Objectives

1. Identify risk factors for health care associated infections in the NICU
2. Discuss recent advances in the prevention of bloodstream infections in the NICU
What is the scope of the problem?

Infection Rates in the NICU

- Prevalence: 6-33% of admissions 
  : 4.8-22/ 1000 patient days
- NNIS Jan-Jun 2004 (m rates/ 1000 pt d)
<table>
<thead>
<tr>
<th>BSI</th>
<th>VAP</th>
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<tr>
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AJIC 2004;320:470

Infection Rates in the NICU

- Prevalence 3-40 % !!!!!
- NNIS Jan-Jun 2004 (m rates/ 1000 pt d)
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★ NNIS definitions< 12 months old 
AJIC 2004;320:470
Neonatal Sepsis: A 2006 Update  
Dr. Anne Matlow, Hospital for Sick Children, Toronto  
A Webber Training Teleclass

Why the variability?
- NICU factors
  - % high risk babies
  - Surgical capabilities
  - Staffing ratios
- Patient factors*
  - Clinical practice variation
  - Surveillance: definitions and methods

Infection Rates in the NICU
- 3.2-30 / 100 admissions
- NNIS Jan-Jun 2004 (m rates/ 1000 pt d)

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Very Low Birth Weight Infants = VLBW

Incidence of Nosocomial Infection
Dutch NICU
- Modified definitions  
  - Infections 28.6
  - Infected patients 20.7
  - BSI 14.9
  - Patients with BSI 13.9
  - Pneumonia 7.5
  - Pts with pneumonia 6.3
Risk Factors for HAI in NICU

- Birth weight
- Gestational age
- Invasive devices
- Duration of device use
- Parenteral nutrition
- Surgery
- Nurse understaffing

Key Points re: Risk Factors for HAI

- Birth weight
- Gestational age
- Invasive devices*
- Duration of device use*
- Parenteral nutrition*
- Surgery
- Nurse understaffing*
* modifiable

Microbiology of Neonatal Sepsis

Adapted from Stoll, Peds 2002
Determining the significance of CONS identified in cultures of paired blood specimens from neonates by species identification and clonality

- Paired blood specimens
- Simultaneous
- Peripheral
- 12/13 were identical species with identical genotypes
- Likely true infection

Huang Y-C et al. ICHI 2006; 27: 70-3

Risk Factors for BSI

IN GENERAL
- VLBW
- CVC, duration
- TPN
- IV Lipids and CONS
- prolonged antibiotic therapy

Risk Factors for BSI

CANDIDEMIA
- Catheter days
- Prior bacterial BSIs
- GI tract pathology
- Feja PIDI;2005:147:156
Risk Factors for BSI

IN VLBW INFANTS
- Gram negatives
- CVC > 10 days, nasal CPAP, H2 blocker/proton pump inhibitors, GI pathology
  - Graham PIDJ 2005: 113
- CANDIDEMIA:
  - in <1000g
  - Decreasing
  - Rare azole resistance
    - Fridkin, Pediatrics, 2006:1680

IN GENERAL
- VLBW
- CVC, duration
- TPN
- prolonged antibiotic therapy
- CANDIDEMIA
  - Catheter days
  - Prior bacterial BSIs
  - GI tract pathology
    - Feja PIDJ;2005:147:156

Impact of staffing on bloodstream infections in the NICU

- 2675 infants admitted to the NICUs in NY
- Main Outcome Measure: Time to first episode of healthcare-associated bloodstream infection.
- 224 infants had HAI-BSI
- RESULTS: nursing hours, BSI
  - hazard ratio: 0.21 (95% CI, 0.06-0.79)

Outcome of BSIs in NICU

- Gram positive: 8.7% mortality
- Gram negative: 26.2%
- Candida: 27.6%

- Makhoul, Pediatrics 2002;109:34-9

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Central-Line Associated BSI Bundle

100,000 Lives/ Getting to 0 Campaigns

1. Hand hygiene
2. Maximum barrier precautions
3. Chlorhexidine antisepsis (no recommendation < 2 months of age)
4. Optimal catheter site
5. Daily review of central line necessity

Pediatric Affinity Group: AAP, NICHQ, NACHRI, CHCA
Multifactorial Prevention Strategy in VLBW: Australia  
Andersen 2005;61:162

Intervention
1. Hand hygiene
2. Standardized IV (all) insertion with packs
3. Skin antisepsis: 2% CHX aq or 1% in EtOH
4. Removal and/ replacement of PIV at 48 hrs
5. Remove IVs when enteral intake > 120 ml/kg
   - BSI rate from 21% → 9%, but 4 of 36 (11%) infants < 1000 g had severe skin irritation from 2% aqueous CHX

Vancomycin-heparin lock solution
- Heparinized normal saline (43)  
  vs  
  heparinized saline + vancomycin 25u/ml (42)
  X 2-3 times daily, 20-60 minutes
  ⇒ 13/43 (30%) vs 2/42 (5%) developed BSI  
  = 7.8 vs 2.3/ 1000 catheter days
- No vancomycin resistance or detectable blood levels

Fluconazole Prophylaxis to prevent fungal infections in VLBW
- Why? High mortality rate (27.6% for sepsis)
  - Cochrane Database Syst Rev. 2004;(1):CD003850
    3 studies eligible;
    Results: may reduce mortality at discharge
    (1 fewer death/ 9 infants treated but wide confidence intervals)
  - Recent review found reduced fungal colonization and progression of colonization to infection with fluconazole
    = Manzoni Peds 2006;117:214
Fluconazole Prophylaxis to prevent fungal infections in VLBW

Final verdict still out
Encouraging data to date, but single centre data only
Need well designed multi-center study
Fananoff Peds 2006

Key Points re: Prevention of BSI

- Bundle concept: a new paradigm
- Emphasize the basics
- Aim for 0

Key Points

1. Risk factors for health care associated infections in the NICU
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Key Points re: Risk Factors for HAI

- Birth weight
- Gestational age
- Invasive devices*
- Duration of device use*
- Parenteral nutrition*
- Surgery
- Nurse understaffing*
  * modifiable

Key Points re: Prevention of BSI

- Bundle concept: a new paradigm
- Emphasize the basics
- Aim for 0

Final Comment

Hand hygiene is the number 1 way of reducing the incidence of health care associated infections
### The Next Few Teleclasses

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Speaker/Location</th>
</tr>
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<tbody>
<tr>
<td>October 12</td>
<td>The Changing Role of Infection Prevention and Control as Documented by the CBIC Practice Analysis</td>
<td>… with members of the CBIC Board</td>
</tr>
<tr>
<td>October 19</td>
<td>Hand Hygiene – Improving Compliance</td>
<td>… with Dr. John Boyce, Hospital of Saint Raphael</td>
</tr>
<tr>
<td>October 25</td>
<td>Urinary Tract Infections in Long Term Care</td>
<td>… with Dr. Chesley Richards, Atlanta VA Medical Center</td>
</tr>
<tr>
<td>November 2</td>
<td>Voices of CHICA</td>
<td>… with CHICA-Canada Board and guests</td>
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For the full teleclass schedule – [www.webbertraining.com](http://www.webbertraining.com)  