

Prevention of HAIs: What Physician should know? [2]

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Outline

- Central Line-Associated Bloodstream Infection (CLABSI)
- Catheter Associated Urinary Tract Infection (CAUTI)

Central Line-Associated Bloodstream Infection (CLABSI)

Cost of antibiotics treating nosocomial infections at Srinagarind Hospital in 2008 and 2009.

Type of nosocomial infection	Cost in 2008 (Baht)	Cost in 2009 (Baht)
VAP	10,495,672	12,209,424
HAP	6,405,616	5,308,639
UTI, catheter related	4,031,067	3,622,903
UTI, non-catheter related	2,265,326	1,722,539
BSI, central line related	1,842,708	1,974,502
BSI, non-central line related	2,561,825	2,160,893
SSI, clean	245,938	251,230
SSI, clean contaminate	1,847,210	1,575,738
SSI, contaminate	1,127,839	151,984
SSI, dirty	42,672	0
Miscellaneous	3,064,161	2,822,473
Total	33,930,034	31,800,325

VAP, ventilator associated pneumonia; HAP, hospital acquired pneumonia; UTI, urinary tract infection; BSI, blood stream infection; SSI, skin and soft tissue infections; miscellaneous, other nosocomial infections (*eg*, cellulitis, bed sore infections, newborn eye infections, bronchitis, sinusitis).

Epidemiology

- 80,000 CRBSIs occur in ICUs each year in US
- Increase hospital costs and length of stay
 - (Average increased length of stay is 7 days)
- 500-4,000 U.S. patients die annually
- Estimated cost per CLABSI is \$3,700-29,000

Pathogens

Organism	Percentage
Coagulase negative Staphylococcus	37
<i>Staphylococcus aureus</i>	22
Yeast	9.3
Enteric gram negative bacilli	12.4
<i>Enterococcus spp.</i> and <i>Streptococcus spp.</i>	4.9
<i>Pseudomonas spp.</i>	5.5
Other	8.9

Central Line

- An intravascular catheter that terminates at or close to the heart or in one of the great vessels
- used for infusion, withdrawal of blood, or hemodynamic monitoring

- Aorta
- Pulmonary artery
- Superior vena cava
- Inferior vena cava
- Brachiocephalic veins
- Internal jugular veins

- Subclavian veins
- External iliac veins
- Common iliac veins
- Femoral veins
- In neonates, the umbilical artery/vein

CLABSI Definition

A laboratory-confirmed bloodstream infection (LCBI) where central line (CL) or umbilical catheter (UC) was in place for > 2 calendar days on the date of event, with day of device placement being Day 1

And

A CL or UC was in place on the date of event or the day before. If a CL or UC was in place for >2 calendar days and then removed, the LCBI criteria must be fully met on the day of discontinuation or the next day

