

Nosocomial infections: Are they inevitable or preventable?

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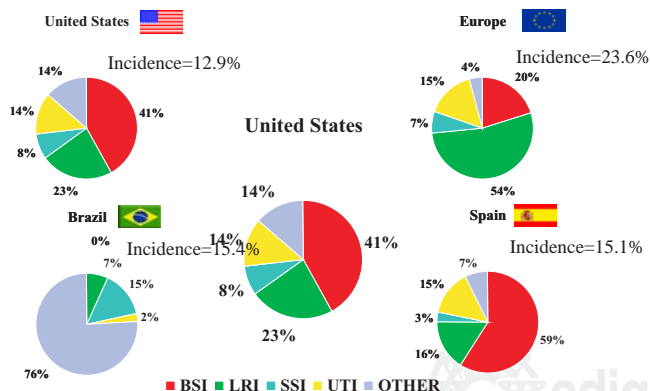
OBJECTIVES

- Review epidemiology and importance of nosocomial infections (NI) in the ICU
- Risk factors for NIs in the PICU and CICU
- Data regarding preventability of NIs

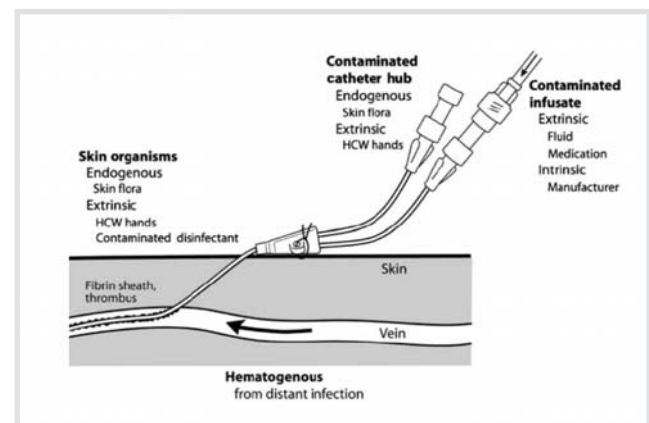
NOSOCOMIAL INFECTIONS IN THE CICU

- Central line associated bloodstream infection (CLABSI)
- Urinary tract infection (UTI)
- Ventilator associated pneumonia (VAP)
- Wound infections/Mediastinitis

NOSOCOMIAL INFECTIONS ARE A GLOBAL PICU PROBLEM



MECHANISM FOR INFECTION OF INVASIVE DEVICES



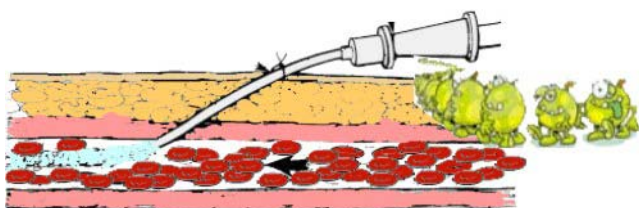
- Colonized or contaminated
- Colonization→biofilm→migration along extraluminal or luminal surface→invasion of sterile tissue→infection⁽¹⁾

Grohskopf LA. J Pediatr 2002; Raymond J. Inf Control Hosp Epidem 2000; Cavalcante SS. PIDJ 2006; Urrea M. PIDJ 2003.

1. Safdar N. Intens Care Med 2003

CENTRAL LINE-ASSOCIATED BLOODSTREAM INFECTIONS (CLABSI)

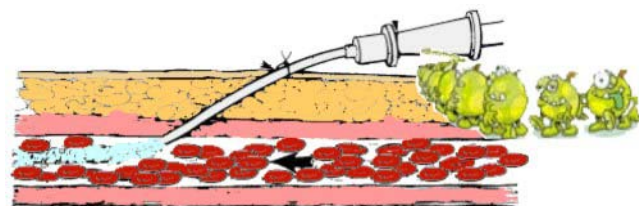
- Most common NI
- Catheter-related vs associated
- Increased costs: \$39k-50k/infection
- Increased LOS: 6.5 – 15 days
- Attributable mortality rate: 13.1%
- Associated with poor outcome on ECMO⁽²⁾
- Mean pooled rate for PICUs: 7.7/1000 cath-days
- Most common organism is coagulase negative staph⁽²⁾



2. Dominguez TE. Crit Care Med 1999; Slonim AD. Crit Care Med 2001; Montgomery V. Crit Care Med 2000; Elward AE. Pediatrics 2005

RISK FACTORS FOR CLABSI

- Severity of Illness
- Invasive lines
- ECMO
- Dialysis
- Mechanical ventilation
- Genetic syndromes
- Transfusions
- TPN⁽³⁾



