

Evidence-based Strategies for Prevention of CAUTI

FL Department of Health CAUTI Collaborative

Carolyn Gould, MD, MSCR

*Division of Healthcare Quality Promotion
Centers for Disease Control and Prevention*

June 22, 2011

National Center for Emerging and Zoonotic Infectious Diseases
Division of Healthcare Quality Promotion



Nothing to Disclose

Outline

- ❑ **Background**
- ❑ **Core Prevention Strategies**
- ❑ **Criteria for Urinary Catheter Insertion**
- ❑ **Removing the Catheter**
- ❑ **Alternatives to Indwelling Catheters**
- ❑ **Resisting the Urge to Treat ASB**

** Citations, references, and credits – Myriad Pro, 11pt*

Impact of CAUTI

- Most common type of HAI
 - > 30% of infections reported to NHSN
- Up to 139,000 hospital-onset, symptomatic CAUTIs occur annually
 - Leading cause of secondary BSI with ~10% mortality
- \$131 million in excess direct medical costs
- One-third of antimicrobial use inappropriately aimed at treatment of asymptomatic bacteriuria

Hidron AI et al. ICHE 2008;29:996-1011

Wise M, et al. SHEA Abstract, Dallas, TX 2011

Scott R, et al. SHEA Abstract, Dallas, TX 2011

Richards M, et al. Crit Care Med 1999;27:887-92

Cope M et al. Clin Infect Dis 2009;48:1182-8

Urinary Catheter Use

- 15-25% of hospitalized patients receive catheters
- 5-10% of NH residents have catheters
- Often placed for inappropriate indications
- Physicians frequently unaware
- In a recent survey of U.S. hospitals:
 - > 50% did not monitor which patients catheterized
 - 75% did not monitor duration and/or discontinuation