LCBSI

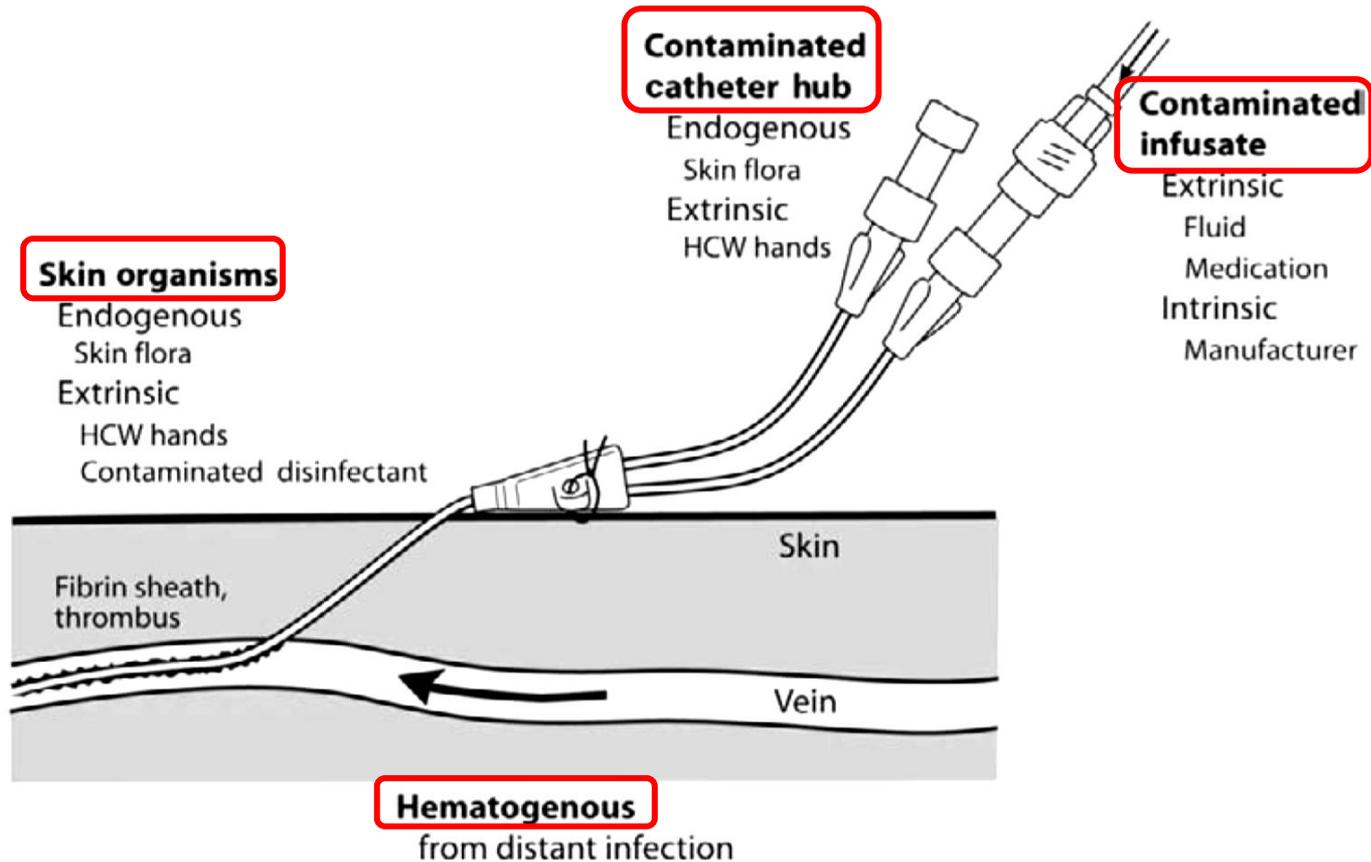
- Patient has a recognized pathogen cultured from one or more blood cultures
- and*
- Organism cultured from blood is not related to an infection at another site

- Patient has at least one of the following signs or symptoms: fever ($>38^{\circ}\text{C}$), chills, or hypotension
- and*
- positive laboratory results are not related to an infection at another site

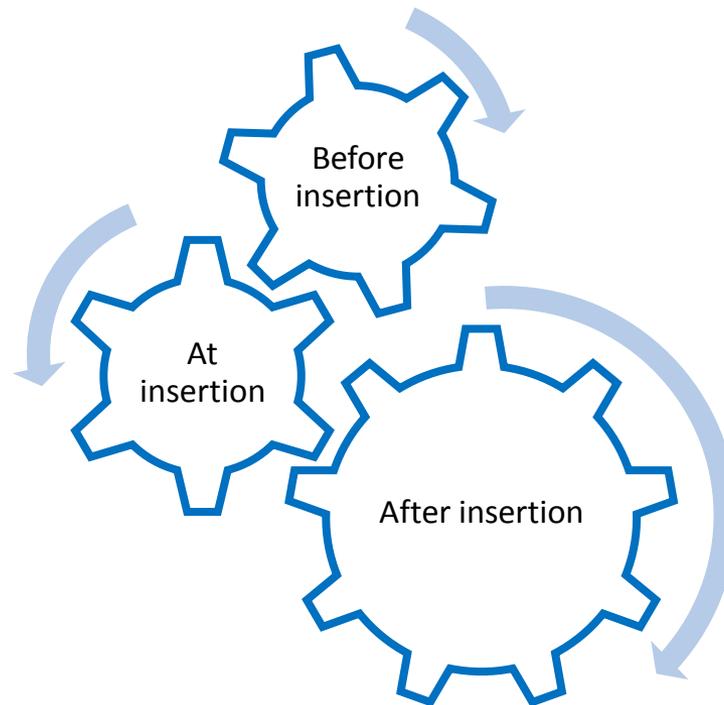
Catheter Related Bloodstream Infection (CRBSI)