3. Grohskopf LA. J Pediatr 2002; Singh-Naz N. Crit Care Med 2000; Elward AE. Inf Control Hosp Epidem 2006

VENTILATOR ASSOCIATED PNEUMONIA (VAP)

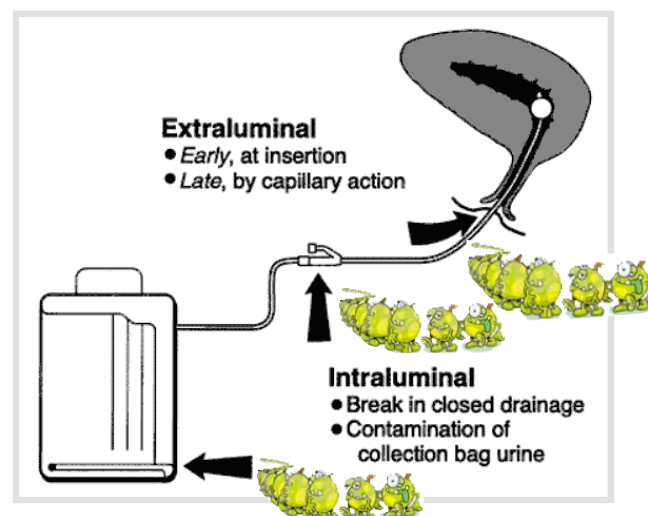
- Second most common NI in PICUs
- Reported incidence 5-10% in pediatric patients
- \$5,000-8,000/event in adults
- Mean rate 6/1,000 vent-days

- Early (community acquired pathogens) vs Late (Gram negative, MRSA)⁽⁴⁾
- Risk factors: genetic syndrome, transfusions, re-intubation
- Associated with delayed extubation by 3.7 days in pediatric cardiac patients⁽⁴⁾

4. Fischer JE. Intensive Care Med 2000; Elward AM. Pediatrics 2002

URINARY TRACT INFECTION

- PICU rate is higher than adults (5.2/1000 cath-days)
- Predominately Gram -, enterococcus, and yeast
- Risk factors: catheterization > 3 days and CV surgery⁽⁵⁾



5. Matlow AE. Pediatr Crit Care Med. 2003

SURGICAL SITE INFECTIONS

- Superficial vs Deep
- Mediastinitis incidence: 0.04-3.9% (higher in with delayed sternal closure)
- Surgical site infection incidence: 0.1-7% (10% with delayed sternal closure)
- Risk factors: neonates, duration of surgery, and transplant patients (? genetic syndrome)⁽⁶⁾

6. Tabbutt S. JTCVS 1997; Tortoriello TA. Ann Thoracic Surg 2003; Alpress AL. PIDJ 2004; Long CB. PIDJ 2005; Shah SS. PIDJ 2005

WOUND INFECTIONS/MEDIASTINITIS

- Mediastinitis
 - 2/3 of infections are Gram +
 - Approximately 30% are Gram - infections
 - 1/2 have positive blood cultures
 - *S. aureus* is associated with BSI⁽⁶⁾
6. Tabbutt S. JTCVS 1997; Tortoriello TA. Ann Thoracic Surg 2003; Alpress AL. PIDJ 2004; Shah SS. PIDJ 2005

CICU AND NIs: OUR PATIENTS ARE SPECIAL

- Severity
 - Systemic inflammatory response
 - Hypothermia
 - Hyperglycemia
 - Multiple access sites
- Patient age (Neonates)
- Multiple transfusions
- Benchmarking difficult- adjustment
- Frequent use of TPN

CICU SPECIFIC STUDIES

- Levy (2003)
 - 16.4% acquired NI
 - BSI infection in 10% and wound infections in 8% (85% of all infections)
 - 76% of infections were gram -
 - Risk factors: neonates, delayed sternal closure, LOS, and complexity⁽⁷⁾
7. Levy I. JTCVS 2003

CICU SPECIFIC STUDIES

- Valera (2001)
 - NI in 30.8%
 - BSI 19/1000 cath-days
 - Wound infection 4.8%
 - Gram + most common
 - Risks for NI: LOS, CVC duration, delayed sternal closure and prosthetic valve⁽⁸⁾
8. Valera. J Inf Control Hosp Epidem 2001

CICU SPECIFIC STUDIES

- Shah (2006)
 - Median sternotomy, 1995-2003, 192 patients
 - Median age 5.4 months
 - BSI in 12/192 (6.3%) (median 11 days post-op)
 - 50% gram - (1 candida)
 - Risks for BSI: ECMO and mediastinitis
 - No difference in mortality in patients with BSI⁽⁹⁾
9. Shah SS. JTCVS 2006

CAN WE AVOID THE INEVITABLE....?

