

INFECTION CONTROL IN THE NICU

Terrence Shenfield MS RRT-ACCS,RPFT/NPS/AE-C



Problem with neonates



- Incomplete Immunity
- Incomplete antioxidant system
- Invasive procedures
- Incomplete lung development



Objectives

Discuss HAI in the NICU

Device acquired infections

Ventilator Associated Pneumonia

Hand washing practices

Preventing the spread of infections



Stats

- Survival rates is > 85% for newborns at 25 weeks gestation
 - *29% of these infants will develop a HAI*
 - *46% will have serious HAI if less than 25-week gestation*
- 2,000,000 HAI each year with infants
- 50%-60% caused by resistant organisms
- 9,600-20,000 deaths each year from catheter related infections





Risk factors for HAI

Risk factors include:

- *Low birth weight*
- *Prematurity*
- *Congenital malformations*
- *Prolonged hospital stay*
- *Frequent invasive procedures*
- *Total parenteral nutrition*
- *Incomplete immunity*



Incomplete immunity

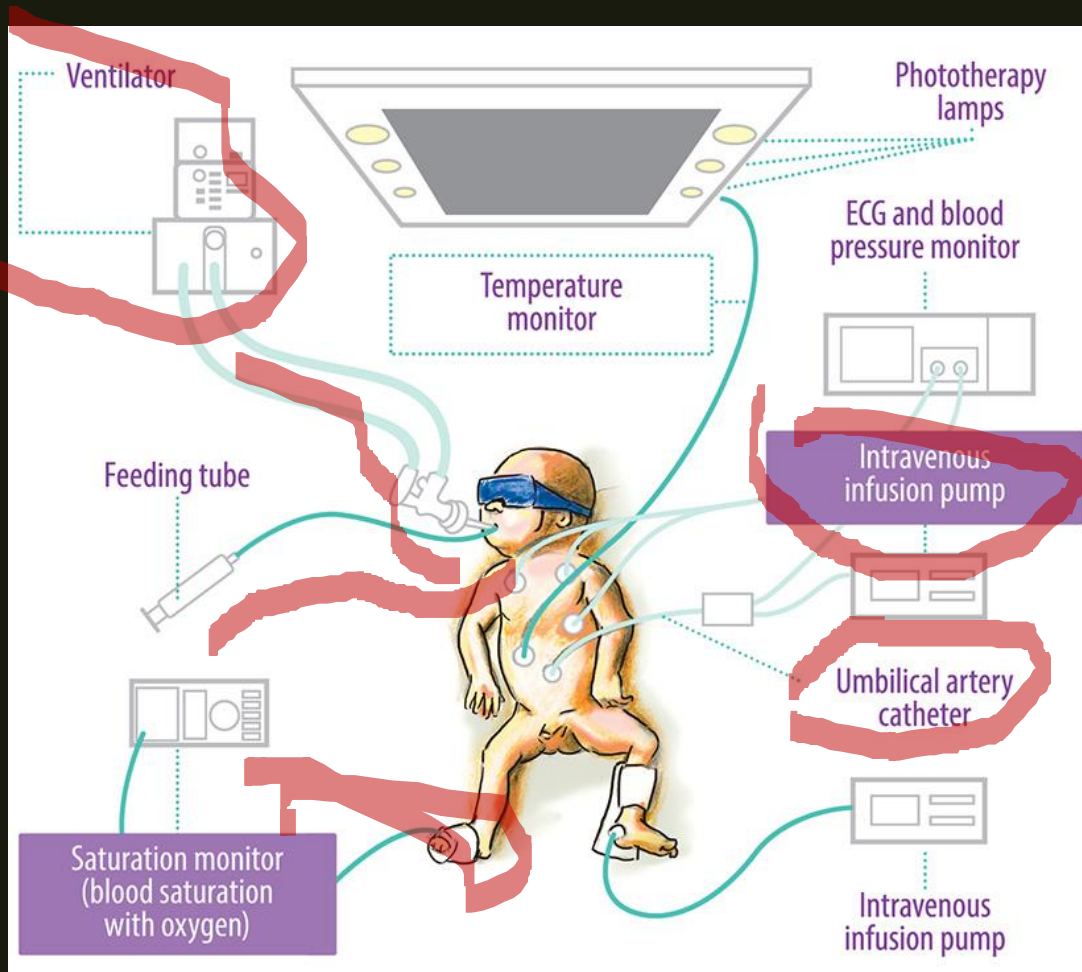
- Immature immune system increases risk of infection
- Deficiencies in innate and adaptive immunity
- Most HAI in the NICU are from:
 - *Instrumentation*
 - *Medical procedures required to preserve an infant's life*
- The mortality rate of hospital infections is between 10-50%
- Economic consequences