- Catheter colonization
 - Growth of > 15 CFU from a 5-cm segment of the catheter tip by semi quantitative (roll-plate) culture
 - Growth of $> 10^2$ CFU from a catheter by quantitative (sonication) broth culture
 - A definitive diagnosis
 - the same organism grow from at least 1 percutaneous blood culture and from a culture of the catheter tip
 - quantitative blood cultures
 - differential time to positivity (DTP)
- 2 blood sample
(Central & peripheral line)

Pathogenesis



Strategies to Prevent CLABSI



Before Insertion

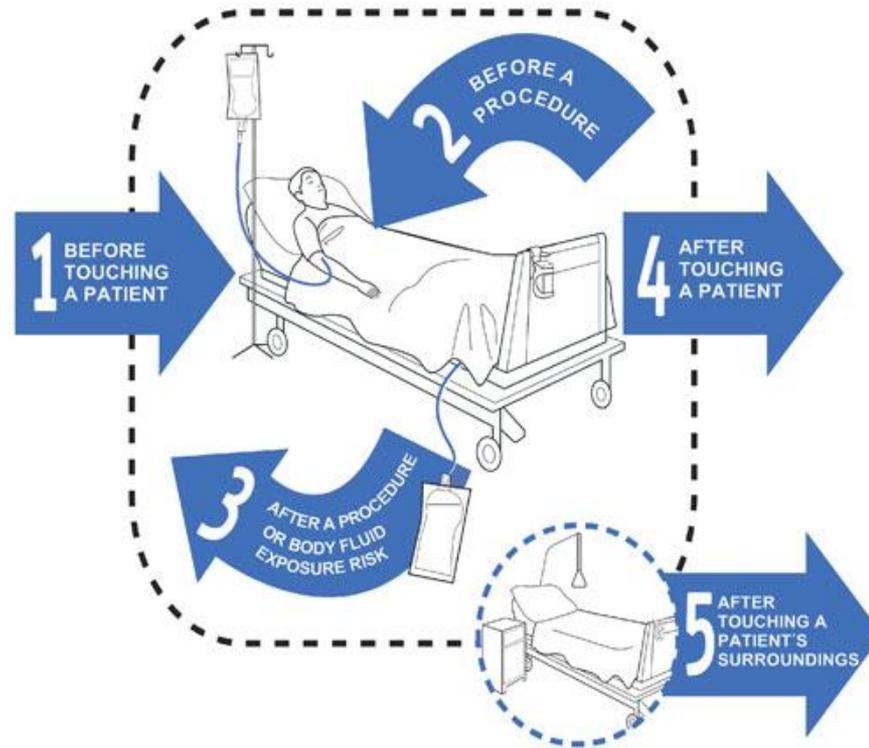
- Educate healthcare personnel
 - involved in the insertion, care, and maintenance of CVC about CLABSI prevention
- Verify HCP
- Assess the knowledge of HCP

At Insertion

1. Use a catheter checklist to ensure adherence to infection prevention practices
2. Perform **hand hygiene** before catheter insertion or manipulation
3. Avoid using the femoral vein for CV access in adult patients
4. Use an all-inclusive catheter cart or kit
5. Use **maximal sterile barrier** precautions
6. Use a **chlorhexidine-based antiseptic** for skin preparation in patients older than 2 months of age