Weinstein JW et al. ICHE 1999;20:543-8

Warren JW et al. Arch Intern Med 1989;149:1535-7

Benoit SR et al. J Am Geriatr Soc 2008;56:2039-44

Rogers MA et al J Am Geriatr Soc 2008;56:854-61

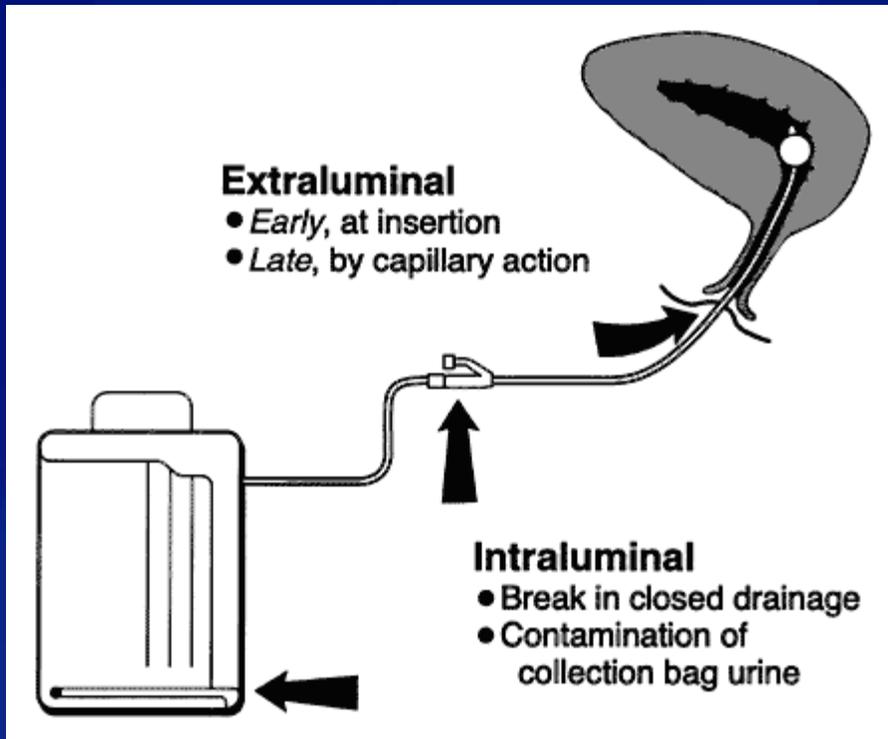
Munasinghe RL et al. ICHE 2001;22:647-9

Saint S et al. Am J Med 2000;109:476-80

Jain P et al. Arch Intern Med 1995;155:1425-9

Saint S. et al. Clin Infect Dis 2008;46:243-50

Pathogenesis of CAUTI



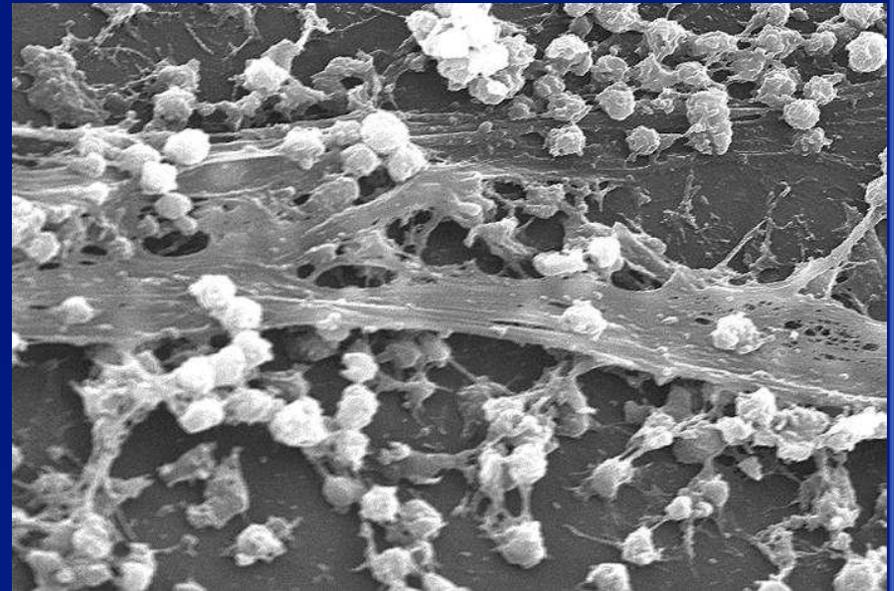
Source of microorganisms

- Endogenous (meatal, rectal, or vaginal colonization)
- Exogenous (contaminated hands of healthcare personnel during catheter insertion or manipulation of collecting system)

Figure from: Maki DG, Tambyah PA. Emerg Infect Dis 2001;7:1-6

Biofilm Formation

- Formation of biofilms by urinary pathogens common on surfaces of catheters and collecting systems
- Bacteria within biofilms resistant to antimicrobials and host defenses
- Some novel strategies in CAUTI prevention have targeted biofilms



Scanning electron micrograph of *S. aureus* bacteria on the luminal surface of an indwelling catheter with interwoven complex matrix of extracellular polymeric substances known as a biofilm

Photograph from CDC Public Health Image Library: <http://phil.cdc.gov/phil/details.asp>



GUIDELINE FOR PREVENTION OF CATHETER-ASSOCIATED URINARY TRACT INFECTIONS 2009

Carolyn V. Gould, MD, MSCR¹; Craig A. Umscheid, MD, MSCE²; Rajender K. Agarwal, MD, MPH²; Gretchen Kuntz, MSW, MSLIS²; David A. Pegues, MD³ and the Healthcare Infection Control Practices Advisory Committee (HICPAC)⁴

Background: Evidence-based Risk Factors for CAUTI

<i>Symptomatic UTI (SUTI)</i>	<i>Bacteriuria</i>
<i>Prolonged catheterization*</i>	<i>Disconnection of drainage system*</i>
<i>Female sex†</i>	<i>Lower professional training of inserter*</i>
<i>Older age†</i>	<i>Placement of catheter outside of OR†</i>
<i>Impaired immunity†</i>	<i>Incontinence†</i>
	<i>Diabetes</i>
	<i>Meatal colonization</i>
	<i>Renal dysfunction</i>
	<i>Orthopaedic/neurology services</i>

* Main modifiable risk factors † Also inform recommendations in guideline

Core Prevention Strategies: (All Category IB)