MOST Common infections in the NICU

- Blood stream infections
 - *Central venous catheter (CVC)*
 - *Umbilical catheter (UC)*
- Ventilator-associated pneumonias (VAPs)
- Devices associated infections (Central line)
- Evidence supports proactive strategies to prevent health care-associated infections in the NICU





DEVICE ASSOCIATED INFECTIONS

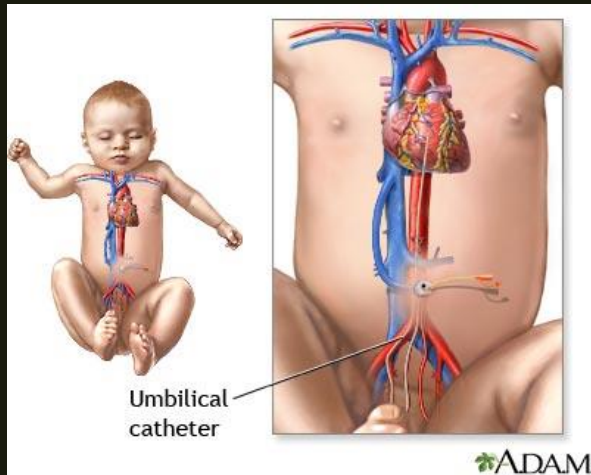


Device-associated infections

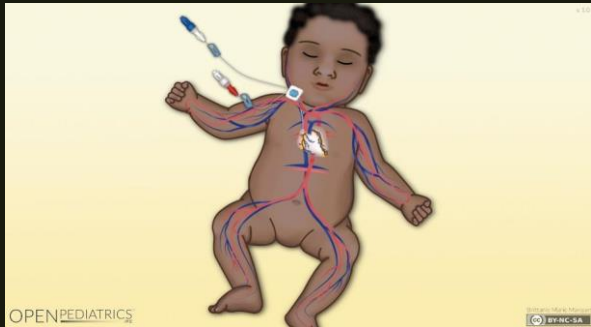
- Most infections are preventable
- ELBW infants are at increased risk
- Need to take precautions to reduce infection
- Hospitals should evaluate their own device associated infection trends regularly and then compare with the national and international data
- Determine problems and resolve them
- Active surveillance programs
 - *Nosocomial pathogens*
 - *Antibiotic resistance patterns*
 - *Antibiogram*

