signs or symptoms with no other recognized cause:
  - Fever (≥ 38°C), urgency, frequency, dysuria, suprapubic tenderness

  and at least one of the following:

- Positive dipstick for leukocyte esterase or nitrate
- Pyuria (urine with ≥ 10 wbc/mm3 or ≥ 3 wbc/HPF unspun urine)
- Microorganisms seen on Gram stain of unspun urine
- At least two urine cultures with repeated isolation of the same uropathogen (Gneg bacteria or S. saprophyticus) with ≥ 10^2 colonies/mL in nonvoided specimens
- ≤ 10^5 colonies/ml of single uropathogen (Gneg bacteria or S. saprophyticus) in patient treated with UTI antimicrobial
- Physician diagnosis of UTI
- Physician institutes Tx for UTI
Symptomatic UTI -3- Pediatrics

• Patient <1 year of age with at least one of the following signs or symptoms with no other recognized cause:
  fever ($\geq 38^\circ C$), hypothermia (<37° C), apnea, bradycardia, dysuria, lethargy, or vomiting

  and at least 1 of the following:

• Positive urine culture $\geq 10^5$ microorganisms per mL
• or urine with no more than two species of microorganisms
Symptomatic UTI - Pediatrics

- Patient <1 year of age with at least one of following signs or symptoms with no other recognized cause: fever (≥ 38°C), hypothermia (≤ 37°C), apnea, bradycardia, dysuria, lethargy, or vomiting

  and at least 1 of the following:

- Positive dipstick for leukocyte esterase or nitrate
- Pyuria (urine with ≥ 10 wbc/mm³ or ≥ 3 wbc/HPF unspun urine)
- Microorganisms seen on Gram stain of unspun urine
- At least 2 urine cultures with repeated isolation of same uropathogen (Gneg bacteria or S. saprophyticus) with ≥ 10² colonies/mL in nonvoided specimens
- ≤ 10⁵ colonies/ml of single uropathogen (Gneg bacteria or S. saprophyticus) in patient treated with UTI antimicrobial
- Physician diagnosis of UTI
- Physician institutes Tx for UTI
Symptomatic UTI

- Positive culture of urinary catheter tip not acceptable laboratory test to diagnose UTI

- Urine cultures must be obtained using appropriate technique
  - Adult: clean catch collection or catheterization.
  - Infants: bladder catheterization or suprapubic aspiration

- Positive urine culture from bag is unreliable and should be confirmed
Risk Factors
Personal Risk Factors

- Female
- Advanced age
- Duration
- Diabetes
- Renal insufficiency (Creatinine > 2mg/dL)
Incidence
Incidence

- Most common in
  - Acute and long term care
  - Pediatric and geriatric populations
  - Urinary instrument: catheter

- Incidence function of duration
  - 1-5% per day
  - Almost 100% after 30 days
Microbes
UTI Agents

- Patient fecal flora in OP:
  - Ecoli 80%

- Hospitalization:
  - Shift to hospital flora
  - Klebsiella, Pseudomonas, Proteus, Enterobacter, Candida
  - More resistant strains

- Shift with duration of
  - Catheter
  - Hospitalization

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<th>NNI S 1990-1992</th>
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<tbody>
<tr>
<td>E.coli</td>
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<tr>
<td>Enterococci</td>
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<tr>
<td>Staph. au</td>
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Prevention
Urinary Catheter Use

- Used in about
  - Wards: 10% pf patients days
  - ICU: 50% pf patients days

- Over-utilization in some hospitals
  - 50% insertions without proper indication
  - 50% continuation without proper indication
  - 30% of physicians unaware of patient status re: Ucath

- Hospital wide protocols
  - For insertion, continuation
  - Computerized charting
  - Allow nurse to remove