Catheter Use

- Insert catheters only for appropriate indications
- Leave catheters in place only as long as needed

Insertion

- Ensure that only properly trained persons insert and maintain catheters
- Insert catheters using aseptic technique and sterile equipment

Maintenance

- Maintain a closed drainage system
- Maintain unobstructed urine flow

Hand Hygiene and
Standard Precautions

Quality Improvement Programs

Appropriate Indications

Table 2. A. Examples of Appropriate Indications for Indwelling Urethral Catheter Use ¹⁻⁴

Patient has acute urinary retention or bladder outlet obstruction

Need for accurate measurements of urinary output in critically ill patients

Perioperative use for selected surgical procedures:

- Patients undergoing urologic surgery or other surgery on contiguous structures of the genitourinary tract
- Anticipated prolonged duration of surgery (catheters inserted for this reason should be removed in PACU)
- Patients anticipated to receive large-volume infusions or diuretics during surgery
- Need for intraoperative monitoring of urinary output

To assist in healing of open sacral or perineal wounds in incontinent patients

Patient requires prolonged immobilization (e.g., potentially unstable thoracic or lumbar spine, multiple traumatic injuries such as pelvic fractures)

To improve comfort for end of life care if needed

Core Prevention Strategies: Specific recommendations (IB)

- Insert catheters using aseptic technique and sterile equipment
 - Hand hygiene
 - Use sterile gloves, drape, sponges, antiseptic or sterile solution for periurethral cleaning, single-use packet of lubricant jelly
 - Properly secure catheters

Aseptic Technique for Catheter Insertion

- NEJM Videos in Clinical Medicine:



The NEW ENGLAND
JOURNAL of MEDICINE

- Male Urethral Catheterization
T. W. Thomsen and G. S. Setnik - 25 May, 2006
- Female Urethral Catheterization
R. Ortega, L. Ng, P. Sekhar, and M. Song - 3 Apr, 2008
- Goal is to avoid contamination of the sterile catheter during the insertion process
- Need to educate and document competency

We have the technique down, so what's the problem?

- *Untrained personnel often given the responsibility of placing catheters*
 - *A known risk factor for bacteriuria*
 - *Task often delegated to nursing assistants*
 - *Poor oversight by hospitals*
 - *ED placement often a routine practice and undocumented*

Core Prevention Strategies: Specific recommendations (IB)

- Maintain a closed drainage system
 - If disconnection or leakage occurs, replace catheter and collecting system
 - Consider systems with preconnected, sealed catheter-tubing junctions (II)
 - Obtain urine samples aseptically

Core Prevention Strategies: Specific recommendations (IB)

- Maintain unobstructed urine flow
 - Keep catheter and collecting tube free from kinking
 - Keep collecting bag below level of bladder at all times (do not rest bag on floor)
 - Empty collecting bag regularly using a separate, clean container for each patient

Core Prevention Strategies: Specific recommendations (IB)

- Leave catheters in place only as long as needed
 - Remove catheters ASAP postoperatively, preferably within 24 hours, unless there are appropriate indications for continued use

One Reason Catheters Are Used Inappropriately

Level	Proportion Unaware of Catheter
<i>Medical Students</i>	18%
<i>House Officers</i>	25%
<i>Attending Physicians</i>	38%

Clinical Infectious Diseases 2010;51(5)

MAJOR ARTICLE

Systematic Review and Meta-analysis:
Reminder Systems to Reduce Catheter-Associated
Urinary Tract Infections and Urinary Catheter Use
in Hospitalized Patients

Jennifer Meddings,¹ Mary A. M. Rogers,¹ Michelle Macy,² and Sanjay Saint^{3,1}

¹Department of Internal Medicine and ²Departments of Emergency Medicine and Pediatrics, University of Michigan, Ann Arbor, and ³Ann Arbor VA Medical Center, Ann Arbor, Michigan