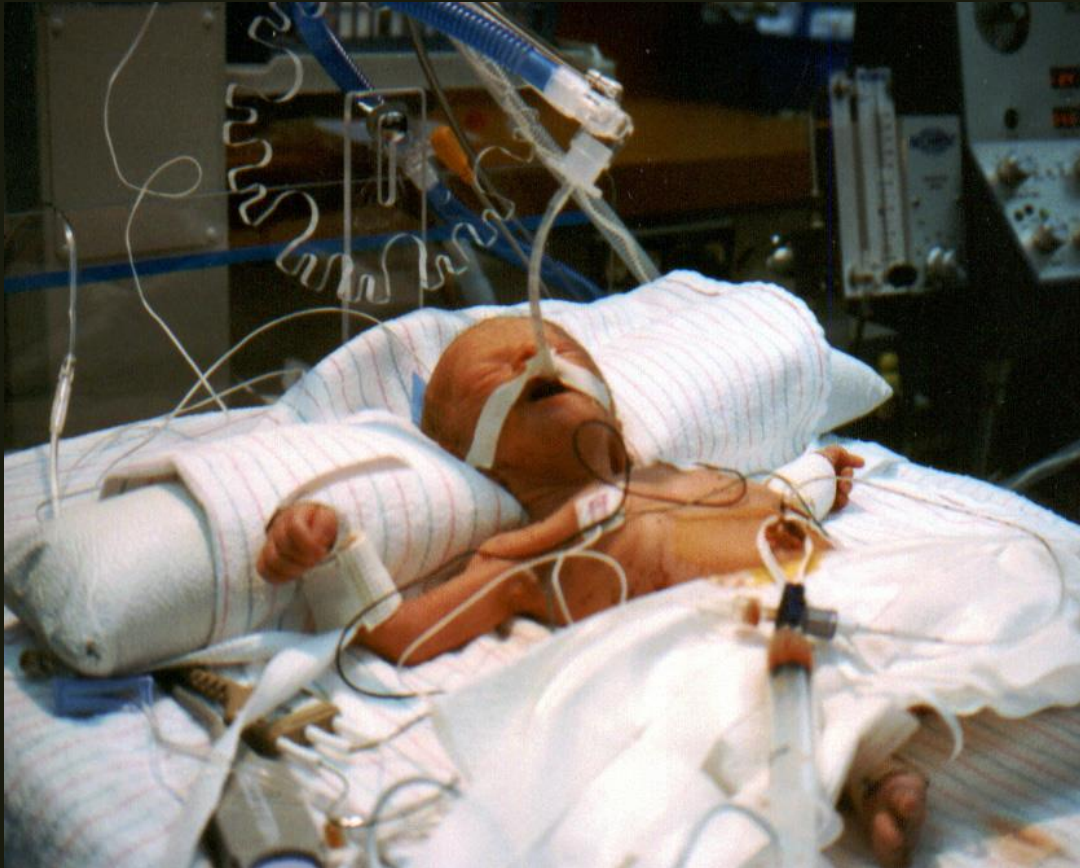


The CVC and Umbilical catheter



- Central venous catheter
- Umbilical catheter-associated blood stream infections
 - *Coagulase-negative staphylococci*
 - MRSA
 - *Acinetobacter baumannii*





The ventilator

- Ventilator-associated pneumonia
- VAP rate was 14/1000 ventilator days
- VAP is important risk factor for mortality
- Premature birth, repeated and prolonged intubation and genetic diseases increase VAP frequency
- Most frequent infective agents
 - *Gram-negative pathogens for VAP*





Reasons for HAI

Prevention of Central Line Associated Bloodstream Infections

- Most common reason for HAI in the NICU
 - Poor Technique
- Methods to reduce central line infections
 - *Practice guideline for insertion*
 - *Proper skin decontamination*
 - *Promotion of breastfeeding*
 - *Gowning of visitors*
 - *Proper hand washing techniques*



Sepsis and the babies

- Immature immune system
- Fetal antibodies are not present < 30 weeks gestation
- Sepsis is leading cause of death in neonates with approx. with 1/250
- Contributes up to 13-15% of all neo natal deaths



Sepsis prevention

- Before Delivery
 - *Maternal health and nutrition*
- During Labor and Delivery
 - *Hand washing during delivery*
 - *Intrapartum antibiotic prophylaxis in the presence of group b streptococcus*
 - Surviving infants often have developmental disabilities, including mental retardation and hearing or vision loss
- After Delivery
 - *Hand washing during delivery*
 - *Neonatal immunization*
 - *Breast feeding*



Prevention of Health Care Associated Pneumonia

- Prevention of transmission of micro-organisms
 - *Proper sterilization or disinfection and maintenance of equipment and devices*
 - *Standard Precautions*
 - *Isolation practices when appropriate*



Ventilator-Associated Pneumonia in Neonates

- Ventilator-associated pneumonia (VAP)
- VAP infections have a large impact on neonatal morbidity, survival, hospital costs, and length of stay
- VAP is a common cause and accounts for 6.8% to 32.2% of health care-acquired infections among neonates..



VAP Risk Factors

- VAP risk factors
 - *Opiate treatment for sedation*
 - *Frequent endotracheal suctioning*
 - *Reintubation*
- Nasal continuous positive airway pressure (NCPAP) reduces risk
- NICU design and staffing may affect VAP rates
- VAP rates decreased significantly when a NICU was moved from a crowded space to a larger unit with 50% more staffing



VAP

Pathogenesis

- Bacterial, fungal, or viral pathogens enter the normally sterile lower respiratory tract
- Microorganisms responsible for VAP can originate
 - *Oropharyngeal airway*
 - *Tracheobronchial colonization begins with the adherence of microorganisms to the epithelial cells of the respiratory tract*
 - *Organisms causing VAP are often noted in the posterior pharynx*



VAP Pathogenesis

- Aspiration of contaminated oral secretions because uncuffed endotracheal tubes
- Gram-positive organisms in the mouth colonize the trachea and endotracheal tubes within the first 48 hours of mechanical ventilation
- Gram-negative bacilli begin colonizing the endotracheal tube and trachea after 48 hours of respiratory support