THE PRESSURE IS ON

Hospital Infections Attorneys
Philadelphia, Pennsylvania, New Jersey, Delaware
800.597.9585



Thousands of patients each year contract infections – often fatal – while they are hospitalized.

In a recently released survey it was reported that 19,154 patients suffered infections contracted while in Pennsylvania hospitals, with 2,478 dying as a result of those infections.

If you or someone you love contracted a hospital infection that resulted in serious illness, injury or death, you may want to **contact a hospital infections attorney** today.

The survey of 168 hospitals was conducted by the Pennsylvania Health Care Cost Containment Council, an independent state agency, and included a study of 1.6 million patient hospitalizations. The survey results were released Nov. 14, 2006. (Click here to [read an article about the survey](#).)

The survey looked at four types of hospital infections. They were bloodstream infections from IVs, ventilator-associated pneumonia, urinary tract infections from catheters and infections at surgical sites.

The council's executive director, Marc P. Volavka, was quoted in The Philadelphia Inquirer as saying that "every patient that enters a hospital is at risk for a hospital-acquired infection."

He said such infections are the result of "flawed processes" of care and hygiene. Indeed, a major cause of infection was noted as poor handwashing by hospital personnel.

GET A FREE EVALUATION OF YOUR CASE

*Name

*Phone Number

*Email Address

Questions or Comments:

BBC NEWS

You are in: Health
Tuesday, 10 April, 2001, 14:20 GMT 15:20 UK

Dirty hospitals 'named and shamed'



Inspectors found 42 hospitals failed to meet basic hygiene standards

Health Secretary Alan Milburn has named and shamed hospitals who failed to meet basic hygiene standards.

A total of 40 hospitals have failed at the second attempt to meet standards laid down by the Department of Health as part of a £60m campaign to improve cleanliness in the health service.

Spot-check inspections were carried out on 689 hospitals in England.

“There is to be no let up in our drive to raise standards of hospital cleanliness”

Alan Milburn, Health Secretary

The standard of hygiene was so poor in 10 hospitals that they have been named, put on "special measures" and told they have until the autumn to clean up their acts.

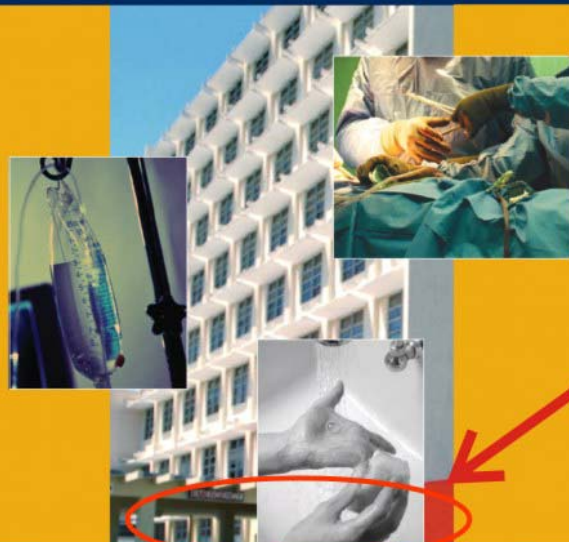
Special hit squads will be sent in to these hospitals in a bid to improve standards.

The BBC's Judith Kolony
'Hospital matrons are to be given extra powers to ensure their wards are spotless' **real 56k**

Bristol Royal Infirmary's Doug Zecocock
'What we suffer from is having older buildings, and the older the building the harder it is to maintain high standards' **real 28k**

Director of the Patients Association Mike Stone
'This cannot be a

Hospital-acquired Infections in Pennsylvania
Data Reporting Period: January 1, 2005 - December 31, 2005



The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 DECEMBER 28, 2006 VOL. 355 NO. 26

An Intervention to Decrease Catheter-Related Bloodstream Infections in the ICU

Peter Pronovost, M.D., Ph.D., Dale Needham, M.D., Ph.D., Sean Berenholtz, M.D., David Sinopoli, M.P.H., M.B.A., Haitao Chu, M.D., Ph.D., Sara Cosgrove, M.D., Bryan Sexton, Ph.D., Robert Hyzy, M.D., Robert Welsh, M.D., Gary Roth, M.D., Joseph Bander, M.D., John Kepros, M.D., and Christine Goeschel, R.N., M.P.A.