Results of the Meta-analysis

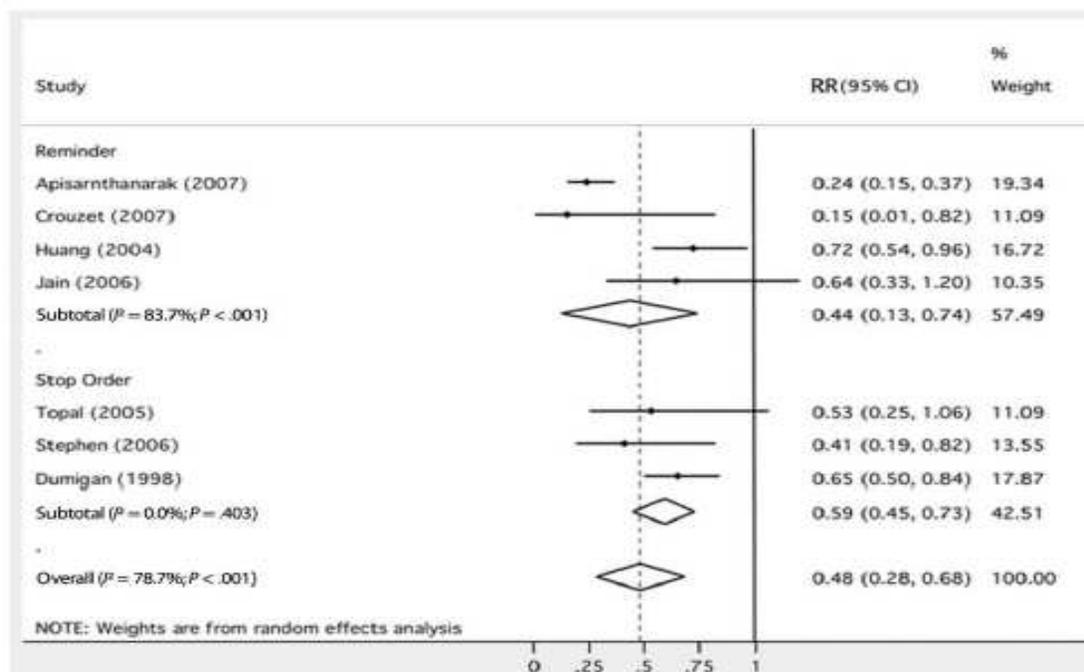


Figure 3. Meta-analysis of rate ratios (RRs) for catheter-associated urinary tract infection (CAUTI) episodes per 1000 catheter-days, for intervention versus control groups. CI, confidence interval.

- Rate of CAUTI (episodes per 1000 catheter-days) was reduced by 52% ($P < .001$) with use of a reminder or stop order
- Mean duration of catheterization decreased by 37%, resulting in 2.61 fewer days of catheterization per patient in the intervention versus control groups

Supplemental Prevention Strategies: Examples

- Alternatives to indwelling urinary catheterization
- Use of portable ultrasound devices
- Antimicrobial/antiseptic-impregnated catheters

Alternatives to Indwelling Catheters

- Consider **intermittent catheterization** for:
 - Patients requiring chronic urinary drainage for neurogenic bladder (e.g., spinal cord injury, myelomeningocele)
 - Postoperative patients with urinary retention
- Consider **external catheters** for:
 - Cooperative male patients without obstruction or urinary retention

Bladder Ultrasounds

- Studies done:
 - Adults with neurogenic bladder undergoing intermittent catheterization
 - Rationale: fewer catheterizations = lower risk of UTI
 - RN-directed protocols and bladder scanners

Antimicrobial/antiseptic catheters: Rationale

- Bacterial adhesion: first step in biofilm formation
- Manufacturers have impregnated latex and silicone catheters with antimicrobial materials to prevent bacterial adhesion
 - Silver alloy and nitrofurazone most common
 - Hydrogel coating often used in addition to reduce urethral friction (may also decrease bacterial adhesion)

Summary of Clinical Data on Silver-Alloy Coated Urinary Catheters

- Decreased risk of bacteriuria in a meta-analysis of RCTs compared to standard latex catheters
- Effects greater for patients catheterized < 1 week and in earlier studies
- No effects seen when compared to silicone control catheters
- Mixed results in observational studies in hospitalized patients