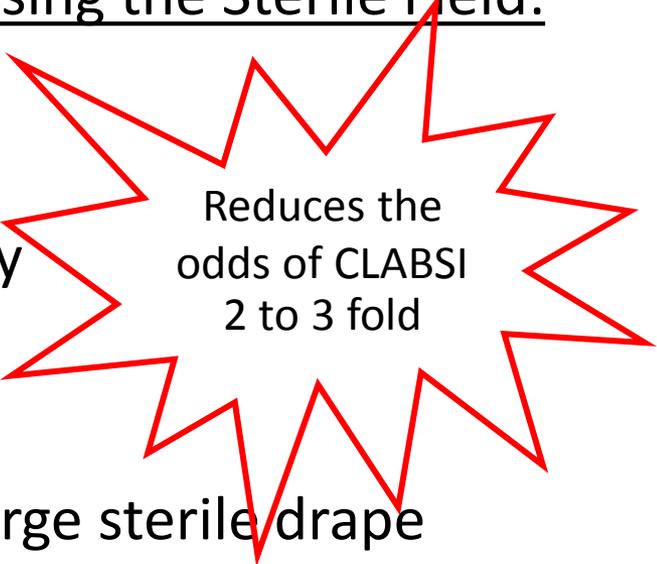
World Health Organization



Use maximal sterile barrier precautions

For Operator & Others Contacting or Crossing the Sterile Field:

- Non-sterile cap and mask
- All hair should be under cap
- Mask should cover nose & mouth tightly
- Sterile gown and gloves



Reduces the odds of CLABSI 2 to 3 fold

For the Patient:

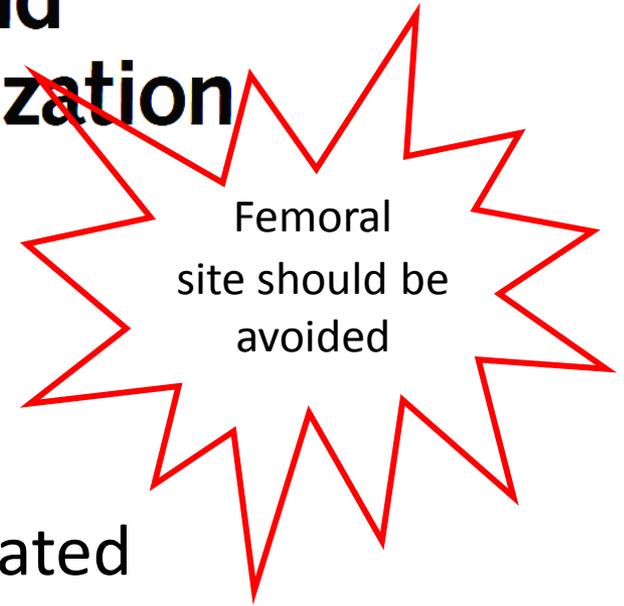
- Cover patient's head and body with a large sterile drape
- Drape should be wide enough to cover bed rail to rail

For Others in the Room

- Non-sterile cap and mask

Complications of Femoral and Subclavian Venous Catheterization in Critically Ill Patients

A Randomized Controlled Trial



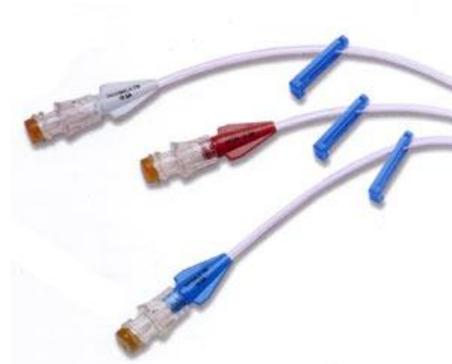
- Femoral catheterization was associated with a higher incidence rate of overall infectious complications
- **19.8%** vs **4.5%**; $P < .001$; incidence density of 20 vs 3.7 per 1000 catheter-day)

After Insertion

1. **Disinfect** catheter hubs, needleless connectors, and injection ports before accessing the catheter
2. Remove nonessential catheters
3. For non tunneled CVC perform site care
 - with a chlorhexidine-based antiseptic when soiled, loose, or damp
 - q 5-7 d for transparent dressing
 - q 2 d for gauze dressing
4. Replace administration sets not used for blood, blood products, or lipids at intervals not longer than 96 h
5. Perform surveillance for CLABSI
6. Use antimicrobial ointments for hemodialysis catheter insertion sites