NOSOCOMIAL INFECTIONS ARE A MAJOR ISSUE

- Institute for Healthcare Improvement (2004)
 - Ventilator associated pneumonia, central line associated bloodstream infection, and surgical site infection
 - Bundles of care-pediatric supplements

NOSOCOMIAL INFECTIONS CAN BE PREVENTED IN ADULTS

- 108 adult ICUs
- CLABSI, daily goals sheet, VAP, and safety culture program
- Mean rate reduction 7.7 to 1.4/1,000 cath-days
- Hand washing

- Chlorhexidine prep
- Full barrier precautions
- Avoid femoral vessels
- Remove lines ASAP

CICU INTERVENTION TO REDUCE NIS

- Dagan (1999)
 - Change in practice 1987 vs 1992
 - NIR decreased 25 to 20%
 - Wound infections decreased 7 to 4.3%
 - ! NIR in CPB patients
 - Severity score (TISS) associated with BSI⁽¹⁰⁾

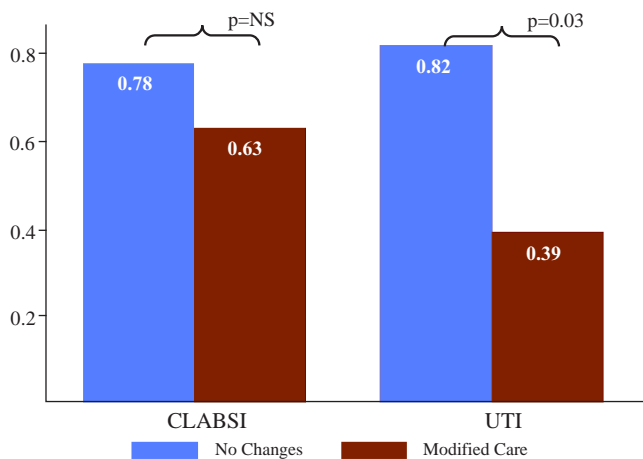
10. Dagan O. Crit Care Med 1999

ARE SOME RISK FACTORS FOR INFECTION MODIFIABLE?⁽¹¹⁾

Modifiable Risk Factors (N = 37 Nosocomial Infections)	Frequency
Central venous catheter > 2 wks	2 (18.2)
Arterial catheter removed and not replaced	3 (27.3)
Central venous catheter removed and not replaced	2 (18.2)
Bladder catheter removed and not replaced	6 (45.5)
Total	13 (100)

11. Dominguez TE, Crit Care Med, 2004

RISK OF INFECTION AND MODIFIABLE PATIENT CARE



REDUCING CATHETER-ASSOCIATED BLOODSTREAM INFECTIONS IN CHILDREN:

SUSTAINABILITY & SPREAD PROJECT 2006

The Children's Hospital of Philadelphia®

Cardiac Intensive Care Unit

Team Leader: Troy Dominguez, MD

Team Member: Sarah Tabbutt, MD

Front Line Leader: Leslie Shannon, RN

Front Line Leader: Ann Adams, RN

Team Member: Eve Teszner, RN

Team Member: Alyce Allenbach, RN

Team Member: Eileen Brunwasser, RN

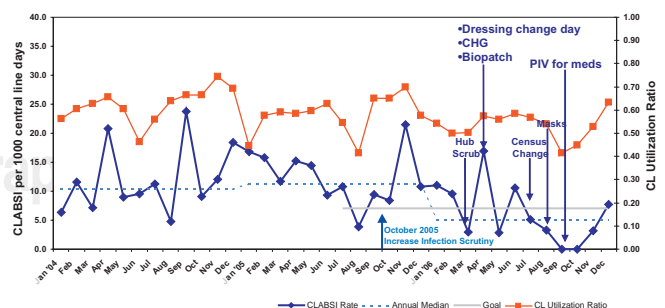


Virtual Learning Session # 3
November 1, 2006

CHANGES IMPLEMENTED TO DATE

1. Ten-second hub scrub
2. CHG skin antiseptic for children 2 months or older
3. Weekly dressing change day
4. Biopatch (≥ 2 months of age)
5. Masks with dressing changes
6. Change claves/stopcocks with all line changes
7. Reduce line access events
8. Use peripheral lines for IV medications when feasible
9. Central line care competency

