

# **Infection Control: Urinary Tract Infections**

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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 polysacharides**
  - **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 ( $\leq 38^\circ \text{C}$ ), 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 ( $\leq 38^\circ \text{C}$ ), urgency, frequency, dysuria, or suprapubic tenderness

# Symptomatic UTI -1-

- Patient has at least on 1 of following signs or symptoms with no other recognized cause:

fever ( $\geq 38^{\circ}$  C), urgency, frequency, dysuria, suprapubic tenderness

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 -2-

- Patient has at least on 1 of following signs or symptoms with no other recognized cause:

fever ( $\geq 38^{\circ}$  C), urgency, frequency, dysuria, suprapubic tenderness

and at least 1 of the following:

- Positive dipstick for leukocyte esterase or nitrate
- Pyuria (urine with  $\geq 10$  wbc/mm<sup>3</sup> or  $\geq 3$  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  $\geq 10^2$  colonies/mL in nonvoided specimens
- $\leq 10^5$  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 ( $\geq 38^{\circ}\text{C}$ ), hypothermia ( $<37^{\circ}\text{C}$ ), 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 -4- Pediatrics

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

and at least 1 of the following:

- Positive dipstick for leukocyte esterase or nitrate
- Pyuria (urine with  $\geq 10$  wbc/mm<sup>3</sup> or  $\geq 3$  wbc/HPF unspun urine)
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- 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

## NNIS 1990-1992

• E.coli	25%
• Enterococci	16%
• Pse. aeruginosa	11%
• Candida	5%
• Klebs.pneumo	7%
• Enterobacter	5%
• Proteus	5%
• StaphCoagNeg	4%
• Staph. au	2%

**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**