Hub Care

- Clean needleless connector/hub before every access
- 70% alcohol



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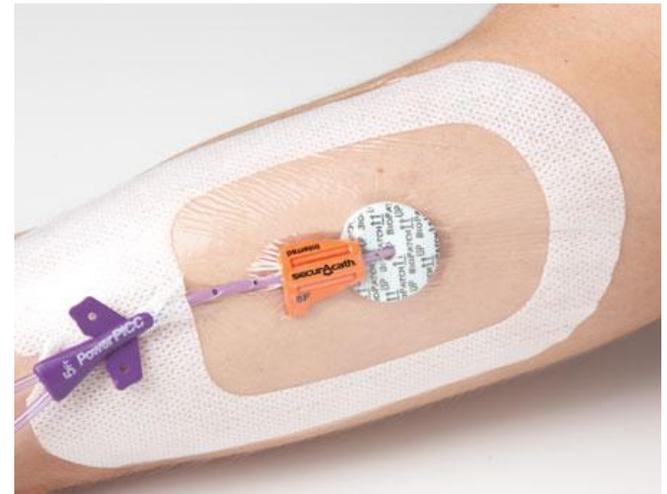
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Site Care

Timing of dressing change

- Any dressing that is damp, loose, or soiled
 - Immediately
- Transparent dressing
 - Every 7 days
- Gauze dressing
 - Every 48 hours



After Insertion

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Special Approaches for The Prevention of CLABSI

- Recommendation: **lack of effective control despite implementation of basic practices**
 1. Bathe ICU patients older than 2 mo of age with a **chlorhexidine** preparation on a daily basis (B-II)
 2. Use antiseptic- or antimicrobial-impregnated CVC for adult patients (A-I)
 3. Use chlorhexidine-containing sponge dressings for CVC in patients older than 2 mo of age (B-I)
 4. Use antimicrobial locks for CVC (A-I)

Dressing Regimens

Catheter Site

- Use a chlorhexidine-impregnated sponge dressing for temporary short-term catheters (Category 1B)
 - if the CLABSI rate is **not** decreasing despite **adherence to basic prevention** measures
 - education and training, appropriate use of chlorhexidine for skin antisepsis, and MSB
- No recommendation is made for other types of chlorhexidine dressings (Unresolved issue)

Patient Cleansing

- Use a 2% chlorhexidine wash for daily skin cleansing to reduce CRBSI (Category II)

NOT Routinely Used

- Systemic antimicrobial prophylaxis
- Routinely CVC or arterial catheters change

Strategies to Prevent CLABSI

Line Insertion	Line Maintenance
1. Perform hand hygiene before and after catheter insertions or manipulation	
2. Use chlorhexidine for skin preparation	2. Hub care
3. Use full barrier precautions during insertion	3. Site care
4. Avoid using the femoral site in adult patients	4. Tubing care
5. Assess the need for the catheter each day and remove ASAP	

Catheter Associated Urinary Tract Infection (CAUTI)

Epidemiology

- HAIs¹
 - CAUTI -> 70-80%
- Incidence
 - 0.2-4.8 cases per 1,000 catheter days¹
- Cause of BSI
 - 21%²
- Increase risk²
 - 2-7% per day

1. Weber DJ, et al. Infect Control Hosp Epidemiol. 2011 Aug;32(8):822-3.
2. Lo E, et al. Infect Control Hosp Epidemiol. 2014 May;35(5):464-79.

Estimated Numbers of Major Types of Health Care-Associated Infection in the United States in 2011

	Infections Identified in Survey	Surveyed Patients with Type of Infection	Estimated Infections in the United States
	No.	95% CI	95% CI
Infections in non-neonatal intensive care units			
CAUTI	25	5.5 (3.7–7.9)	35,600 (9100–78,000)
BSI	11	2.4 (1.3–4.2)	15,600 (3200–41,500)
VAP	35	7.7 (5.5–10.5)	49,900 (13,600–103,700)

Mechanisms of Colonization

- Rapidly progress;
 - 72 hours, to concentrations $> 10^5$ CFU/mL
- Colonic and perineal flora
- Hands of healthcare personnel
 - during catheter insertion or manipulation of the collection system
- Extraluminal contamination
- Intraluminal contamination
 - retrograde reflux of contaminated urine

Colonization of Organisms

Escherichia coli

Enterococcus spp.

