

Infection Control: Urinary Tract Infections

**Infectious Disease Epidemiology Section
Office of Public Health
Louisiana Dept of Health & Hospitals
800-256-2748**

www.oph.dhh.louisiana.gov

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 ≥ 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 $\geq 10^2$ 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 ≥ 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 $\geq 10^2$ colonies/mL in nonvoided specimens
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- 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

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**