CLABSI RATE CICU

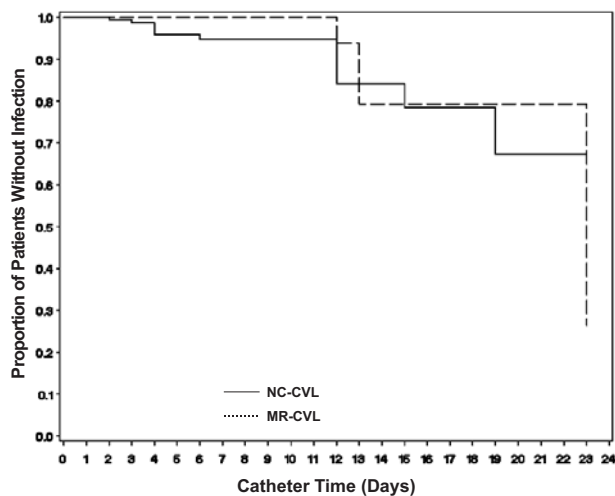


OTHER INTERVENTIONS FOR PREVENTIONS OF CLABSI

- Special Catheters
 - Heparin bonded
 - Impregnated/Coated catheters
- Tunneled catheters (?)
- Reduce skin colonization (chlorhexidine)
 - 28% reduction in neonatal mortality in LBW infants, 11% reduction overall⁽¹²⁾

12. Tielsch JM, Pediatrics, 2006

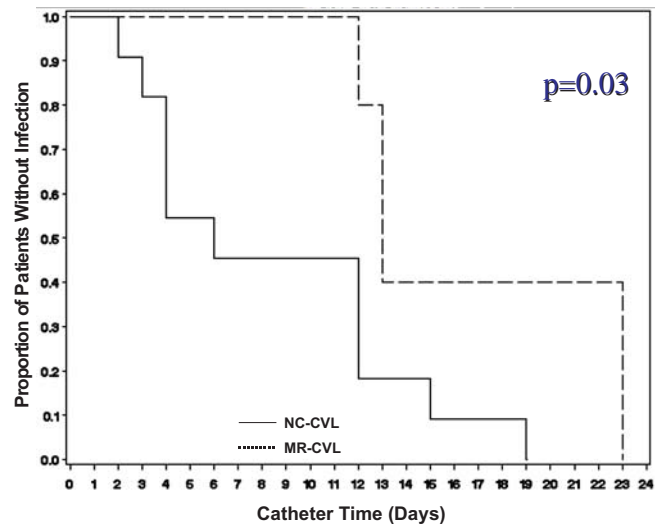
TIME TO BSI AFTER CATHETER INSERTION⁽¹³⁾



In Press, Pediatric Inf Disease J

13. In Press, Pediatric Inf Disease J

ANTIBIOTIC COATED CATHETERS⁽¹³⁾



In Press, Pediatric Inf Disease J

13. In Press, Pediatric Inf Disease J

PICC LINES

- No difference in infection rates in inpatients (6.4/1,000 cath-days in hospitalized children)⁽¹⁴⁾

	Catheter type	# CLA-BSI	Catheter Days	CLA-BSI rate*
Tunneled	Broviacs, ports, tunneled Medcomp	14	981	14.3 (7.8-23.9)
Non-tunneled	Internal jugular, subclavian, femoral	32	2,523	12.7 (8.6-17.9)
PICC	Antecubital fossa	8	785	10.2 (4.4-20.0)
Total		54	4,289	12.6 (9.5-16.4)

14. St. John K. SHEA 2004; Yeung CY. PIDJ 1998; Sadfar N. Chest 2005

VAP BUNDLE

- Head of bed elevation
 - Extubation readiness
 - GI prophylaxis
 - DVT prophylaxis-age appropriate
- } Adults

SSI BUNDLE

- Directed toward the timely antimicrobial prophylaxis (0-60 minutes prior to incision)
 - Other measures (?):
 - Hair removal
 - Glucose control
 - Normothermia
- } Adults

RISK OF SSI: ASA SCORE

Physical status

1. A normal healthy patient
 2. A patient with a mild systemic disease
 3. A patient with a severe systemic disease that limits activity, but is not incapacitating
 4. A patient with an incapacitating systemic disease that is a constant threat to life
 5. A moribund patient not expected to survive 24 hours with or without operation
- E Emergency
- Most neonates

PREVENTION OF UTI

- Timely removal of device
 - Boston: 3.8→1.0/1000 pt-days
 - Toronto: 1.4→0.12/100 admissions (< 3 days)

- ? Antimicrobial impregnated catheters⁽¹⁵⁾

15. Matlow AG. *Pediatr Crit Care* 2003; Costell JM. *Pediatr Crit Care Med* 2005

SUMMARY

- Reviewed epidemiology and impact of nosocomial infections in the ICU
- Risk factors for NIs in the PICU and CICU
- Data regarding the preventability of NIs
- Ways to prevent NIs

SURGEON BUNDLE (AKA «SPRAY PLAN»)

I want everything out!