Summary of Data on Nitrofurazone-Impregnated Catheters

- Reduced risk of bacteriuria in a meta-analysis of 3 studies when duration of catheterization was < 1 week
 - Only one individual study significant
- No significant differences in SUTI
- No clinical studies comparing silver coated to nitrofurazone impregnated urinary catheters

Challenges in interpreting the literature

- Trial designs varied widely
- Outcomes usually included ASB
 - Questionable clinical relevance
- Studies often inadequate (sample size, randomization, blinding, abstracts/letters)
- Difficult to distinguish effects of hydrogel coatings from silver alloy and effect of control material (silicone vs. latex)

In vitro studies: summary

- Nitrofurazone-silicone catheters decreased bacterial adherence compared to silicone-only, but inhibitory effect diminished after 3-5 days
- Silver in silicone catheters had no effect compared to silicone-only
- Silver in latex-hydrogel catheters reduced *E.faecalis* but not *E. coli* adherence compared to latex-hydrogel
- Hydrogel coating itself seems to reduce bacterial adherence

Antimicrobial/ Antiseptic- Impregnated Catheters: HICPAC recommendation

- Considered using if CAUTI rates not decreasing after implementing a comprehensive strategy
 - First implement core recommendations for use, insertion, and maintenance
 - Ensure compliance with core recommendations

IDSA Guidelines on Diagnosis, Prevention, and Treatment of CAUTI

- *Antimicrobial coated catheters:*

Antimicrobial-Coated Catheters

Recommendations

28. In patients with short-term indwelling urethral catheterization, antimicrobial (silver alloy or antibiotic)-coated urinary catheters may be considered to reduce or delay the onset of CA-bacteriuria (B-II).

i. Data are insufficient to make a recommendation about whether use of such catheters reduces CA-UTI in patients with short-term indwelling urethral catheterization.

ii. Data are insufficient to make a recommendation as to whether use of such catheters reduces CA-bacteriuria or CA-UTI in patients with long-term catheterization.

SHEA/IDSA Compendium

c. Catheter materials

i. Reviews and meta-analyses of silver-coated and other antibacterial urinary catheters consistently conclude that evidence does not support a recommendation for the uniform use of such devices.^{26,31,32}

ii. Silver-alloy catheters may decrease bacteriuria but have not been shown to decrease symptomatic infection or other undesirable outcomes.^{31,32}

(a) Some of the variability in outcomes reported in trials of silver catheters may be related to whether the comparator catheter is silicone or latex.³³

(b) A recent prospective crossover study comparing a silver-alloy, silicone-based hydrogel-coated catheter with a silicone-based hydrogel-coated catheter reported no difference in symptomatic or asymptomatic infection or in bloodstream infections attributable to a urinary source.³⁴

Diagnostic and Treatment Issues

Bacteriuria

- *Asymptomatic bacteriuria*
 - *Quantitative culture with $>10^5$ colony forming units/ml without clinical signs/symptoms localizing to the urinary tract*
- *Incidence of bacteriuria with indwelling urinary catheters*
 - *3-10% per catheter-day*
 - *26% of people with a catheter between 2-10 days*
 - *100% of people with long-term ($>30d$) catheters*
- *Bacteriuria is rarely symptomatic*

Asymptomatic Bacteriuria (ASB)

Clinical Infectious Diseases 2005;40:643–54

IDSA GUIDELINES

Infectious Diseases Society of America Guidelines for the Diagnosis and Treatment of Asymptomatic Bacteriuria in Adults

Lindsay E. Nicolle,¹ Suzanne Bradley,² Richard Colgan,³ James C. Rice,⁴ Anthony Schaeffer,⁵ and Thomas M. Hooton⁶

¹University of Manitoba, Winnipeg, Canada; ²University of Michigan, Ann Arbor; ³University of Maryland, Baltimore; ⁴University of Texas, Galveston; ⁵Northwestern University, Chicago, Illinois; and ⁶University of Washington, Seattle

Prevalence of ASB

Table 2. Prevalence of asymptomatic bacteriuria in selected populations.

