INFECTION CONTROL IN THE NICU

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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

Diagram showing medical devices connected to a baby:
- Ventilator
- Feeding tube
- Temperature monitor
- Phototherapy lamps
- ECG and blood pressure monitor
- Intravenous infusion pump
- Umbilical artery catheter
- Saturation monitor (blood saturation with oxygen)
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
- Most frequent infective agents
  - 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

- 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 neonatal 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 microorganisms
- Proper sterilization or disinfection and maintenance of equipment and devices
- Standard Precautions
- Isolation practices when appropriate
VENTILATOR-ASSOCIATED PNEUMONIA (VAP)

- 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 HEALTH CARE–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 HEALTH CARE–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 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
  - Visitation guidelines to identify ill/infected visitors
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
REFERENCES


THANK YOU
ANTIBIOTIC USE AND EXTENDED-SPECTRUM BETA-LACTAMASE

- ESBL-producing organisms (primarily Gram-negative enteric agents)
- Present because of third-generation cephalosporins and other broad-spectrum β-lactam antibiotic agents
- Curtailing the use of third-generation cephalosporins and using other antibiotic agents, such as aminoglycosides for empirical therapy, has been associated with less antibiotic resistance, including ESBL-producing organisms.
- Good infection-control practices also play a significant role in reducing horizontal transmission of antibiotic-resistant bacteria.