Staphylococcus aureus

Candida albicans

Coagulase-negative staphylococci

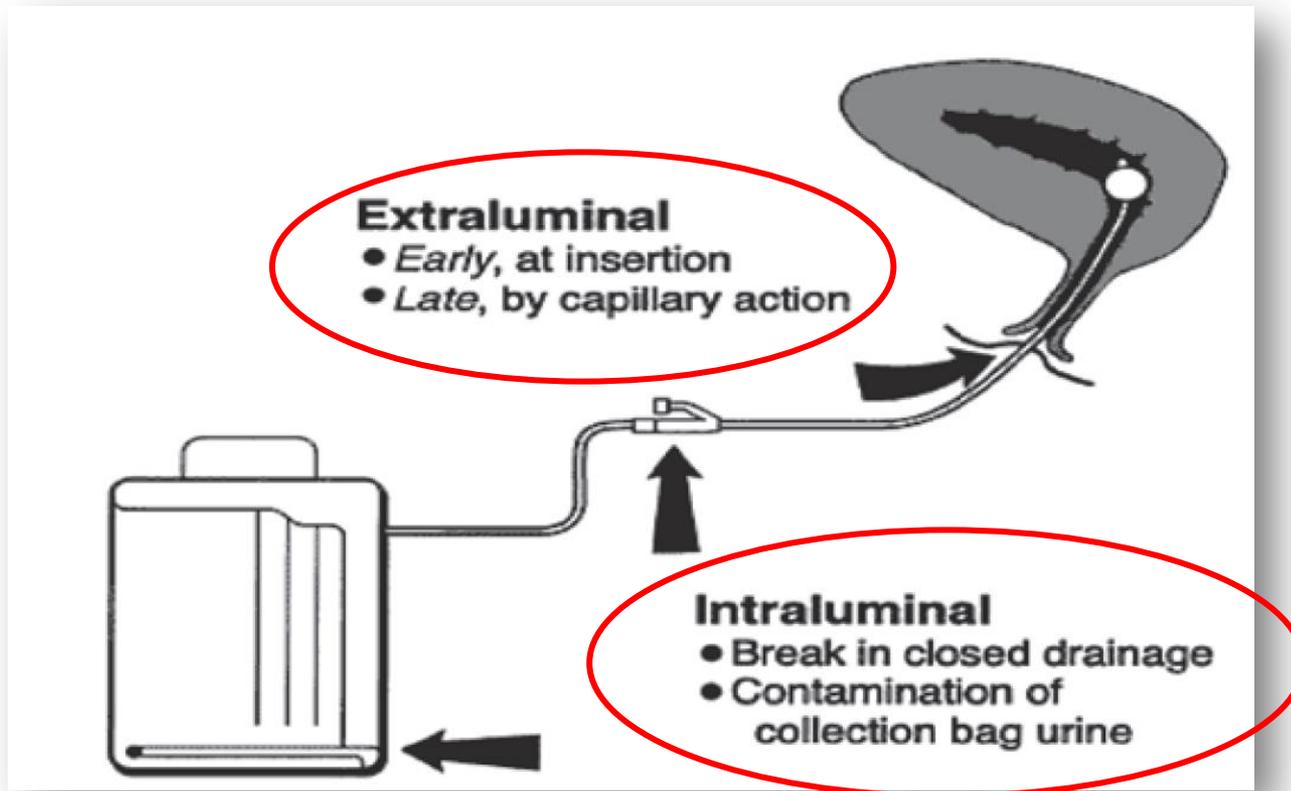
Pseudomonas spp.

Enterobacter spp.

Proteus spp.

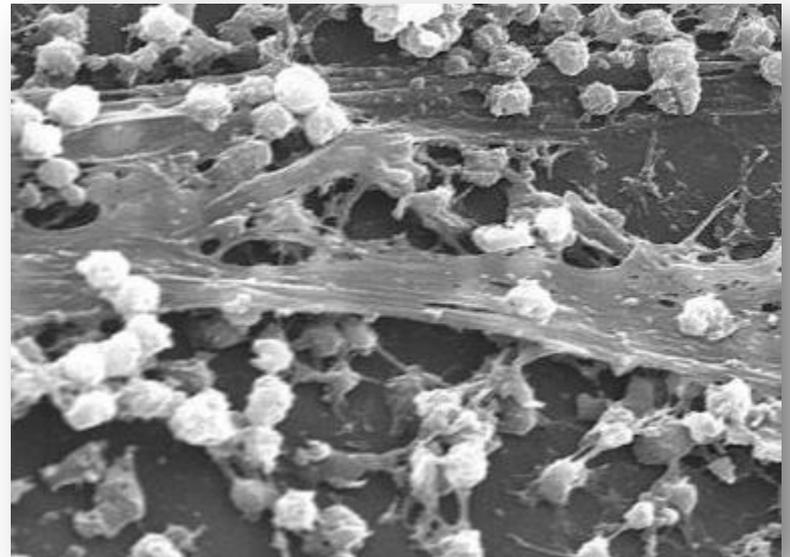
1. Vergidis P, et al. Infect Dis Clin North Am. 2012 Mar;26(1):173-86.
2. Padawer D, et al. Am J Infect Control 2015;43:e19-22.