Population	Prevalence, %	Reference
Healthy, premenopausal women	1.0–5.0	[31]
Pregnant women	1.9–9.5	[31]
Postmenopausal women aged 50–70 years	2.8–8.6	[31]
Diabetic patients		
Women	9.0–27	[32]
Men	0.7–11	[32]
Elderly persons in the community ^a		
Women	10.8–16	[31]
Men	3.6–19	[31]
Elderly persons in a long-term care facility		
Women	25–50	[27]
Men	15–40	[27]
Patients with spinal cord injuries		
Intermittent catheter use	23–89	[33]
Sphincterotomy and condom catheter in place	57	[34]
Patients undergoing hemodialysis	28	[28]
Patients with indwelling catheter use		
Short-term	9–23	[35]
Long-term	100	[22]

^a Age, ≥ 70 years.

Management of ASB: DON'T screen/ treat

Recommendations against screening for, and treatment of, asymptomatic bacteriuria (2)

Recommendation	Level
----------------	-------

Screening for, and treatment of, asymptomatic bacteriuria is not recommended for:

- | | |
|---|------|
| 1. Premenopausal, nonpregnant women | A-I |
| 2. Diabetic women | A-I |
| 3. Older people living in the community | A-II |
| 4. Elderly, institutionalized people | A-I |
| 5. People with spinal-cord injury | A-I |
| 6. Patients with indwelling catheters | A-I |

Is pyuria diagnostic?

3. Signs and symptoms compatible with CA-UTI include new onset or worsening of fever, rigors, altered mental status, malaise, or lethargy with no other identified cause; flank pain; costovertebral angle tenderness; acute hematuria; pelvic discomfort; and in those whose catheters have been removed, dysuria, urgent or frequent urination, or suprapubic pain or tenderness (A-III).

i. In patients with spinal cord injury, increased spasticity, autonomic dysreflexia, or sense of unease are also compatible with CA-UTI (A-III).

4. In the catheterized patient, pyuria is not diagnostic of CA-bacteriuria or CA-UTI (AII).

i. The presence, absence, or degree of pyuria should not be used to differentiate CA-ASB from CA-UTI (A-II).

ii. Pyuria accompanying CA-ASB should not be interpreted as an indication for antimicrobial treatment (A-II).

iii. The absence of pyuria in a symptomatic patient suggests a diagnosis other than CA-UTI (A-III).

5. In the catheterized patient, the presence or absence of odorous or cloudy urine alone should not be used to differentiate CA-ASB from CA-UTI or as an indication for urine culture or antimicrobial therapy (A-III).

Pyuria and ASB

Prevalence of pyuria in different populations with asymptomatic bacteriuria

Population	Bacteriuria (%)	Pyuria with bacteriuria (%)
Healthy adult women [7]	2–5	32
Pregnant women [15]	2–11	50
Diabetic women [16]	7–9	70
Elderly: nursing home [17]	5–50	90
Spinal-cord injury patients [18]	50	33–86
Indwelling urethral catheter [19,20]	100	70

- *Pyuria accompanying bacteriuria is NOT an indication for antimicrobial treatment*

Pyuria in the elderly – *not useful*

- *Over 90% of older adults with positive urine cultures (bacteriuria) have pyuria*
 - *No evidence of poor clinical outcomes with high levels*
 - *Some individuals have very high levels of pyuria over 1000 white cells/mm³ of urine*
- *If LE and Nitrite negative, >97% predictive value that urinary tract infection not present*
- ***Bottom line: Don't get the test unless you know how to interpret AND plan on acting on the results***

When Is it appropriate to screen for and treat ASB?

- ❑ *In pregnant women*
- ❑ *Before transurethral resection of the prostate and other urologic procedures where mucosal bleeding is anticipated*

Risks of antimicrobial use for ASB

- ❑ *Selection for antimicrobial resistant pathogens*
- ❑ *Adverse reactions to antimicrobial*
- ❑ *C. difficile infection*
- ❑ *Should not expose patients to the risks of antimicrobial exposure when there is no known benefit*

Thank you! Questions?

For more information please contact Centers for Disease Control and Prevention

1600 Clifton Road NE, Atlanta, GA 30333
Telephone, 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348
E-mail: cdcinfo@cdc.gov Web: www.cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

National Center for Emerging and Zoonotic Infectious Diseases
Place Descriptor Here