Prevention of Ventilator Associated Pneumonia

- Aspiration is a major risk for the development of health care-associated pneumonia
- ETT should be removed ASAP and try NIV
- HOB should be greater than 30 degrees
- Comprehensive oral-hygiene
- Closed-suctioning systems
 - *Reduce physiologic disruptions (hypoxia and decrease in heart rate)*
 - *Reduce environmental contamination of the endotracheal tube*



Prevention of Ventilator Associated Pneumonia

- Keeping the endotracheal tube and the ventilator circuit in a horizontal position might reduce tracking of oropharyngeal sections down into the lower respiratory tract
- Lateral position also is associated with reduced aspiration of gastric secretions into the trachea
- Using a nonsupine position may reduce the risk of ventilator-associated pneumonia



Most effective method for reducing health care–associated infections is HAND HYGIENE

- Most effective method for reducing health care–associated infections
- Higher rates of hand hygiene compliance results in lower rates of central line bloodstream infection
- CDC published guidelines for hand hygiene in health care settings in 2016
 - *Recent analysis (Not so good news!)*
 - Implementation of these guidelines had no effect on hand hygiene compliance rates (mean, 56.6%)



Soap or an alcohol- based gel – which one is better?

- Alcohol based preparation is as effective to hand washing
- Larson et al compared the effectiveness of a traditional antiseptic hand wash with an alcohol hand sanitizer in reducing bacterial colonization
 - *No differences in mean microbial counts on nurses' hands or infection rates among patients in the NICU*
 - *No data to suggest superiority of one method over the other*
 - *Compliance with hand hygiene may be enhanced if alcohol-based products*



World Health Organization Guidelines Hand Hygiene

- Soap and water for
 - *Visibly soiled with body fluids*
 - *After toilet use*
 - *Exposure to potential spore-forming pathogens*

- Alcohol-based hand rub
 - *Before and after touching patients*
 - *Before handling invasive devices*
 - *Contact with body fluids or excretions, mucous membranes, nonintact skin, or wound dressings*
 - *Between touching contaminated body site and another body site*
 - *Contact with inanimate surfaces and objects*
 - *After removing gloves*



Breast Feeding Reducing Risk for Infection

- Breast milk has been associated with a lower risk of sepsis and necrotizing enterocolitis in preterm infants
- Immunologic properties of breast milk
 - *Secretory IgA*
 - *Macrophages and lymphocytes for immunity*
 - *Secretory molecules with antibacterial properties*
 - *All may all contribute to this protective effect*



Reducing Health Care–Associated Infections in the NICU

- Opportunities to reduce colonization of the critically ill neonate with health care–associated pathogens
 - *Appropriate vaccination of health care workers*
 - Influenza vaccine
 - *Cohorting in selected outbreak situations*
 - e.g. for Candida and MRSA infections
 - *Visitation guidelines to identify ill/infected visitors*



Antibiotic Use and Misuse

- Use and misuse of antibiotics can be associated with alteration in neonates' microflora and the development of antibiotic resistance
- Antimicrobial resistance
 - *Intrinsic* (*genetically resistant*)
 - Vancomycin is resistant to Gram-negative organisms
 - *Extrinsic* (*acquired resistance*) by *antimicrobial exposure*
 - *Staphylococcus aureus* and the extended-spectrum β -lactamase (ESBL)-producing organisms



Antibiotic Use and best practices

- Judicious use of antibiotic agents
- Prolonged use of antimicrobial agents
- Limiting use to only those situations in which a bacterial infection is likely
- Discontinuing empirical treatment when a bacterial infection has not been identified
- Using the narrowest spectrum on the basis of susceptibility testing
- Treating for the appropriate duration



Antimicrobial stewardship and improving antibiotic resistance

- Strategies that might be helpful in the NICU setting include the following:
 - *Auditing antimicrobial use of practitioners*
 - *Formulary restriction for selected antimicrobial agents*
 - *Education of prescribers and nurses*
 - *Development of clinical guidelines/pathways for selected conditions*



Summary

- Immunity is decreased with pre mature births
- Device associated infections can be minimized with good infection control practices
- Oral care and NIV reduce VAP rates in the NICU
- Catheter associated infections can be reduced proper technique and barrier protection
- Hand washing decreases the spread of infections
- Surveillance techniques work



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THANK YOU