Routes of Entry to Catheterized Urinary Tract



Biofilms

- Survival strategy
 - Protection from both the body's defenses
 - Antimicrobial agents
- Gram-negative organisms
- Gram-positive organisms
- Yeasts



1. Stickler DJ, et al. J Hosp Infect. 2008;69:350-360.
2. Public Health Image Library, Centers for Disease Control and Prevention; 2005.

Risk Factor for CAUTI

- Duration of indwelling catheter
- Diabetes
- Older age
- Female
- Contamination of closed system
- Neurological disease

Strategies to Detect CAUTI

- Surveillance definitions
 - Clinical presentation is fever with a positive urine culture result, without other localizing findings.
- Surveillance criteria
 1. Bacteriuria in patients with an indwelling urinary catheter in place is usually asymptomatic.
 2. Microbiologic diagnosis usually requires growth of more than or equal to 10^5 CFU/mL

Symptomatic UTI

Patient must meet 1, 2, and 3 below :

1. Patient had an indwelling urinary catheter that had been in place for > 2 days on the date of event (day of device placement = Day 1) AND was either:
 - Present for any portion of the calendar day on the date of event[†] , OR
 - Removed the day before the date of event
2. Patient has at least one of the following signs or symptoms:
 - fever (>38.0°C)
 - suprapubic tenderness
 - costovertebral angle pain or tenderness
 - urinary urgency
 - urinary frequency
 - dysuria
3. Patient has a urine culture with no more than two species of organisms identified, at least one of which is a bacterium of $\geq 10^5$ CFU/ml

Inappropriate Indications for Indwelling Urethral Catheter Use

As a substitute for nursing care of the patient or resident with incontinence

As a means of obtaining urine for culture or other diagnostic tests when the patient can voluntarily void

For prolonged postoperative duration without appropriate indications (e.g., structural repair of urethra or contiguous structures, prolonged effect of epidural anaesthesia, etc.)

Strategies to Prevent CAUTI

- Appropriate Urinary Catheter Use
- Proper Techniques for Urinary Catheter Insertion
- Proper Techniques for Urinary Catheter maintenance
- Quality Improvement Programs
- Administrative Infrastructure
- Surveillance

Appropriate Urinary Catheter Use

Appropriate indications

- Minimize urinary catheter use and duration.
- Avoid use of urinary catheters in patients and nursing home residents for management of incontinence.
- Use urinary catheters in operative patients only as necessary.
- For operative patients who have an indication for an indwelling catheter, remove the catheter as soon as possible postoperatively.

Appropriate Indications for Indwelling Urethral Catheter Use

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
- 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

Appropriate Urinary Catheter Use

- Consider using alternatives to indwelling urethral catheterization.
- Consider using external catheters.
- Consider intermittent catheterization, in spinal cord injury patients and patients with bladder emptying dysfunction.
- Consider intermittent catheterization in children with myelomeningocele and neurogenic bladder.

Care bundles

- Group of evidence-based practices that improve the quality of care
- Multidisciplinary teams and individual wards/units
- Implementation of a care bundle
 - Decreased CAUTIs from 6.23/1000 device days to 0.63/1000 device days

Surveillance

- Consider surveillance for CAUTI when indicated by facility-based risk assessment
- Routine screening of catheterized patients for asymptomatic bacteriuria (ASB) is not recommended
- When performing surveillance for CAUTI, consider providing regular feedback of unit-specific CAUTI rates

Thank You